Review Article

Review on Functions of Dietary Agents and Plants in Cancer Prevention and Treatment

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ABSTRACT

Over 60% of the current anticancer drugs have their origin from natural sources. Natural products, dietary flavonoids and other polyphenols have an important role as chemo-preventive agents. These substances are compounds with different chemical entities and many of these are present in plants with medicinal value and in various fruits and vegetables commonly consumed by humans. The essential role played by natural products and dietary agents in the discovery and development of effective anticancer agents and the importance of multidisciplinary collaboration in the generation and optimization of novel molecular leads from natural product sources will be reviewed.

Introduction

Cancer is a disease in which disorder occurs in the normal processes of cell division that are controlled by the genetic material (DNA) of the cell. Most of the agents discovered in the first two decades of cancer chemotherapy interacted with DNA and its precursors, inhibiting the synthesis of new genetic material or cause damage to DNA itself.[1] The process of cancer development is called as carcinogenesis. There are three phases of cancer, first phase is initiation in this carcinogen cause genotoxic damage; second is tumor promotion, in this phase cells undergo rapid proliferation results in accumulation of preneoplastic cells and the final stage is progression phase which involves the growth of tumor with metastatic potential.[2] Dietary agents are known to modify all these phases. Majority of human cancers results from exposure to environmental carcinogens that include both natural and artificial chemicals, radiations and viruses. Mainly virus, chemical carcinogens, chromosomal rearrangements or spontaneous transformations have been implicated as the cause of cancer. Cancer can occur in different parts of body. The most common cancer in men is lung, prostate or colon cancer where as in women the major ones are breast, lung and colon cancer. The literature indicates that many natural products are available as chemo-protective agents against commonly occurring cancers worldwide.[3] Despite major scientific and technological progress in combinatorial chemistry, drugs derived from natural products still make an enormous contribution to drug discovery today. An analysis of the number of chemotherapeutic agents and their source indicates that over 60% of the approved drugs are derived from natural compounds.[4] For e.g. Taxol as a drug has been developed by the National cancer institute, USA and had been approved for the treatment of ovarian, metastatic breast and lung cancer and Kaposi sarcoma. Taxol showed promising results in phase 1 and phase 2 clinical trials conducted in patients of lung, ovarian, breast cancer and squamous cell carcinoma of head and neck. It was originally isolated from the bark of *Taxus brevifolia,* a finite source of the compound. It binds specifically to the beta-tubulin unit of microtubule and antagonizes the assembly of cytoskeletol protein.[5] Another example is vinca alkaloid derived from periwinkle *Catharanthus roseus* which is found in rain forests of Madagascar had significantly contributed in the treatment of cancer. Vincristine, an alkaloid comstituent of vinca is responsible for increase in cure rate for Hodgkin's disease and some other forms of leukemia. Vincristine inhibits microtubule assembly, including tubulin self association into coiled spiral aggregates at

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cellular levels.[6] Etoposide is third exemplary chemoprotective agent derived from plant *Podophyllum peltatum* and *Podophyllum emodi*. It has significant activity against small–cell lung carcinoma. Etoposide is topoisomerase-2 inhibitor, stabilizing enzyme-DNA cleavable complexes leading to DNA breaks.[7] In addition; the camptothecin derivatives irinotecan and topotecan have shown significant antitumor activity against colorectal and ovarian cancer. These compounds are obtained from bark and wood of *Camptothecea acuminata* and act by inhibiting topoisomerase.[8] The present work constitutes a review of literature on dietary agents and natural products with potential antitumor activity.

Role of diet in cancer prevention

Eating a balanced diet with plenty of fruits and vegetables helps in reducing the risk of cancer. Higher vegetable consumption will reduce the risk of colon cancer and high fruit consumption can reduce the risk of stomach cancer. Antioxidants and vitamins present in fruits helps in cancer prevention.[9] The active components of dietary vegetables are responsible for anticancer activity like allicin (Garlic), lycopene (Tomato), soy isoflavones (Soybeans), resveratrol (Grapes), anethole (Fennel), 6-gingerol (Ginger) etc. A major group of these products are the powerful antioxidants, others are phenolic in nature and the remainder includes reactive groups that confer protective properties. These natural products are found in vegetables, fruits plant extracts and herbs, although the mechanism of the protective effect is unclear and the fact that the consumption of fruit and vegetables lowers the incidence of carcinogenesis at a wide variety of sites is broadly supported.[10] Most of the non-nutrient antioxidants in these foods are phenolic or polyphenolic compounds, such as isoflavones in soybeans, catechins in tea, phenolic esters in coffee, phenolic acid in red wine, quercetin in onions and rosmaric acid in rosemary are responsible for anticancer activity. Many human cancers are prevented by dietary agents.[1] These are listed in [Table 1].

Natural products and their defense against carcinogenesis

The search for natural products as anticancer agents dates back, at least to the *Ebers papayrus* in 1500 B.C but scientific period of this search becomes more recent with the investigation by Hartwell and co-workers on the application of podophyllotoxin as potential anticancer agent. Plants contain an extensive variety of compounds some of them are extensive modifiers of chemicals carcinogenesis. Many plant extracts and plant derived agents are currently successfully employed in cancer treatment.[10] These are listed in [Table 2].

Epidemiological studies

In United States, cancer accounts for 25% of the deaths in humans presently. According to the American cancer society, 559,650 deaths were expected from cancer related causes in the year 2007. In addition, 1444920 new cases of cancer will also be diagnosed.[11] Epidemiological studies also indicated that populations that consume food rich in fruits and vegetables have a lower incidence of cancers. Review of results from 206 human epidemiologic studies has indicated an inverse relationship between consumption of vegetables and fruits and risk for cancers of stomach, esophagus, lung, oral cavity, pharynx, endometrial, pancreases and colon.[12] Statistics indicate that men are largely

Table 1: Dietary agents used in treatment of cancer

Source	Part	Active component/ extract	Mechanism of action	Cancer inhibited	Ref.
Anar *(Punica granatum)*	Fruit	Ellagic acid, punicic acid, luteolin and caffeic acid	Induces apoptosis	PC-3 human prostate cancer cells	[16]
	Fruit	Extract contaning polyphenols	Induces apoptosis	Breast cancer in mouse mammary organ culture	[17]
Almond *(Prunus dulcis)*	husk	Terpenoids		MCF-7 human breast cancer cells	[18]
Apple *(Pyrus malus)*		Extract	Inhibits TNF-alpha induced Nuclear factor kappaB activation.	MCF-7 human breast cancer cells	[19]
Bael *(Aegle marmelos)*		Hydroalcohlic extract	Induces apoptosis	Ehrlich ascites carcinoma in mice	[20]
Black tea *(Camellia sinensis)*	Leaves	Decoction	Apoptosis by Bax translocation cytochrome C release and caspase activation	Various tumors	[21]
Brown rice and rice bran *(Oryza sativa)*	Fermented by aspergillus oryze		Decreases multiplicity of hepatocellular carcinoma	Hepatocellular carcinoma in male F 344 rats	[22]
Clove *(Eugenia caryophyllus)*		Eugenol	Reactive oxygen speices mediated apoptosis	HL-60 human promylenocytic leukemic cells	[23]
Green tea *(Thea sinensis)*	Leaves	Epigallocatechin 3-gallate	Catalyzes oxidative DNA cleavage	Various tumors	[24,25]
Grapes *(Citrus paradise)*	Seed extract	a) Proanthocyanidins.	G1 phase cell cycle arrest and increase in Ci P1/P2 protein level	HT29 human colorectal cancer cells	[26]
		b) Proanthocyanidin B 2-3-3'-di-O-gallate.	Apoptotic death and growth inhibition	DU145 human prostate cancer cells	[27,28]
Garlic *(Allium sativum)*	Bulbs	S-allyl cysteine	Restoration of E-cadherin expression at transcription and protein level	Human androgen independent prostate cancer	[29]
		Diallyl trisulphide	Increase in caspase -3 activity and inhibition of tubulin proliferation	Human colon cancer	[30]
		Allicin	Accumulation of cells in G0/G1 Phase and cause drop in glutathione level	Human breast, endometrial and colon cancer	[31]

(*Continued*)

Table 1: (Continued)

Source	Part	Active component/ extract	Mechanism of action	Cancer inhibited	Ref.
Ginger *(Zingiber officinalis)*	Rhizome	Pungent principles: Vallinoids, (6)-gingerol, shogaols and zingerone.	Induces apoptosis	Various tumors	[32,33]
Lemon *(Citrus limonoids)*	Seeds and molasses	Limonoids	Enhace chromosomal abnormalities and induces caspase 3/7 activity	Human neuroblastoma and colonic adenocarcinoma cells	[34]
Kalmegh *(Andrographis paniculata)*		Andrographolide	Cell cycle arrest at G0/G1 phase and enhance production of tumor necrosis factor	HT-29 colon cancer cells	[35]
Mulberry *(Morus alba)*		Cyaniding 3-rutinoside and cyaniding 3- glucoside	Decrease expression of matrix metalloprotinase -2 (MMP-2) and urokinase plasminogen activator	A-549 human lung carcinoma cells	[36]
Mango *(Mangnifera indica)*	Juice	Juice extract	Inhibition of cell cycle at G0/G1 phase	HL-60 cells	[37]
Mandarin oranges *(Citrus reticulata)*		Extract	Induces apoptosis	Sarcoma 180 cells and hepatic cancer cell lines	[38]
Pudina *(Mentha piperata)*	Leaves	Aqueous extract	Decrease level of lipid peroxidation and increase glutathione content and cause caspase activation	Chemoprotection in benzo[a] pyrene induced lung cancer in swiss albino mice	[39]
Pumpkin *(Cucurbita moschata)*	Seeds	Moschatin	Ribosomes inactivation and inhibit growth of melanoma cells M-21	Various tumors	[40]
Red- spinach *(Amaranthus gangeticus)*		Aqueous extract	.	Liver cancer cell lines and MCF-7 breast cancer cells	[41]
Soybeans *(Glycine max)*		Soy spingolipids	Affect gene expression and cause decrease in m –RNA expression of transcription factors	Colon carcinoma	[42]
		Isoflavones	Cell cycle arrest	Human breast cancer cells	[43]
		Isoflavones	Prevent progression of spontaneous tumors	Hormone refractory prostate cancer in lobund wister rats	[44]
Saffron *(Crocus sativus)*	Stigma	Carotenoids	Inhibits DNA synthesis	Various tumors	[45,46]
Spinach *(Spinacea oleracea)*		Sulfoquinovosyl diacyl glycerol	Cell growth suppression	Various tumors	[47]
	Leaves	Antioxidant	Inhibits cellular proliferation and reduction on number of reactive oxygen speices	Prostate cancer cell lines	[48]
Tomato (*Solanum lycopersicum*)		Lycopene	Decrease activity of MMP-2 and 9 and inhibit cell growth in dose dependent manner	SK-Hep 1 human hepatoma cells	[49]
	Tomato paste	Hexane extracts and lycopene	Inhibits cell growth in dose dependent manner and there is increase in level of 8- hydroxydeoxyguanosine/deoxyguanosine	LNCaP human prostate cancer cells	[50,51]
Turmeric (*Curcuma longa*)	Rhizome	Curcumin	Inhibition of transcription factor NF-kappaB	Pancreatic cancer	[52,53]
		Curcumin	Inhibits proliferation of both IFN alpha- sensitive and IFN alpha- resistant cancer cells in bladder	Bladder cancer	[54]
Wheat germ			Reduces chemotherapy induces febrile neutropenia	Pediatric cancer	[55]

Table 2: Herbs and natural products for cancer prevention

Plant name	Part	Active component/extract	Mechanism of action	Cancer inhibited	Ref.
Azadiracta indica	Leaves	Aqueous leaf extract	Decrease in oxidative stress and increase in glutathione content that leads to apoptosis	Skin tumor in male balb/c mice	[56]
		Ethanolic leaf extract	Decrease expression of PCNA, mutant p 53 and Bcl -2	Hamster buccal pouch carcinoma	[57]
		Ethanolic leaf extract	Lipid peroxidation and enhances antioxidant status of stomach.	Gastric carcinoma	[58]
Amoora dasyclada	Twigs	3α-acetoxy-24,25,26,27 tetranortirucalla-7-ene		Human liver cancer cells	[59]
Agalia elliptifolia		Rocoglamide	Inhibits TNF-alpha or PMA induced NF-kappaB activity in T-lymphocytes and induces apoptosis	Human cancer cell lines	[60]
Aralia nudicaulis	Rhizomes	Hexane extract		Human colon cancer cells and human leukemic cells	[61]
	Fruit	Hexane extract		Human cervix cancer cells	[61]
Aglaia crassinervia	Bark	Rocaglaol	Induces apoptosis of LNCaP cells and G2/M phase cell cycle arrest	Various cancer	[62]
Alstonia scholaris		Alkaloid fraction	Induces apoptosis	HeLA, Hep G (2), KB, HL-60, MCF-7 cancer cells	[63]
Artemisia sylvatica	Aerial parts	Sesquiterpenes from methanol extract	Inhibitory effect on LPS- induced NF-kappaB	Various cancers	[64]
Artemisia princep		Yomogin	Causes activation of caspase -3 and induces apoptosis	HL-60 human promylenocytic leukemic cells	[65]

(*Continued*)

Table 2: (Continued)

Plant name	Part	Active component/extract	Mechanism of action	Cancer inhibited	Ref.
Angelica sinensis		n-butylidenephthalide from chloroform extract	Up regulation of expression of cyclin kinase inhibitor and cause cell cycle arrest at G0/G1 phase.	Malignant brain tumor	[66]
		Acetone fraction	Decrease number of cells in S-phase and induces apoptosis	A-549, HT-29, JS human cancer cells	[67]
Annona glabra		Cunabic acid (diterpene)	Arrest at G0/G1 phase and induces apoptosis by down regulating the gene expression of Bcl-2 gene	SMMC-7721 human liver cell line	[68]
Aglaia silvestris	Fruits and twigs	Silvestrol and episilvestrol		Human oral epidermoid carcinoma cell line	[69]
Arisaema tortuosum	Tubers	Lectin		HT-29, OVCAR-5, SiHa human lung cancer cell lines	[70]
Avicennia germinans	Leaves and twigs	3-chloro deoxylapachol		KB human cancer cells	[71]
Annona reticulata	Seeds	Squamocin	Induces expression of Bax and enhances caspase-3 activity	T-24 bladder cancer cells	[72]
Alvaradoa haitiensis	Leaves	Alvaradoin E	Chromatin condensation	Various tumors	[73]
Bamboo	Leaves	201-hydroxy purpurin-7 δ lactone ethyl methyl diester from methanolic extract	Induces apoptosis.	CMK-7 human leukemic cell lines	[74]
Bischofia javanica	Bark	Betulic acid and its derivatives	DNA topoisomerase II inhibitors	Various tumors	[75]
Betula platyphylla		Methanolic extract	Increases cell viability against water and induces apoptosis	Hamster lung fibroblast cell lines	[76]
Calotropis procera	Latex	Methanolic extract	Decrease in Serum vascular endothelial growth factor and cause cell death in hepatoma and non hepatoma cell lines.	Hepatocellular cell lines.	[77]
Clematis manshrica		Saponins		Sarcoma-180, Hep A and P-388 cancer cell lines.	[78]
Chamaecyparis nootkatensis		Diterpenes		Various cancers	[79]
Coptis japonica	Root	Methanol extract	Induces apoptosis through caspase -3 activation	SNU-688 human gastric cancer cells.	[80]
Capaifera multijuga		Oil resin		Melanoma cell line	[81]
Capparis sikkimensis		Cappamensin A		Ovarian (1A-9), lung (A-549), Breast (MCF-7) cancer cell lines	[82]
Digitalis purpurea	Leaves	Gitoxin and gitoxigenin	Induces apoptosis	TK-10 renal adenocarcinoma cancer cells	[83]
Dioscorea futschauensis	Rhizomes	Pentacyclic triterpenoid glycoside	Induces apoptosis by mitrocondrial controlled apoptotic pathway	HCT human colon carcinoma cells	[84]
Dioscorea bulbifera		Petroleum ether extract		Chemoprotection in mice bearing HepA	[85]
Dendrobrium loddigesii	Stems	Moscatilin	G2 phase arrest	Various cancers	[86]
Dioscorea collettii	Rhizomes	Steroidal saponins(methyl protoneogracillin and gracillin)		Leukemic , Prostate and CNS cancer cells	[87]
Evodia fructus		Evodiamine	Causes G2/M phase areast and cause tubulin polymerization and promotes phosphorylations of kinase and Bcl-2	Human multiple drug resistant breast cancer cells	[88]
Evodia ruteacarpa	Fruits	Quinolone compounds	Inhibitory activity on nuclear factor of activated T–cells	Various cancers	[89]
Gymnocladus chinensis baillon	Fruit	Triterpenoid saponin	Induces apoptosis and causes inactivation of NF- kappaB	Various cancers	[90]
Garcinia hanburyi		Gambogic acid and epigambogic acid		Human leukemic K-562 and doxorubicin resistant K-562/R cell lines	[91]
Ginkgo biloba		Extract	Decreases peripheral type benzodiazepine receptor levels and induces apoptosis	MDA-MB-231 breast cancer cell lines and U-87 glioma cell lines	[92]
Geum quellyon sweet	Roots	Tannins	Necrosis cell death and apoptotic cell death	Colon adenocarcinoma, oral squamous and androgen insensitive prostate cancer cells	[93]
Hibiscus sabdariffa	Dried calicus	Delphidin 3-sambubioside	Elevation of intracellular reactive oxygen speices and cause activation of caspase 3, 8 and 9	Human leukemic cells	[94]
Kaempferia parviflora	Rhizomes	Flavone derivatives from ethanol extract	Increase accumulation of rhodamine 123 and danorubicin in LLC-GA5-COL150 cells.	Increase oral bioavailability of anticancer agents	[95]
Lindera strychifolia	Roots	Extract	Induces apoptosis	A-549 and SBC-3 human lung cancer cell line	[96]

(*Continued*)

Table 2: (Continued)

Plant name	Part	Active component/extract	Mechanism of action	Cancer inhibited	Ref.
Lycium barbarum		Polysaccharide	Cause cell cycle arrest in S phase and apoptosis induction	QGY7703 human hepatoma cells	[97]
Morinda citrifolia	Fruit	Polysaccharide rich compounds		Sarcoma 180 ascites tumour in mice	[98]
Miliusa sinensis	Flowers	Miliusanes		MCF-7, COL-2, Lu -1, LNCap cancers cells	[99]
Oledenlandia diffusa		Water extract	Pro apoptotic effect	Effect on lung metastases	[100]
Phyllanthus urinaria		Extract	Increaseof apoptosis in tumour sections.	Lewis lung carcinoma	[101]
		Aqueous extract	Induces apoptosis in human cancer cells	Human cancer cells	[102]
Partinia villosa	Leaves	Flavones		K-562 cancer cells	[103]
Plumeria bicolor	bark	Plumeridepentaacetate obtained from methanolic extract		Various cancers	[104]
Parinari sprucei	Leaves	Kaurene type diterpenoids		Various cancers	[105]
Platycodon grandiflorum	Roots	Petroleum ether extract		Various cancers	[106]
Pterocarpus santalinus		Methanolic extract	Chromatin condensation and sub G1 phase accumulation	Human cervical adenocarcinoma cell line	[107]
Pinus maritima	Bark	Phenolic compounds containing extract		Skin carcinoma	[108]
Peganum hermala		Harmine alkaloids	Inhibits expression of Bcl-2 gene and significantly induces apoptosis	Various cancers	[109]
Pistacia lentiscus		50% ethanol extract	Cell cycle arrest at G1 phase and cause activation of caspase -3, 8 and 9	HCT116 human colon cancer cells	[110]
Rhus verniciflua		Flavanoids	Growth inhibition and apoptosis in HOS cells, activation of caspase -3 and Bax activity	Hepatic cell line in mouse	[111]
Rhodiola rosea	Rhizomes	Extract	Apoptosis from G2/M phase of cell cycle and cause necrosis in HL-60 cells	Cytotoxic to HL-60 cells	[112]
Sequia sempervirens	Leaves	Norlignans(agatharesinol acetonide)		A-549 non- small- lung cancer cell line	[113]
Scutellaria baicalensis	Roots	Flavanoids	Inhibits growth in recurrent and drug resistant brain tumor cell lines	Various cancers	[114]
		Baicalein/wogonin/ neobaicalein	Causes cell cycle changes and shows antiandrogenic effect	Prostate cancer	[115]
Scatellariae radix		5,6,7 trimethyl baicalein	Cell cycle arrest	Hepatocellular carcinoma	[116]
Saurures chinensis		Neolignans	Cell cycle arrest at G1 phase and cause down regulation of Bcl-2 and upregulation of Bax	PC-3 prostate cancer cells	[117]
Savda munzid		Aqueous extract	Cytoplasmic cleavage and concentration dependent inhibition of protein , DNA and RNA synthesis	HepG2 human hepatoma cells	[118]
Silibium marium		Silibin	G1 and G2/M phase arrest and inhibits CDK2,CDK4 kinase activity in hepatic cells	Human hepatocellular carcinoma	[119]
		Silibin	Reduces expression of MMP-2 and urokinase plasminogen factor activator	Human lung cancer cells	[120]
Solanum nigrum		150 –kDa glycoprotein	Inhibits protein kinase C alpha translocation and NO production	Carcinogenic to HCT-116 cells	[121]
Toddalia asiatica		Dihydronitidine		A-549 cells	[122]
Tinospora cordifolia		Dichloromethane extract	Depletion of glutathione concentration and increase in lipid peroxidation	Ehrlich ascites carcinoma of mice	[123]
Tribulus terrestris	Fruits	Steroidal glycosides		SK-MEL human malignant melanoma cell	[124]
Toona sinensis		Aqueous extract	Apoptosis accompanied by release of cytochrome C and caspase 3-activation	Human premyelocytic leukemic cells	[125]
Uvaria hamiltonii		Aurone 20	G2/M phase cell cycle arrest	Anticancer agent	[126]
Voodoo lily (sauromatum venosum	Tubers	Lectin alkaloids		Antiproliferative activity	[127]
Viscum coloratum		Lectin alkaloids	Caspase 3 activation, lectin -11 induced apoptosis, enhancement of cytokinin release	U-937, HL-60, lymphoblastoid cells and hepatocarcinoma cells	[128]
Viscum album		Extract	Induces apoptosis and necrosis	Colorectal cancer	[129]
Vitex trifolia		Flavonoids	Cause cell cycle arrest at G2/M and G0/G1 phase	Mammalian cancer cells	[130]
Ximenia Americana		Riproximin	Inhibits ribosomes protein	Antineoplastic agent	[131]
		Aqueous extract		CC531 rat colorectal cancer cells	[132]
Youngia japonica		Aqueous extract		Human myelogenous leukemia	[133]
Zanthoxylum madagascariense	Stem bark	Cyclohexane extract (benzophenanthridine type alkaloids)	Cell cycle arrest in G0/G1 phase as well as decrease of cells in S – phase	Human colorectal adenocarcinoma.	[134]

plagued by lung, colon, rectum and prostrate cancer. Recent United States study was conducted involving 628 men under the age of 65 years with newly diagnosed prostrate cancer.[1] A large study involving 35,000 non-smokings, mainly vegetarian, Seventh Day Adventists found a reduced risk of lung, prostrate, pancreas and colon cancers.[9] Women in Japan and the Far East have a much lower incidence of breast cancer than women in the West. These women have a high consumption of soy products containing isoflavones, which are phytoestrogen or plant estrogen.[13] The changing profiles in the incidence of certain cancers in South Africa have been attributed to urbanization, with increased consumption of meat, refined carbohydrates, alcohol and smoking. The rural African diet of Soy and vegetables was a perfect combination of protein and complex carbohydrates with adequate fiber and plant nutrients.[14] The epidemiological evidence suggests protection against a wide array of cancers, particularly those of the respiratory and digestive tracts and to a lesser extent the hormone-related cancers.[15]

Conclusion

This paper has discussed role of diet and natural products in the treatment of cancer. Diet rich in vegetables, fruits and legumes contains large amount of antioxidants that protect against the deleterious actions of free radicals that may lead to cancer development. Experimental agents derived from natural sources are offering us a great opportunity to evaluate not only totally new chemical class of anticancer agents, but also with novel and potential mechanism of action. So it is no longer an option to ignore plants and dietary agents or treat them as something unconventional from regular medical practice. The challenge put before this system of medicine is to move forward carefully, using both reasoning and wisdom.

References

1. Reddy L, Odhav B, Bhoda KD. Natural products for cancer prevention: A global prespective. Pharmacol Ther 2003;99:1-13.
2. Calabresi P, Chabner BA. Chemotherapy of neoplastic agents. In: Hardman JG, Limbird LE, editor. Goodman and Gilman's the pharmacological basis of therapeutics. 9th ed. Texas: McGraw Hill; 1997. p. 1225-33.
3. Gordon MC, David JN. Plants as a source of anticancer agents. J Ethanopharmacol 2005;100:72-9.
4. Cragg GM, Newman DJ, Snader KM. Natural products in drug discovery and development. J Nat Prod 1997;60:52-60.
5. Wani MC, Taylor HL, Wall ME, Coggon P, McPhail AT. Plants antitumor agents V1, the isolation and structure of taxol, a novel antileukemic and antitumor agents from *Taxus brevifolia*. J Am chem Soc 1971;93:2325-7.
6. Noble RL. The discovery of vinca alkaloid — chemotherapeutic agents against cancer. Biochem Cell Biol 1990;68:1344-51.
7. Chabner BA. Anticancer drugs, In Cancer: Principles and Practice. 4th ed. Philadelphia: Lippincott; p. 325-417.
8. Liu LF, Desai SD, Li TK. Mechanism of action of camptothecin. Ann N Y Acad Sci 2000;922:1-10.
9. Abdulla M, Gruber P. Role of diet modification in cancer chemoprevention. Biofactors 2000;12:45-51.
10. Cragg GM, Newman DJ. Plants as a source of anticancer agents. J Ethanopharmacol 2005;100:72-9.
11. Cancer-Pain.org [homepage on the Internet]. New York: Association of Cancer Online Resources, Inc.; c2000-01. Available from: http://www.cancer-pain.org/. [Updated 2002 May 16; cited 2012 Aug 11].
12. Bharat B, Aggarwal SS. Molecular targets of dietery agents for prevention and therapy of cancer. Biochem Pharmacol 2006;71:1397-421.
13. Allred CD, Allred KF, Ju YH, Virant SM, Helferich WG. Soy diets containing varying amount of gentisin stimulate growth of estrogen — dependent (MCF-7) tumors in a dose dependent manner. Cancer Res 2001;61:5045-50.
14. Willett WC. Diet and health: What should we eat? Science 1998;264:532-7.
15. Block G, Patterson B, Suber A. Fruits, Vegetables and Cancer prevention: A review of the epidemiological evidence. Nutr Cancer 1992;18:1-29.
16. Lansky EP, Harrison G, Froom P, Jiang WG. Pomegranate (*Punica granatum*) pure chemicals show possible synergistic inhibition of human PC-3 prostate cancer cell invasion across Matrigel. Invest New Drugs 2005;23:121-2.
17. Mehta R, Lansky EP. Breast cancer chemopreventive properties of pomegranate (*Punica granatum*) fruit extracts in a mouse mammary organ culture. Eur J Cancer Prev 2004;13:345-8.
18. Amico V, Barresi V, Condorelli D, Spatafora C, Tringali C. Antiproliferative terpenoids from almond hulls (*Prunus dulcis*): Identification and structure-activity relationships. J Agric Food Chem 2006;54:810-4.
19. Yoon H, Liu RH. Effect of selected phytochemicals and apple extracts on NF-kappaB activation in human breast cancer MCF-7 cells. J Agric Food Chem 2007;55:3167-73.
20. Jagetia GC, Venkatesh P, Baliga MS. Aegle marmelos (L.) Correa inhibits the proliferation of transplanted Ehrlich ascites carcinoma in mice. Biol Pharm Bull 2005;28:58-64.
21. Bhattacharyya A, Lahiry L, Mandal D, Sa G, Das T. Black tea induces tumor cell apoptosis by Bax translocation, loss in mitochondrial transmembrane potential, cytochrome c release and caspase activation. Int J Cancer 2003;117:308-15.
22. Katayama M, Sugie S, Yoshimi N, Yamada Y, Sakata K, Qiao Z, *et al*. Preventive effect of fermented brown rice and rice bran on diethylnitrosoamine and phenobarbital-induced hepatocarcinogenesis in male F344 rats. Oncol Rep 2003;10:875-80.
23. Yoo CB, Han KT, Cho KS, Ha J, Park HJ, Nam JH, *et al*. Eugenol isolated from the essential oil of *Eugenia caryophyllata* induces a reactive oxygen species-mediated apoptosis in HL-60 human promyelocytic leukemia cells. Cancer Lett 2005;225:41-52.
24. Moyers SB, Kumar NB. Green tea polyphenols and cancer chemoprevention: Multiple mechanisms and endpoints for phase II trials. Nutr Rev 2004;62:204-11.
25. Azam S, Hadi N, Khan NU, Hadi SM. Prooxidant property of green tea polyphenols epicatechin and epigallocatechin-3-gallate: Implications for anticancer properties. Toxicol *In Vitro* 2004;18:555-61.
26. Kaur M, Singh RP, Gu M, Agarwal R, Agarwal C. Grape seed extract inhibits *in vitro* and *in vivo* growth of human colorectal carcinoma cells. Clin Cancer Res 2006;12(20 pt.1):6194-202.
27. Agarwal C, Veluri R, Kaur M. Fractionation of high molecular weight tannins in grape seed extract and identification of procyanidin B2-3,3'-di-O-gallate as a major active constituent causing growth inhibition and apoptotic death of DU145 human prostate carcinoma cells. Carcinogenesis 2007;28:1478-84.
28. Tyagi A, Agarwal R, Agarwal C. Grape seed extract inhibits EGF-induced and constitutively active mitogenic signaling but activates JNK in human prostate carcinoma DU145 cells: Possible role in antiproliferation and apoptosis. Oncogene 2003;22:1302-16.
29. Chu Q, Lee DT, Tsao SW. S-allylcysteine, a water-soluble garlic derivative, suppresses the growth of a human androgen-independent prostate cancer xenograft, CWR22R, under *in vivo* conditions. BJU Int 2007;99:925-32.
30. Hosono T, Fukao T, Ogihara J. Diallyl trisulfide suppresses the proliferation and induces apoptosis of human colon cancer cells through oxidative modification of beta-tubulin. J Biol Chem 2005;280:41487-93.
31. Hirsch K, Danilenko M, Giat J. Effect of purified allicin, the major ingredient of freshly crushed garlic, on cancer cell proliferation. Nutr Cancer 2000;38:245-54.
32. Shukla Y, Singh M. Cancer preventive properties of ginger: A brief review. Food Chem Toxicol 2007;45:683-90.
33. Miyoshi N, Nakamura Y, Ueda Y. Dietary ginger constituents, galanals A and B, are potent apoptosis inducers in Human T lymphoma Jurkat cells. Cancer Lett 2003;199:113-9.

34. Poulose SM, Harris ED, Patil BS. Antiproliferative effects of citrus limonoids against human neuroblastoma and colonic adenocarcinoma cells. Nutr Cancer 2006;56:103-12.
35. Kumar RA, Sridevi K, Kumar NV. Anticancer and immunostimulatory compounds from *Andrographis paniculata*. J Ethnopharmacol 2004;92:291-5.
36. Chen PN, Chu SC, Chiou HL. Mulberry anthocyanins, cyanidin 3-rutinoside and cyanidin 3-glucoside, exhibited an inhibitory effect on the migration and invasion of a human lung cancer cell line. Cancer Lett 2006;235:248-59 .
37. Percival SS, Talcott ST, Chin ST. Neoplastic transformation of BALB/3T3 cells and cell cycle of HL-60 cells are inhibited by mango (*Mangifera indica* L.) juice and mango juice extracts. J Nutr 2006;136:1300-4.
38. Qian SH, Wang YX, Yang NY. Study on the anticancer activities (*in vivo*) of the extract from *Citrus reticulata* Blanco and its influence on sarcoma-180 cells cycle. Zhongguo Zhong Yao Za Zhi 2003;28:1167-70.
39. Samarth RM, Panwar M, Kumar A. Modulatory effects of *Mentha piperita* on lung tumor incidence, genotoxicity and oxidative stress in benzo[a] pyrene-treated Swiss albino mice. Environ Mol Mutagen 2006;47:192-8.
40. Xia HC, Li F, Li Z, Zhang ZC. Purification and characterization of Moschatin, a novel type I ribosome-inactivating protein from the mature seeds of pumpkin (*Cucurbita moschata*) and preparation of its immunotoxin against human melanoma cells. Cell Res 2003;13:369-74 .
41. Sani HA, Rahmat A, Ismail M. Potential anticancer effect of red spinach (*Amaranthus gangeticus)* extract. Asia Pac J Clin Natr 2004;13:396-400.
42. Symolon H, Schmelz EM, Dillehay DL. Dietary soy sphingolipids suppress tumorigenesis and gene expression in 1,2-dimethylhydrazine-treated CF1 mice and ApcMin/+ mice. J Nutr 2004;134:1157-61.
43. Stoll BA. Eating to beat breast cancer: Potential role for soy supplements. Am Oncol 1997;8:223-5.
44. Pollard M, Suckow MA. Dietary prevention of hormone refractory prostate cancer in Lobund-Wistar rats: A review of studies in a relevant animal model. Comp Med 2006;56:461-7.
45. Nair SC, Kurumboor SK, Hasegawa JH. Saffron chemoprevention in biology and medicine: A review. Cancer Biother 1995;10:257-64.
46. Nair SC, Pannikar B, Panikkar KR. Antitumour activity of saffron (*Crocus sativus*). Cancer Lett 1991;57:109-14.
47. Kuriyama I, Musumi K, Yonezawa Y. Inhibitory effects of glycolipids fraction from spinach on mammalian DNA polymerase activity and human cancer cell proliferation. J Nutr Biochem 2005;16:594-601.
48. Nyska A, Suttie A, Bakshi S. Slowing tumorigenic progression in TRAMP mice and prostatic carcinoma cell lines using natural anti-oxidant from spinach, NAO-a comparative study of three anti-oxidants. Toxicol Pathol 2003;31:39-51.
49. Hwang ES, Lee HJ. Inhibitory effects of lycopene on the adhesion, invasion and migration of SK-Hep1 human hepatoma cells. Exp Biol Med 2006;231:322-7.
50. Hwang ES, Bowen PE. Effects of lycopene and tomato paste extracts on DNA and lipid oxidation in LNCaP human prostate cancer cells. Biofactors 2005;23:97-105.
51. Guttenplan JB, Chen M, Kosinska W. Effects of a lycopene-rich diet on spontaneous and benzo[a]pyrene-induced mutagenesis in prostate, colon and lungs of the lacZ mouse. Cancer Lett 2001;164:1-6.
52. Thangapazham RL, Sharma A, Maheshwari RK. Multiple molecular targets in cancer chemoprevention by curcumin. AAPS J 2006;8:E443-9.
53. Kunnumakkara AB, Guha S, Krishnan S. Curcumin Potentiates antitumor activity of gemcitabine in an orthotopic model of pancreatic cancer through suppression of proliferation, angiogenesis and inhibition of nuclear factor-{kappa}B-regulated gene products. Cancer Res 2007;67:3853-61.
54. Kamat AM, Sethi G, Aggarwal BB. Curcumin potentiates the apoptotic effects of chemotherapeutic agents and cytokines through down-regulation of nuclear factor-kappaB and nuclear factor-kappaB-regulated gene products in IFN-alpha-sensitive and IFN-alpha-resistant human bladder cancer cells. Mol Cancer Ther 2007;6:1022-30.
55. Garami M, Schuler D, Babosa M. Fermented wheat germ extract reduces chemotherapy-induced febrile neutropenia in pediatric cancer patients. J Pediatr Hematol Oncol 2004;26:631-5.
56. Koul A, Ghara AR, Gangar SC. Chemomodulatory effects of *Azadirachta indica* on the hepatic status of skin tumor bearing mice. Phytother Res 2006;20:169-77.
57. Subapriya R, Kumaraguruparan R, Nagini S. Expression of PCNA, cytokeratin, Bcl-2 and p53 during chemoprevention of hamster buccal pouch carcinogenesis by ethanolic neem (*Azadirachta indica*) leaf extract. Clin Biochem 2006;39:1080-7.
58. Subapriya R, Nagini S. Ethanolic neem leaf extract protects against N-methyl -N'-nitro-N-nitrosoguanidine-induced gastric carcinogenesis in Wistar rats. Asian Pac J Cancer Prev 2003;4:215-23.
59. Yang SM, Song QS, Qing C. Anticancer activity of tirucallane triterpenoids from *Amoora dasyclada*. Z Naturforsch [C] 2006;61:193-5.
60. Kim S, Salim AA, Swanson SM. Potential of cyclopenta[b]benzofurans from Aglaia species in cancer chemotherapy. Anticancer Agents Med Chem 2006;6:319-45.
61. Wang J, Li Q, Ivanochko G. Anticancer effect of extracts from a North American medicinal plant–wild sarsaparilla. Anticancer Res 2006;26:2157-64.
62. Mi Q, Su BN, Chai H. Rocaglaol induces apoptosis and cell cycle arrest in LNCaP cells. Anticancer Res 2006;26:947-52.
63. Jagetia GC, Baliga MS. Evaluation of anticancer activity of the alkaloid fraction of *Alstonia scholaris* (Sapthaparna) *in vitro* and *in vivo*. Phytother Res 2006;20:103-9.
64. Jin HZ, Lee JH, Lee D. Inhibitors of the LPS-induced NF-kappaB activation from *Artemisia sylvatica*. Phytochemistry 2004;65:2247-53.
65. Jeong SH, Koo SJ, Ha JH. Induction of apoptosis by yomogin in human promyelocytic leukemic HL-60 cells. Biol Pharm Bull 2004;27:1106-11.
66. Tsai NM, Chen YL, Lee CC. The natural compound n-butylidenephthalide derived from *Angelica sinensis* inhibits malignant brain tumor growth *in vitro* and *in vivo*. J Neurochem 2006;99:1251-62.
67. Cheng YL, Chang WL, Lee SC. Acetone extract of *Angelica sinensis* inhibits proliferation of human cancer cells via inducing cell cycle arrest and apoptosis. Life Sci 2004;75:1579-94.
68. Zhang YH, Peng HY, Xia GH. Anticancer effect of two diterpenoid compounds isolated from *Annona glabra* Linn. Acta Pharmacol Sin 2004;25:937-42.
69. Hwang BY, Su BN, Chai H. Silvestrol and episilvestrol, potential anticancer rocaglate derivatives from *Aglaia silvestris*. J Org Chem 2004;69:3350-8.
70. Dhuna V, Bains JS, Kamboj SS. Purification and characterization of a lectin from *Arisaema tortuosum* Schott having *in-vitro* anticancer activity against human cancer cell lines. J Biochem Mol Biol 2005;38:526-32.
71. Jones WP, Lobo-Echeverri T, Mi Q. Antitumour activity of 3-chlorodeoxylapachol, a naphthoquinone from *Avicennia germinans* collected from an experimental plot in southern Florida. J Pharm Pharmacol 2005;57:1101-8.
72. Yuan SS, Chang HL, Chen HW. Selective cytotoxicity of squamocin on T24 bladder cancer cells at the S-phase via a Bax-, Bad- and caspase-3-related pathways. Life Sci 2006;78:869-74.
73. Mi Q, Lantvit D, Reyes-Lim E. Apoptotic anticancer effect of alvaradoin E isolated from *Alvaradoa haitiensis*. Anticancer Res 2005;25:779-87.
74. Kim KK, Kawano Y, Yamazaki Y. A novel porphyrin photosensitizer from bamboo leaves that induces apoptosis in cancer cell lines. Anticancer Res 2003;23:2355-61.
75. Wada S, Tanaka R. Betulinic acid and its derivatives, potent DNA topoisomerase II inhibitors, from the bark of *Bischofia javanica*. Chem Biodivers 2005;2:689-94.
76. Ju EM, Lee SE, Hwang HJ. Antioxidant and anticancer activity of extract from *Betula platyphylla* var. japonica. Life Sci 2004;74:1013-26.
77. Choedon T, Mathan G, Arya S. Anticancer and cytotoxic properties of the latex of *Calotropis procera* in a transgenic mouse model of hepatocellular carcinoma. World J Gastroenterol 2006;12:2517-22.
78. Zhao Y, Wang CM, Wang BG. Study on the anticancer activities of the *Clematis manshrica* saponins *in vivo*. Zhongguo Zhong Yao Za Zhi 2005;30:1452-3.
79. Pettit GR, Tan R, Northen JS. Antineoplastic agents. 529. Isolation and structure of nootkastatins 1 and 2 from the Alaskan yellow cedar *Chamaecyparis nootkatensis*. J Nat Prod 2004;67:1476-82.
80. Park HJ, Kim YJ, Leem K. Coptis japonica root extract induces apoptosis through caspase3 activation in SNU-668 human gastric cancer cells. Phytother Res 2005;19:189-92.

81. Lima SR, Junior VF, Christo HB. *In vivo* and in vitro studies on the anticancer activity of *Copaifera multijuga* hayne and its fractions. Phytother Res 2003;17:1048-53.
82. Wu JH, Chang FR, Hayashi K. Antitumor agents. Part 218: Cappamensin A, a new *in vitro* anticancer principle, from *Capparis sikkimensis*. Bioorg Med Chem Lett 2003;13:2223-5.
83. Lopez-Lazaro M, Palma De La Pena N, Pastor N. Anti-tumour activity of *Digitalis purpurea* L. subsp. Heywoodii. Planta Med 2003;69:701-4.
84. Wang SL, Cai B, Cui CB. Diosgenin-3-O-alpha-L-rhamnopyranosyl-(1 -> 4)-beta-D-glucopyranoside obtained as a new anticancer agent from *Dioscorea futschauensis* induces apoptosis on human colon carcinoma HCT-15 cells via mitochondria-controlled apoptotic pathway. J Asian Nat Prod Res 2004;6:115-25.
85. Yu ZL, Liu XR, McCulloch M. Anticancer effects of various fractions extracted from *Dioscorea bulbifera* on mice bearing HepA. Zhongguo Zhong Yao Za Zi 2004;29:563-7.
86. Ho CK, Chen CC. Moscatilin from the orchid *Dendrobrium loddigesii* is a potential anticancer agent. Cancer Invest 2003;21:729-36.
87. Hu K, Yao X. The cytotoxicity of methyl protoneogracillin (NSC-698793) and gracillin (NSC-698787), two steroidal saponins from the rhizomes *of Dioscorea collettii* var. hypoglauca, against human cancer cells *in vitro*. Phytother Res 2003;17:620-6.
88. Liao CH, Pan SL, Guh JH. Antitumor mechanism of evodiamine, a constituent from Chinese herb *Evodia fructus*, in human multiple-drug resistant breast cancer NCI/ADR-RES cells *in vitro* and *in vivo*. Carcinogenesis 2005;26:968-75.
89. Jin HZ, Lee JH, Lee D. Quinolone alkaloids with inhibitory activity against nuclear factor of activated T cells from the fruits of *Evodia rutaecarpa*. Biol Pharm Bull 2004;27:926-8.
90. Ma YX, Fu HZ, Li M. An anticancer effect of a new saponin component from *Gymnocladus chinensis* Baillon through inactivation of nuclear factor-kappaB. Anticancer Drugs 2007;18:41-6.
91. Han Q, Yang L, Liu Y. Gambogic acid and epigambogic acid, C-2 epimers with novel anticancer effects from *Garcinia hanburyi*. Planta Med 2006;72:281-4.
92. Pretner E, Amri H, Li W. Cancer-related overexpressions of the peripheral-type benzodiazepine receptor and cytostatic anticancer effects of *Ginkgo biloba* extract (EGb 761). Anticancer Res 2006;26:9-22.
93. Russo A, Cardile V, Lombardo L. Antioxidant activity and antiproliferative action of methanolic extract of *Geum quellyon* Sweet roots in human tumor cell lines. J Ethanopharmacol 2005;100:323-32.
94. Hou DX, Tong X, Terahara N. Delphinidin 3-sambubioside, a *Hibiscus anthocyanin*, induces apoptosis in human leukemia cells through reactive oxygen species-mediated mitochondrial pathway. Arch Biochem Biophys 2005;440:101-9.
95. Patanasethanont D, Nagai J, Yumoto R. Effects of *Kaempferia parviflora* extracts and their flavone constituents on P-glycoprotein function. J Pharm Sci 2007;96:223-33.
96. Li YM, Ohno Y, Minatoguchi S. Extracts from the roots of *Lindera strychifolia* induces apoptosis in lung cancer cells and prolongs survival of tumor-bearing mice. Am J Clin Med 2003;31:857-69.
97. Zhang M, Chen H, Huang J. Effect of lycium barbarum polysaccharide on human hepatoma QGY7703 cells: Inhibition of proliferation and induction of apoptosis. Life Sci 2005;76:2115-24.
98. Furusawa E, Hirazumi A, Story S. Antitumour potential of a polysaccharide-rich substance from the fruit juice of *Morinda citrifolia* (Noni) on sarcoma 180 ascites tumour in mice. Phytother Res 2003;17:1158-64.
99. Zhang HJ, Ma C, Nguyen VH. Miliusanes, a class of cytotoxic agents from *Miliusa sinensis*. J Med Chem 2006;49:693-708.
100. Gupta S, Zhang D, Yi J. Anticancer activities of *Oldenlandia diffusa*. J Herb Pharmacother 2004;4:21-33.
101. Huang ST, Yang RC, Lee PN. Anti-tumor and anti-angiogenic effects of *Phyllanthus urinaria* in mice bearing Lewis lung carcinoma. Int Immunopharmacol 2006;6:870-9.
102. Huang ST, Yang RC, Pang JH. Aqueous extract of *Phyllanthus urinaria* induces apoptosis in human cancer cells. Am J Clin Med 2004;32:175-83.
103. Peng J, Fan G, Wu Y. Preparative isolation of four new and two known flavonoids from the leaf of *Patrinia villosa* Juss. by counter-current chromatography and evaluation of their anticancer activities *in vitro*. J Chromatogr A 2006;1115:103-11.
104. Dobhal MP, Li G, Gryshuk A. Structural modifications of plumieride isolated from *Plumeria bicolor* and the effect of these modifications on *in vitro* anticancer activity. J Org Chem 2004;69:6165-72.
105. Braca A, Armenise A, Morelli I. Structure of kaurane-type diterpenes from *Parinari sprucei* and their potential anticancer activity. Planta Med 2004;70:540-50.
106. Lee JY, Hwang WI, Lim ST. Antioxidant and anticancer activities of organic extracts from *Platycodon grandiflorum* A. De Candolle roots. J Ethnopharmacol 2004;93:409-15.
107. Kwon HJ, Hong YK, Kim KH. Methanolic extract of *Pterocarpus santalinus* induces apoptosis in HeLa cells. J Ethanopharmacol 2006;105:229-34.
108. Kyriazi M, Yova D, Rallis M. Cancer chemopreventive effects of *Pinus maritima* bark extract on ultraviolet radiation and ultraviolet radiation-7,12, dimethylbenz(a)anthracene induced skin carcinogenesis of hairless mice. Cancer Lett 2006;237:234-41.
109. Chen Q, Chao R, Chen H. Antitumor and neurotoxic effects of novel harmine derivatives and structure-activity relationship analysis. Int J Cancer 2005;114:675-82.
110. Balan KV, Prince J, Han Z. Antiproliferative activity and induction of apoptosis in human colon cancer cells treated in vitro with constituents of a product derived from *Pistacia lentiscus* L. var. chia. Phytomedicine 2007;14:263-72.
111. Son YO, Lee KY, Lee JC. Selective antiproliferative and apoptotic effects of flavonoids purified from *Rhus verniciflua* Stokes on normal versus transformed hepatic cell lines. Toxicol Lett 2005;155:115-25.
112. Majewska A, Hoser G, Furmanowa M. Antiproliferative and antimitotic effect, S phase accumulation and induction of apoptosis and necrosis after treatment of extract from *Rhodiola rosea* rhizomes on HL-60 cells. J Ethanopharmacol 2006;103:43-52.
113. Zhang YM, Tan NH, Yang YB. Norlignans from *Sequoia sempervirens*. Chem Biodivers 2005;2:497-505.
114. Scheck AC, Perry K, Hank NC. Anticancer activity of extracts derived from the mature roots of *Scutellaria baicalensis* on human malignant brain tumor cells. BMC Complement Altern Med 2006;6:27.
115. Bonham M, Posakony J, Coleman I. Characterization of chemical constituents in *Scutellaria baicalensis* with antiandrogenic and growth-inhibitory activities toward prostate carcinoma. Clin Cancer Res 2005;11:3905-14.
116. Liao HL, Hu MK. Synthesis and anticancer activities of 5, 6, 7-trimethylbaicalein derivatives. Chem Pharm Bull 2004;52:1162-5.
117. Song SY, Lee I, Park C. Neolignans from *Saururus chinensis* inhibit PC-3 prostate cancer cell growth via apoptosis and senescence-like mechanisms. Int J Mol Med 2005;16:517-23.
118. Yusup A, Upur H, Baudrimont I. Cytotoxicity of abnormal *Savda Munziq* aqueous extract in human hepatoma (HepG2) cells. Fundam Clin Pharmacol 2005;19:465-72.
119. Varghese L, Aggarwal C, Tyagi A. Silibinin efficacy against human hepatocellular carcinoma. Clin Cancer Res 2005;11:8441-8.
120. Chu SC, Chiou HL, Chen PN. Silibinin inhibits the invasion of human lung cancer cells via decreased productions of urokinase-plasminogen activator and matrix metalloproteinase-2. Mol Carcinog 2004;40:143-9.
121. Lee SJ, Oh PS, Ko JH. A 150-kDa glycoprotein isolated from *Solanum nigrum* L. has cytotoxic and apoptotic effects by inhibiting the effects of protein kinase C alpha, nuclear factor-kappa B and inducible nitric oxide in HCT-116 cells. Cancer Chemother Pharmacol 2004;54:562-72.
122. Iwasaki H, Oku H, Takara R. The tumor specific cytotoxicity of dihydronitidine from *Toddalia asiatica* Lam. Cancer Chemother Pharmacol 2006;58:451-9.
123. Jagetia GC, Rao SK. Evaluation of the antineoplastic activity of guduchi (Tinospora cordifolia) in Ehrlich ascites carcinoma bearing mice. Biol Pharm Bull 2006;29:460-6.
124. Bedir E, Khan IA. New steroidal glycosides from the fruits of *Tribulus terrestris*. J Nat Prod 2000;63:1699-701.
125. Yang HL, Chang WH, Chia YC. *Toona sinensis* extracts induces apoptosis via reactive oxygen species in human premyelocytic leukemia cells. Food Chem Toxicol 2006;44:1978-88.
126. Lawrence NJ, Rennison D, Gown AT. The total synthesis of an aurone isolated from *Uvaria hamiltonii*: Aurones and flavones as anticancer agents. Bioorg Med Chem Lett 2003;13:3759-63.

127. Singh Bains J, Singh J, Kamboj SS. Mitogenic and anti-proliferative activity of a lectin from the tubers of Voodoo lily (*Sauromatum venosum*). Biochim Biophys Acta 2005;1723:163-74.
128. Peng HY, Zhang YH, Han Y. Studies on the anticancer effects of total alkaloid from *Viscum coloratum*. Zhongguo Zhong Yao Za Zi 2005;30:381-2, 387.
129. Enesel MB, Acalovschi I, Grosu V. Perioperative application of the *Viscum album* extract Isorel in digestive tract cancer patients. Anticancer Res 2005;25:4583-90.
130. Li WX, Cui CB, Cai B. Flavonoids from *Vitex trifolia* L. inhibit cell cycle progression at G2/M phase and induce apoptosis in mammalian cancer cells. J Asian Nat Prod Res 2005;7:615-26.
131. Voss C, Eyol E, Frank M. Identification and characterization of riproximin, a new type II ribosome-inactivating protein with antineoplastic activity from *Ximenia Americana*. FASEB J 2006;20:1194-6.
132. Voss C, Eyol E, Berger MR. Identification of potent anticancer activity in *Ximenia americana* aqueous extracts used by African traditional medicine. Toxicol Appl Pharmacol 2006;211:177-87.
133. Ooi LS, Wang H, Luk CW. Anticancer and antiviral activities of *Youngia japonica* (L.) DC (Asteraceae, Compositae). J Ethanopharmacol 2004;94:117-22.
134. Pachon G, Rasoanaivo H, Azqueta A. Anticancer effect of a new benzophenanthridine isolated from *Zanthoxylum madagascariense* (Rutaceline). *In Vivo* 2007;21:417-22.

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