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Anticancer effects of Arabian medicinal plants (part 1) - A review

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Abstract: Many Arabian medicinal plants possessed anticancer activitys by many mechanisms as tested by different anticancer tests. These plants included: Adonis aestivalis, Ailanthus altissima, Alhagi maurorum, Allium cepa, Allium sativum, Allium schoenoprasum, Althaea officinalis, Althaea rosea, Ammannia baccifera, Anagyris foetida, Anchusa italica, Antirrhinum majus, Apium graveolens, Arctium Lappa, Aristolochia maurorum, Artemisia campestris, Arundo donax, Asclepias curassavica, Asparagus officinalis, Astragalus hamosus, Bauhinia variegata, Bellis perennis, Betula alba, Bidens tripartita, Brassica rapa, Bryonia dioica, Bryophyllum calycinum, Caccinia crassifolia, Caesalpinia crista, Calendula officinalis, Calotropis procera, Canna indica, Capparis spinosa, Capsella bursa-pastoris, Capsicum annuum , Capsicum frutescens, Carthamus tinctorius, Casuarina equisetifolia, Celosia cristata, Chenopodium album, Chrozophora tinctoria, Cicer arietinum, Cichorium intybus, Citrullus colocynthis, Citrus species, Clerodendron inerme, Clitoria ternatea, Convolvulus arvensis, Convolvulus scammonia, Corchorus aestuans, Corchorus capsularis, Coriandrum sativum, Coronilla scorpioides, Coronilla varia, Cotoneaster racemiflora, Crocus sativus, Cuminum cyminum, Cupressus sempervirens, Cuscuta planiflora, Cydonia oblonga, Cynodon dactylon, Cyperus rotuntdus, Dactyloctenium aegyptium, Datura metel , Daucus carota, Delphinium brunonianum, Desmostachya bipinnata, Dianthus caryophyllus, Digitalis lanata , Digitalis purpurea, Dodonaea viscosa, Lablab purpureus, Echinochloa crus-galli, Equisetum arvense, Erigeron canadensis, Erodium cicutarium, Eryngium creticum, Eucalyptus species, Eupatorium cannabinum, Euphorbia hirta, Euphorbia macroclada, Fagopyrum esculentum, Ficus carica , Ficus cunia and Ficus religiosa. The current paper will discuss the anticancer effects of some medicinal plants as a first part of this review.

Keywords: *cancer, tumor, natural products, plants, herbs, pharmacology, pharmacognosy*

I. INTRODUCTION

Globally cancer is a disease which severely effects the human population. There is a constant demand for new therapies to treat and prevent this life-threatening disease.Control survival and death of cancerous cell are important strategies in the management and therapy of cancer. Anticancer agents should kill the cancerous cell with the minimal side effect on normal cells. In recent years, a number of natural products isolated from medicinal plants have been found to inhibit proliferation, induce apoptosis, suppress angiogenesis, inhibit invesiveness, retard metastasis and enhance chemotherapy [1-7]. The current review will discuss the naturally-derived compounds from medicinal plants and their properties which make them a promising potential anticancer treatments.

Plants with anticancer effects:

Plant	Test	Activity	Ref
Adonis aestivalis	HSC-2, HSC-3, HSC-4, and HL-60 cells, as well as HGF, HPLF cell lines	Three of five cardenolide compounds isolated from the seeds of *Adonis aestivalis* were found to display selective cytotoxicity toward malignant tumor cell lines.	8-9
Ailanthus altissima	tumor cell lines HeLa, MCF-7, MDA-MB-231, HepG2 and A549 cells, as well as the normal HUVEC line	Quassinoids exhibited different levels of inhibitory activity against tumor cell lines	10
	Against guinea pig ear keratinocytes	Canthin-6-one, 1-methoxycanthin-6-one, 5-methoxycanthin -6-one, and canthin-6-one-3-N-oxide showed cytotoxicity with IC50 values range from 1.11 to 5.76 micrograms/ml.	11
	Against human glial tumor cell line SF188	shinjulactone A, shinjuglycoside B, 5-hydroxy methyl furaldehyde and protocatechuic acid cytotoxicity was investigated. Shinjulactone A, shinjuglycoside B, 5-hydroxy	12

		methyl furaldehyde, together with extracts I (the extract with water of fruits of *Ailanthus altissima* chromatographed on HPD-100 resin and eluted 60% ethanol) and II (the EtOAc extract of ethanolic extract of fruits of *Ailanthus altissima*), exhibit moderate antiproliferative activity	
	against Epstein-Barr virus early antigen activation introduced by 12-O-tetradecanoylphorbol-13-acetate in Raji cells	Quassinoids were found to show potent activity	13-14
	against three human hepatoma cell lines	quassinoids, altissinol A and B, together with 12 known quassinoids were evaluated. Seven quassinoids displayed potent cytotoxic activities against human hepatoma Hep3B and HepG2 cell lines. Interestingly, 3 compounds exhibited cytotoxic activity against multidrug resistance HepG2/ADM cell line	15
	Against HeLa cells	Cytotoxicity observed in HeLa cells was time-dependent; the treatment with 10 microg/ml of the root chloroform extract reduced cell viability by 56% at 24h and 29% at 48 h of exposure.	16-17
	Against human leukemia (Jurkat), thyroid carcinoma (ARO and NPA), and hepatocellular carcinoma (HuH7) cell lines	1-methoxy-canthin-6-one, showed >50% of sub-G1 (hypodiploid) elements in flow cytometry analysis; the apoptosis-inducing activity was evident at <10 micromol/l and half-maximal at about 40 micromol/l 1-methoxy-canthin-6-one	18
Alhagi maurorum	human leukemia cell line (HL-60)	Leaves and flowers extract induced inhibitory effect against the proliferation of HL-60 cells and IC50 was 16.0 and 22.0 μg/ ml respectively	19-20
Allium species ***Allium cepa*** ***Allium Sativum*** ***Allium schoenoprasum***	Wide range of chemically induced cancers and wide range of tumor cell lines	Allylsulfides (ajoene, allicin, diallylsulfide, dialyldisulfide, diallyltrisulfide, S- allyl cysteine, and sallylmercaptocysteine) exerted anticarcinogenic and antitumor activities. Many mechanisms proposed for anticancer activity of *Allium cepa* included, inhibition of cell proliferation , inhibition of protein tyrosine kinase, inhibition of carcinogens activation, and modulation of phase II enzyme activity	21-54
Althaea officinalis	tumoral lymphocytes	Scopoletin produced dual action on tumoral lymphocytes exhibiting both a cytostatic and a cytotoxic effect on the cell , and also exert apoptosis	55-56
Althaea rosea	brine shrimp	Ethyl acetate extract showed cytotoxic activity against brine shrimp	57
Ammannia baccifera	HeLa cancer cell line	The methanolic extract was cytotoxic to the HeLa cancer cell line but relatively non-toxic to the normal cell line NIH 3T3. Treatment of mice with *A. baccifera* extract resulted in significant decreases in tumor volume, viable cell count and tumor weight and enhanced the life span of DAL bearing mice.	58-59
Anagyris foetida	HL-60 and LoVo Cell lines	The alkaloids of *Anagyris foetida* showed cytotoxicity activity against both tumour cell lines	60
Anchusa italica	MCF-7, HepG2, WEHI and MDBK cell lines	The cytotoxic activity of *Anchusa italic*a against MCF-7, HepG2, WEHI and MDBK cell lines SHOWED THAT IC50 was more than 100 μg/ml against all evaluated cell lines.	61-62
	HepG2 cell line	The effects of ethanol extract significantly inhibited the growth of HepG2	63
Antirrhinum majus	cytotoxic effect was studied by haemolytic activity against human red blood cells	The study showed that the percent lysis of human erythrocytes resulted in less than 5.0 % for all samples, thus these findings indicate minor cytotoxicity of the plant	64-65
Apium graveolens	human cell lines (DLA, Dalton's lymphoma ascites; L929) and Mouse lung fibroblast	The antiproliferative effect of the methanolic extract of *Apium graveolens* was evaluated *in vitro* on two human cell lines (DLA, Dalton's lymphoma ascites; L929) and Mouse lung fibroblast. Typical morphological changes including cell shrinkage, chromatin condensation and characteristic DNA ladder formation were induced by *Apium graveolens.* The extract was found to be cytotoxic towards L-929 cells in 72 hrs MTT assay and concentration required for 50% cell death was 3.85μg/ml.	66-67
Arctium lappa	Caco-2 cells and promyelocytic leukemia (HL60)	The ethyl-acetate fraction (EAF) showed antiproliferative activity against Caco-2 cells. Onopordopicrin , a sesquiterpene lactone isolated from the leaves of *A. lappa* showed antitumor activity with IC50 of 15 umol/L against a cell line of promyelocytic leukemia (HL60).	68-69
Aristolochia maurorum	brine shrimp test	Aristolochic acid I was found to be the potent in brine shrimp lethality test (LC50, 4.9 microg/mL)	70
Artemisia	HT-29 cell lines	The essential oil and other extracts of *A. campestris* (100	71-

campestris		µg/ml) showed cytotoxic activity against the HT-29 cells ranging from 19.5% for essential oil to 64.4% for infusion extract	72
Arundo donax	(without specifying which kind of tumour)	*Arundo donax* was used incombination with *Spartium junceum* L. and *Cynodon dactylon* L. for the treatment of tumors	73-74
Asclepias curassavica	Many cell lines including human nasopharynx, HepG2 and Raji cell lines	The alcololic extract showed cytotoxic activity against nasopharynx human carcinoma cells. It was proved that calotropin (a cardiac glycoside) isolated from the plant, exerted cytotoxic activity. In addition, cardenoliedes extracted from the aerial parts and roots of *Asclepias curassavica* showed pronounced cytotoxicity (IC50 of 0.01 to 0.20 microgM/ml) against four cancer cell. Asclepin from the aerial part of *Asclepias curassavica* showed the strongest cytotoxic activity (IC50 of 0.02 microM), while 12 beta-hydroxycalotropin (a cardenolide) exerted significant cytotoxic activity (IC50 of 0.69 microM/ml) against HepG2 and (1.46 microM/ml) against Raji cell lines	75-78
Asparagus officinalis	HepG2 cells	Asparagus saponins inhibited the growth of HepG2 cells in a dose-dependent manner. The median inhibitory concentration (IC50) was 101.15 mg/l at 72 hours. However, the anticancer activity of *Asparagus officinalis* included: (1) antimutagenic effect – preventing genetic mutations which can directly precede the earliest stages of cancer development.(2) the promotion of (cellular phase II detoxifying enzymes) (3) synergistically enhancing the antioxidant activity of other plant foods. (4) the inhibition of chronic inflammation (cycooxygenase-2 suppression) which is thought to play a role in tumor development. (5) the promotion of healthier digestion and immune function.	79-81
	HL-60 cells	The asparagus crude saponins at 6 µg/ml inhibited the synthesis of DNA, RNA and protein in HL-60 cells by 41, 5, and 4% respectively, and at 50 µg/ml by 84, 68 and 59% respectively.	82
	human leukemia HL-60 cells	Two oligofurostanosides from the seeds of *Asparagus officinalis* inhibited the growth of human leukemia HL-60 cells in culture and macromolecular synthesis in a dose-dependent manner	83
	breast, colon and pancreatic cancers	Saponins suppressed cell viability of breast, colon and pancreatic cancers in a concentration-dependent manner, with half-maximum inhibitory concentrations ranging from 809.42 to 1829.96 µg/ml.	84
	human A2780, HO-8910, Eca-109, MGC-803, CNE, LTEP-a-2, KB and mouse L1210 tumor cells	Eight steroids were isolated from the roots of *Asparagus officinalis* L. These compounds together with nine steroids which were previously isolated from this plant, were tested for cytotoxic activity. Among them, eight compounds displayed significant cytotoxicities against human A2780, HO-8910, Eca-109, MGC-803, CNE, LTEP-a-2, KB and mouse L1210 tumor cells	85
Astragalus hamosus	HL-60/Dox cell line	The saponin mixture demonstrated significant antiproliferative effects against a multi-drug resistant cell line HL-60/Dox, with a collateral sensitivity phenomenon, i.e. the IC50 value was lower in the resistant sub-line in comparison withthe chemosensitive parent cell line HL-60.	86-87
	in two breast carcinoma cell lines MCF-7 estrogen receptor (ER) positive and MDA-MB 231 - ER negative	The anticancer activity of dinaline , decitabine , erufosine , tamoxifen were compared with the isolated mixture of two saponins,derived from *Astragalus hamosus* in two breast carcinoma cell lines MCF-7 estrogen receptor (ER) positive and MDA-MB 231 - ER negative. The study confirmed the antineoplastic activity of the saponin mixture, derived from *Astragalus hamosus*, which were previously found to be active against human leukemia cells. Moreover, the saponin mixture showed dramatic decrease in the expression level of the mitochondrial protein BclxL, which outlines its special influence on the cell death signal transduction and suggests a probable mechanism of action.	88-89
	human acute lymphoid leukemia	Volatile compounds of this plant showed significant cytotoxic activity against human acute lymphoid leukemia in concentration dependent manner.	90
Bauhinia variegata	Dalton's ascitic lymphomas	The ethanolic possessed antitumor effect in Dalton's ascitic lymphomas.	91-92
	skin papilloma model against 7, 12-	The methanolic extract of stem bark of *B. variegate* (at a dose	93

	dimethylbenz (a) anthracene and croton oil induced skin carcinogenesis in mice	of 500 and 1000 mg/kg bw) exerted anticancer effects in skin papilloma model against 7, 12- dimethylbenz (a) anthracene and croton oil induced skin carcinogenesis in mice.	
	human epithelial larynx cancer and human breast cancer (HBL-100) cells	Ethanolic extract was found to be cytotoxic against human epithelial larynx cancer and human breast cancer (HBL-100) cells.	94
	N- nitrosodiethylamine induced experimental liver tumor in rats	Ethanolic extract of the stem showed chemoprevention and cytotoxic effect against N- nitrosodiethylamine induced experimental liver tumor in rats at a dose of 200mg/kg.	95
Bellis perennis	potato disc tumor induction bioassay	Butanol extract of flowers showed antitumor activity when evaluated by potato disc tumor induction bioassay (93% inhibition). The active constituent is a saponin [3-*O*-α-rhamnopyranosyl polygalacic acid 28-*O*-{α-rhamnopyranosyl-(1→3)-β- Xylopyranosyl (1→4)-α-rhamno pyranosyl-(1→2)-[α- arabino furanosyl -(1→3)-4-*O*-acetyl-β-fucopyranoside]. Antitumor activities of different fractions of flowers at different concentrations were evaluated using potato disc tumor induction bioassay. The most active fraction showed 99% tumor inhibition at 3000 mg/l.	96-98
Betula alba	neuroblastoma, rabdomyo-sarcoma medulloblastoma, glioma, thyroid, breast, lung, colon carcinoma, leukemia, multiple myeloma, ovarian carcinoma, cervical carcinoma and glioblastoma multiforme cell lines.	A remarkable antiproliferative effect was recorded for betulinic acid in neuroblastoma, rabdomyosarcoma-medulloblastoma, glioma, thyroid, breast, lung, colon carcinoma, leukemia, multiple myeloma, ovarian carcinoma, cervical carcinoma and glioblastoma multiforme cell lines.	99-100
	A431 (skin epidermoid carcinoma), A2780 (ovarian carcinoma), HeLa (cervix adenocarcinoma) and MCF7 (breast adenocarcinoma)	Betulin enriched extracts produced an in vitro antiproliferative effect against four malignant human cell lines: A431 (skin epidermoid carcinoma), A2780 (ovarian carcinoma), HeLa (cervix adenocarcinoma) and MCF7 (breast adenocarcinoma)	101
	liver metastatic murine colon 26-L5 carcinoma cells	Betulinic acid was tested for its cytotoxicity towards highly liver metastatic murine colon 26-L5 carcinoma cells. It showed cytotoxic effects with an ED50of 75.4 μg/ml	102
	WI-38 fibroblast cells, VA-13 malignant tumor cells	Betulinic acid inhibited the growth of three kinds of human cell lines, WI-38 fibroblast cells, VA-13 malignant tumor cells, and HepG2 human liver tumor cells, with IC50 values of 1.3, 11.6 and 21 μM, respectively.	103
	K562 tumor cell line	Betulinic acid also showed an inhibitory activity on the growth of K562 tumor cell line with IC50 value of 6.25 μg/ml and also induced 35% apoptosis at a concentration of 25 μg/ml.	104
Bidens tripartita	mouse leukemia cells	The methylene chloride extract showed high activity against of cancer L1210 (mouse leukemia) cells	105-106
Brassica rapa	against human lung cancer A-549 cell line (ATCC#CCL-185)	It showed anticancer effect against human lung cancer A-549 cell line (ATCC#CCL-185).	107-109
	Hep-2, AMN-3 and Hela	The anticancer activity of aqueous extract was studied against three types of cancer cell lines; Hep-2, AMN-3 and Hela in vitro. The results showed that the cytotoxic effect of the extract dependent on type of cells, amount of dose and exposure time. The concentration 1250 μg/ml gave higher growth inhibition (63 and 42%) against ANM-3 and Hep-2 respectively , the inhibition rate of 10000 μg/ml crud roots extract against Hela cells was 64% after 24 hours exposure.	110
	human cancer lines, HCT-116, MCF-7, and HeLa	phenanthrene derivative, 6-methoxy-1-[10-methoxy-7-(3-methylbut-2- enyl) phenanthren -3-yl]undecane-2,4-dione, named brassica phenanthrene A along with two known diarylheptanoid compounds, 6-paradol and trans-6-shogaol, were exhibited high inhibitory activity against the growth of human cancer lines, HCT-116, MCF-7, and HeLa, with IC50 values ranging from 15.0 to 35.0 μM.	111
	HepG2 and MCF cancer cells	An 9.4-kDa peptide designated as campesin was isolated from seeds of the plant. It inhibited proliferation of HepG2 and MCF cancer cells with an IC50 of 6.4 microM and 1.8 microM	112
Bryonia dioica	Burkitt's lymphoma BL41 cell lines	*Bryonia dioica root* aqueous extract was evaluated in the Burkitt's lymphoma BL41 cell lines. The *Bryonia dioica* aqueous extract induced cell death in a dose-dependent	113

		manner.	
Bryophyllum calycinum	Ehrlich ascites carcinoma (EAC)	The antitumor effect of *Bryophyllum calycinum* Salisb was evaluated against Ehrlich ascites carcinoma (EAC) bearing Swiss albino mice. Significant decreases in tumor cell count and tumor weight were observed in extract treated animals.	114-115.
Caccinia crassifolia	MCF7, HepG2, WEHI164 cancer cell lines	The methanolic root extract of the plant was tested against three cancer cell lines (MCF7, HepG2, WEHI164) and one normal cell line (MDBK). IC50 of the plant root extract against all cancer cell lines and normal cell line, was >100 µg/ml.	116
Caesalpinia crista	Ehrlich ascites carcinoma	The methanol extract was evaluated for antitumor activity against Ehrlich ascites carcinoma (EAC)-bearing Swiss albino mice. The extract was administered at the doses of 50, 100, and 200 mg/kg body weight per day for 14 days after 24h of tumor inoculation. The methanol extract caused significant ($P<0.01$) decrease in tumor volume, packed cell volume, and viable cell count; and it prolonged the life span of EAC-tumor bearing mice.	117-118
	brine shrimp lethality test	The fractions of methanolic extracts were subjected to a brine shrimp lethality test to evaluate their cytotoxicity. Moderate cytotoxicity was found for the methanol extract and its three fractions . The LC50 values of the methanol crude extract and ethyl acetate, chloroform, petroleum ether fractions and vincristine sulfate were 223.87, 281.84, 112.20, 199.53, and 12.59mµg/ml, respectively. Ethyl acetate fraction showed maximum cytotoxicity, whereas minimum cytotoxicity was observed for the chloroform fraction.	119
	T47D, DU145 cell lines	A new cassane-type diterpene (1α-acetoxy-5α, 7β-dihydroxycassa-11,13(15)-diene-16,12 -lactone) isolated from *Caesalpinia crista* showed significant antitumor activity against T47D, DU145.	120
	MCF-7 (breast adenocarcinoma), DU145 (prostate carcinoma), C33A (cervical carcinoma) and Vero (African green monkey kidney fibroblast) cells	Three cassane diterpene (caesalpinolide-C, caesalpinolide-D and caesalpinolide-E) and one cassane furanoditerpene were tested for their antiproliferative activity against MCF-7 (breast adenocarcinoma), DU145 (prostate carcinoma), C33A (cervical carcinoma) and Vero (African green monkey kidney fibroblast) cells. They were f exerted low to moderate antiproliferative activity profile	121
Calendula officinalis	L929 and HepG2 cells	The cytotoxicity was evaluated in L929 and HepG2 cells with the MTT assay. Iin concentrations greater than or equal to 30 mg/ml, the toxic effects were observed.	122-123
	colon cancer, leukemia, and melanoma cells	Two triterpene glycosides , isolated from the plant, exhibited potent cytotoxic effects against colon cancer, leukemia, and melanoma cells.	124
	human skin fibroblast (HSF) and human breast cancer cells (T47D)	Three extracts (heptane, ethyl acetate and methanol) were introduced to a human skin fibroblast (HSF) and human breast cancer cells (T47D) cultures. The ethyl acetate in concentrations above 25 microg/ml stimulated cell proliferation and cellular metabolism by increase of mitochondrial dehydrogenase activity. However, concentrations exceeding 75microg/ml have been found to be toxic for cells.	125
	leukemias, melanomas, fibrosarcomas and cancers of breast, prostate, cervix, lung, pancreas and colorectal cells (in vitro) and Ando-2 melanoma cells (in vivo)	The anti-tumor and immunomodulatory activities of laser activated *Calendula officinalis* extract (LACE) was investigated *in vitro*. Tumor cell lines derived from leukemias, melanomas, fibrosarcomas and cancers of breast, prostate, cervix, lung, pancreas and colorectal were used. The LACE extract showed a potent *in vitro* inhibition of tumor cell proliferation when tested on a wide variety of human and murine tumor cell lines. The inhibition ranged from 70 to 100%. The intraperitoneal injection or oral administration of LACE extract in nude mice inhibited *in vivo* tumor growth of Ando-2 melanoma cells and prolonged the survival day of the mice.	126
Calotropis procera	Hep-2 cell line	Different extracts of *Calotropis procera* leaves were evaluated for *in-vitro* cytotoxic activity against the Hep-2 cell line. The *n*-butanol extract had most pronounced cytotoxicity against the Hep-2.	127-128

	Hep2 and Vero cell lines	The cytotoxic activity of methanolic extract of flowers was studied against Hep2 and Vero cell lines. The extract showed maximum activity on Hep 2 cells than Vero cells at higher concentration, and it exhibited toxicity only on Hep 2 cells at low concentration.	129
	COLO 320 tumor cells	The root extract of *C. procera* has been found to produce a strong cytotoxic effect on COLO 320 tumor cells.	130
	57 human cancer cell lines	The hemi synthetic derivative of a cardenolide isolated from the root barks of *C. procera* showed a strong cytotoxic effect on several human cancer lines, a high *in vivo* tolerance to tumor growth and prolonged survival in the human xenograft models of nude mice.	131
	HL-60, CEM (human leukemia), HCT-8 (human colon cancer) and B-16/F10 (murine melanoma)	Among five extracts (hexane, dichloromethane, ethyl acetate, acetone and methanol), ethyl acetate and acetone extracts displayed higher cytotoxic potential against tumor cells, with IC50 ranging from 0.8 to 4.4 µg/ml.	132 .
	Hep2 cancer cells	The anti-tumor potential of the root extracts was investigated against Hep2 cancer cells. Treatment with the extracts at different doses of 1, 5, 10 and 25 µg/ml revealed that methanolic, hexane and acetate extract possessed cytotoxicity, whereas aqueous extract had no cytotoxic effect. Acetate extract (10 µg/ml) showed strongest cytotoxic effect (96.3 %) on Hep2 at 48h exposure, whereas methanolic and hexane exhibited cytotoxicity of 72.7 and 60.5 %, respectively.	133
	7, 12-dimethyl benz(a)anthracene (DMBA)-induced breast cancer	When *Calotropis procera* protein (CP-P) was administered individually or in combination with cyclophosphamide (CYC, 0.2 mg/kg) to rats with 7, 12-dimethyl benz(a)anthracene (DMBA)-induced breast cancer, it decreased tumor volume. Also, the combination was more effective in down-regulating the expression of NF-kB-regulated gene products (cyclin D1 and Bcl-2) in breast tumor tissues.	134
	Normal human skin fibroblast (HEPK) cells	The dose of (100µg/ml) of protein did not affect the cell morphology, but the higher dose of protein (1000µg/ml) showed some changes on Normal human skin fibroblast (HEPK) cells after 24h exposure.	135
Canna indica	brine shrimp toxicity test	The dichloromethane and ethanol extracts of the leaves were evaluated for brine shrimp toxicity. Their LC50 values were 273.9(167.8-447.0) and >1000 µg/ml respectively.	136-137
Capparis spinosa	hepatoma HepG2 and breast cancer MCF-7 cells	A novel dimeric 62-kDa lectin extracted from (*C. spinosa*) seeds, inhibited the proliferation of both hepatoma HepG2 and breast cancer MCF-7 cells.	138-139
	, human epidermoid larynx carcinoma Hep-2 and human cervix uteri epitheloid carcinoma Hela	The effect of the crude aqueous leaf extract in a concentration of used (125، 250،500 and1000 µg/ml, for 48-72 hrs exposure time) was studied against two cellular cancer lines, human epidermoid larynx carcinoma Hep-2 and human cervix uteri epitheloid carcinoma Hela. The extracts induced significant inhibitory effect ($p<0.001$) on the cancer lines growth,Hep-2 and Hela with low concentration. The cellular Hep-2 density was (0.340%), whereas the density in Hela was (0.6545%) at the lowest concentration 125 µg / ml.	140
	Ehrlich Ascites carcinoma	*Capparis spinosa* r oot bark extract also showed antitumor activity against Ehrlich Ascites carcinoma in albino mice. It significantly decreased the tumor volume, and it prolonged the life span of EAC tumor-bearing mice.	141-142
	SGC-7901 cells	Chloroform extraction/fractions of *Capparis spinosa* L. also imposed inhibitory effects on SGC-7901 cells.	143
	Hep-2 and HeLa tumor cell lines	The effect of (aqueous and methanol) crude extracts and secondary metabolites extracts (polyphenol, rutin, and alkaloids) of mature fruits of *C. spinosa* was investigated in Hep-2 and HeLa tumor cell lines. They revealed significant antitumor difference ($P\leq 0.0001$) or ($P \leq 0.01$) among all types of extracts, and among all concentrations for each extract in two periods 24 and 48 hrs of the treatment.	144
Capsella bursa-pastoris	Ehrlich tumour in mice	An inhibitory effect of the extracts of the herb on Ehrlich solid tumour in mice was found to be due to the fumaric acid in the plant.	145-146
	Ehrlich tumour in mice	The treatment of ICR mice with ip injections (0.14 g/kg/ day) of the extract of *Capsella bursa-pastoris* herb caused 50 to 80% inhibition of the solid growth of Ehrlich tumor cells that had been inoculated into the sc tissue of the animals.	147

	HSC-2 human oral cancer cells	The effects of methanol extracts of *Capsella bursa-pastoris* (MECB) was evaluated on the cell growth and apoptosis of HSC-2 human oral cancer cells. MECB caused growth inhibition and the induction of apoptosis in a concentration-dependent manner in HSC-2 cells. A marked reduction in specificity protein 1 (Sp1) expression following treatment with MECB was also observed. The down regulation of Sp1 by siRNA resulted in growth inhibition and a reduction of total poly (ADP-ribose) polymerase (PARP) expression. In addition MECB was significantly increased Bak expression levels and decreased Mcl-1 expression levels.	148
	Ehrlich, MH134, and L1210 mouse tumor cells	Fumaric acid, isolated as the active component of *Capsella bursa-pastoris* was found to reduce markedly the growth and viability of Ehrlich, MH134, and L1210 mouse tumor cells in culture at concentration of 0.3 approximately 1.2 mg/ml.	149
Capsicum annuum* and *Capsicum frutescens	Hep-G2 cells	Four types of chili (*Capsicum annuum*) extracts, categorized according to color (green and red), and size (small and large) were studied in Hep-G2 cells. Red small (RS) chili had an LC50 value of 0.378 ± 0.029 mg/ml compared to green big (GB) 1.034 ± 0.061 mg/ml and green small (GS) 1.070 ± 0.21 mg/ml. Red big (RB) was not cytotoxic.	150-151
	Two human oral tumor cell lines (HSC-2, HSG)	*Capsicum annuum* L. *var. angulosum* Mill. extracts showed relatively higher cytotoxic activity against two human oral tumor cell lines (HSC-2, HSG) than against normal human gingival fibroblasts (HGF), suggesting a tumor-specific cytotoxic activity.	152
	TE-13 (esophageal squamous cell carcinoma) cell line	The extracts of Indian spices like chili pepper, cloves, black pepper and black cumin were investigated for cytotoxic effect. In studying the *in vitro* anticancer activities of aqueous and ethanolic extracts against the TE-13 (esophageal squamous cell carcinoma) cell line, DAPI staining and DNA fragmentation assays showed maximum cell death and apoptotic cell demise (88%) to occur within 24 hours with an aqueous extract of chili pepper at 300 µl/ml.	153
	brine shrimp lethality bio-assay	By using an *in vitro* brine shrimp lethality bio-assay, the LC_{50} of *Capsicum frutescens* was 83.33 µg/ml.	154
Carthamus tinctorius	SW620, Hep2 and control BHK cells	Among many extracts, only dichloromethane extract of *C. tinctorius* exhibited inhibitory effect on growth of SW620 cells with IC50 of 0.15 mg/ml, in comparison to the Hep2 (0.5 mg/ml) and control BHK cells (0.6 mg/ml).	155-156
	MDA-MB-231 breast cancer cell and normal human mammary gland cell lines	A compound (Zhu-xiang) from herbal extracts containing ginseng and *Carthamus tinctorius* was used to treat the MDA-MB-231 breast cancer cell and normal human mammary gland cell lines. The Zhu-xiang showed significantly inhibition in cell proliferation and the inhibition was dose dependent. The inhibitory effect of Zhu-xiang was significantly greater than that of commonly used cytotoxic drugs.	157
	skin tumor induced by 7,12-dimethylbenz [a]anthracene	The mixture of erythro-alkane-6,8-diols from the flowers of *C. tinctorius* markedly suppressed the promoting effect of TPA (12-0-Tetradecanoylphorbol-13-acetate) on skin tumor formation in mice following initiation with 7,12-dimethylbenz [a]anthracene	158.
	S180 Sarcoma and LA795 lung cancer in mice	The Anti-tumor activity of polysaccharide (SPS) was studied against three types of tumor cells *in vitro*. SPS significantly inhibited the growth of S180 Sarcoma in mice with an inhibitory rate of 51.33% ($P<0.01$). It can also inhibit the growth of LA795 lung cancer in mice and the tumor volume was reduced obviously for 3.29 mm3 ($P<0.05$).	159
Casuarina equisetifolia	brine shrimp lethality test	Methanolic extracts of leaves of *Casuarina equisetifolia* showed moderate cytotoxic activity in Brine Shrimp lethality bioassay test, where the LC50was 95.87 µg/ml.	160-161
Celosia cristata	HeLa, Cos 7, HepG2, SK-Hep1 and LS 174T cell lines	IC50 of the water extracts against Cos7, HeLa, HepG2,SK-Hep1 and LS 174T were 263.9, 2773.5, 200, 180 and >200 µg/ml respectively. IC50 of CH_2Cl_2 extracts against HeLa and Cos 7 were 472.0 and 136.0 µg/ml,while IC50 of MeOH extracts against the same cell lines,were 499.8 and 77.2 respectively.	162-163
Chenopodium album	estrogen dependent (MCF-7) and estrogen independent (MDA-MB-468) human breast cancer cell lines	The effects of *Chenopodium album* (leaves) was evaluated on the growth of estrogen dependent (MCF-7) and estrogen independent (MDA-MB-468) human breast cancer cell lines.	164-165

		Methanolic extract of *Chenopodium album* (leaves) exhibited maximum antibreast cancer activity having IC50 value 27.31 mg/ml against MCF-7 cell line. Significant percent inhibition (94.06%) was recorded for MeOH extract of leaves, at 48 h of exposure and concentration 100 mg/ml ($p < 0.05$) against MCF-7 breast cancer cell line.	
Chrozophora tinctoria	brine shrimp assay	The cytotoxicity of the plant leaves , roots and stems extracts was studied using brine shrimp assay, antitumor activity using potato disc assay. Mortalities (%) of brine shrimps at concentrations of 1000,100 and 10 ppm of the plant leaves , roots and stems extracts were (80,30 and 20), (33.3, 26.6 and 20) and (36.6,20 and 20) respectively. In antitumor potato disc assay, the tumor inhibition (%) of of the plant leaves, roots and stems extracts at concentrations of 1000,100 and 10 ppm were (55.43, 47.83 and 41.30), (58.82, 49.41 and 17.65) and (61.96, 45.65 and 35.87) respectively.	166-167
	mouse skin tumors induced by 7, 12-Dimethylbenze (a) anthracene (DMBA)	The inhibitory effect of *Chrozophora tinctoria* was studied in mouse skin tumors induced by 7, 12-Dimethylbenze (a) anthracene (DMBA) (40 µg/100 µl acetane/mouse). After 7 days, tumor promotion was begun by twice-weekly topical application of Benzoyl peroxide (BPO) (20 mg/300 µl acetone/mouse) for a period of 32 weeks. Also before 4 hours of DMBA application , animals received a single topical dose of *Chrozophora tinctoria* extract (10 mg/gr carbopol gel/mouse). Results showed that there were higher yields of tumors in those animals receiving both DMBA and BPO. However, the *Chrozophora tinctoria* pretreated group showed complete inhibition of tumor incidence. The authors suggested that the antitumor effect of the plant was mediated by its scavenging of free radicals which play an important role in skin cancer.	168
Cicer arietinum	oral cancer cells and normal cells	Cytotoxic activity of C-25 protein isolated from *Cicer arietinum* was studied on oral cancer cells and normal cells. It reduced the cell proliferation of human oral carcinoma cells with IC50 of 37.5 µg/ml.	169-170
	MCF-7 breast cancer cell line	The cytotoxicity evaluation of isoflavones isolated from *Cicer arietinum* (10, 20, 40, 80, 160 and 360 µg/ml) against MCF-7 breast cancer cell line showed a dose dependent inhibition of cell growth.	171.
Cichorium intybus	Ehrlich ascites carcinoma in mice	Ethanolic extract of chicory root showed a tumour-inhibitory effect against Ehrlich ascites carcinoma in mice. A 70% increase in the life span was observed with a 500 mg/kg/day intraperitoneal divided over 8 doses.	172
	human leukemia HL-60 and U-937 cells	Magnolialide, a 1β-hydroxyeudesmanolide isolated from the roots of *Cichorium intybus*, inhibited several tumor cell lines and induced the differentiation of human leukemia HL-60 and U-937 cells to monocyte or macrophage-like cells.	173.
	melanoma C32 cell lines	The aqueous-alcoholic macerate of the leaves of *Cichorium intybus* exerted an antiproliferative effect on amelanotic melanoma C32 cell lines.	174
	human prostate cancer PC-3 cells, human breast carcinoma T47D cells and colon cancer RKO cells	The anticancer properties of aqueous extracts of *Cichorium intybus* was studied against human prostate cancer PC-3 cells, human breast carcinoma T47D cells and colon cancer RKO cells. Extract demonstrated a modest cell growth inhibition in all three cancer cell lines. *Cichorium intybus* (seeds) exhibited 5-24% inhibition in cell viability at 1.0 to10% concentration for 24 hour.	175.
	dimethylbenz[a]anthracene (DMBA) induced benign breast tumors	The protective effect of sun lightactivated chicory against dimethylbenz[a]anthracene (DMBA) induced benign breast tumors was investigated in female Sprague-Dawley rats. Chicory's extract was significantly increased P. carbonyl and malondialdehyde and decreased the hepatic levels of total antioxidant capacity and superoxide dismutase in benign breast tumorsinduced group compared to control. It also significantly decreased the number of estrogen receptors ER-positive cells in tumor masses.	176.
Citrullus colocynthis	ER+ MCF-7 and ER- MDA-MB-231 human breast cancer cell lines	The antiproliferative effect of cucurbitacin glycosides extracted from *Citrullus colocynthis* leaves was studied in human breast cancer cell growth. The Cucurbitacin glycoside combination (1:1) inhibited growth of ER+ MCF-7 and ER-MDA-MB-231 human breast cancer cell lines.	177-178

Citrus species	Epidemilological and experimental studies in many types of cancer	The ingestion of citrus fruit has been reported to be beneficial for the reduction of certain types of human cancer. Limonene, one of the main constituents of citrus species fruit, reduces the risk of mouth, skin, lung, breast, stomach and colon cancer. Hesperidin, and its flavone analogue, diosmin, also exerted anticarcinogenic activities in various *in vivo* studies. polymethoxylated flavones have shown strong antiproliferative action against cancer cells and antigen activated T-lymphocytes. Beta-cryptoxanthin (an orange-red carotenoid) inhibited development of lung cancer.	179-182
	human breast carcinoma cell line (MDA-MB-453) and a human lymphoblastoid B cell line (RPMI-8866)	The *in vitro* effects of concentrated lime juice (CLJ) extract was evaluated on the spontaneous proliferation of human breast carcinoma cell line (MDA-MB-453) and a human lymphoblastoid B cell line (RPMI-8866). Using the concentrations of 125, 250, and 500 µg/ml of CLJ extract a significant inhibition of the spontaneous proliferation of RPMI-8866 cell line.	183
	human pancreatic cancer cells and colon cancer cells	The bioactive compounds isolated from of seeds of *Citrus aurantifolia* were found to posses the potential of inhibiting human pancreatic cancer cells. While, the compounds purified from peel had the potential of suppressing the colon cancer cells.	184.
	human colon cancer cells (SW-480)	*Citrus aurantifolia* fruit volatile oil showed 78% inhibition of human colon cancer cells (SW-480) with 100 µg/ml concentration at 48 h.	185
	Human astrocytoma cancer cells	The antimutagenicity and anticancer effect of *Citrus medica* fruit juice were evaluated on human astrocytoma cancer cells. Treated human astrocytoma cell line revealed a meaningful cell death when compared with controls ($P<0.01$).	186-187
	brine shrimp (*Artemia franciscana*)	*C. limetta* root extract at the concentration of 500 µg/ml was found to be lethal towards the larvae of brine shrimp (*Artemia franciscana*).	188
	Ehrlich ascites carcinoma (EAC) in mice	The antitumor activity of methanol extract of peel of *Citrus limetta* fruits (MECL) was evaluated against Ehrlich ascites carcinoma (EAC) cell line in Swiss albino mice. Intraperitoneal administration of MECL at the doses of 200 and 400 mg/kg for nine days to the carcinoma induced mice demonstrated a significant ($P<0.001$) decrease in tumor volume, viable tumor cell count, tumor weight and a significant ($P<0.001$) improvement in hematologica parameters and life span as compared to the EAC control mice.	189
	benzo[a]pyrene induced neoplasia in the fore stomach of ICR/Ha mice	A study of the inhibitory effects of two limonoid aglycones (limonin and nomilin) on the formation of benzo[a]pyrene induced neoplasia in the fore stomach of ICR/Ha mice showed that incidence of tumors was reduced by more than 50% at 10mg/dose.	190
	Human larynx, cervix, breast and liver carcinoma cell lines	The cytotoxicity of hesperidin from the peel of *Citrus sinensis* was evaluated gainst different human carcinoma cell lines (larynx, cervix, breast and liver carcinoma cell lines). The results revealed that hesperidin exhibited pronounced anticancer activity against the selected cell lines. IC_{50} were 1.67, 3.33, 4.17, 4.58 µg/ml, respectively.	191
Clerodendron inerme	7,12- dimethylbenz(a) anthracene (DMBA) induced skin carcinogenesis in mice	The anticancer effects of ethanolic extract was investigated in 7,12- dimethylbenz(a) anthracene (DMBA) induced skin carcinogenesis in Swiss albino mice. Extract at a dose of 300 mg/kg significantly prevented the tumor formation as well as restored the status of glycoconjugates and red blood cell osmotic fragility in DMBA treated animals.	192-193
	7,12-dimethylbenz(a) anthracene (DMBA) induced skin squamous cell carcinoma in mice	The chemopreventive and anti-lipidperoxidative effect of the ethanolic extract of *Clerodendron inerme* leaves were studied in 7,12- dimethylbenz(a) anthracene (DMBA) induced skin squamous cell carcinoma in mice. Oral administration of the ethanolic extract of *Clerodendron inerme* leaves (300 mg/ kg bw) for 25 weeks significantly prevented the tumor incidence, volume and burden of tumor. The ethanolic extract of *Clerodendron inerme* leaves also showed potent antilipidperoxidative effect as well as enhanced the antioxidant defense mechanisms in DMBA painted mice.	194

	7,12-dimethylbenz(a) anthracene (DMBA)- induced hamster buccal pouch carcinogenesis	The chemopreventive potential of the aqueous leaf extract of *Clerodendron inerme* was investigated in 7,12-dimethylbenz(a) anthracene (DMBA)-induced hamster buccal pouch carcinogenesis. Oral administration of the extract at a dose of 500 mg/kg bw to on days alternate to DMBA painting for 14 weeks significantly prevented the tumor incidence, and decreased tumor volume and tumor burden.	195
Clitoria ternatea	hormone-dependent breast cancer cell line (MCF-7), non-hormone-dependent breast cancer cell line (MDA-MB-231), human ovary cancer cell line (Caov-3), human cervical cancer cell line (Hela), human liver cancer cell line (HepG2) and human foreskin fibroblast cell line (Hs27)	The cytotoxicity of the aqueous and methanol extracts of the flowers of *Clitoria ternatea* was evaluated against hormone-dependent breast cancer cell line (MCF-7), non-hormone-dependent breast cancer cell line (MDA-MB-231), human ovary cancer cell line (Caov-3), human cervical cancer cell line (Hela), human liver cancer cell line (HepG2) and human foreskin fibroblast cell line (Hs27). Results showed that the water extracted of *Clitoria ternatea* had significant effects ($p<0.05$) against MCF-7 with an IC_{50} value of 175.35 µg/ml.	196-197
	brine shrimp lethality test	The crude methanol extract of leaves, seeds and stem-bark demonstrated a significant cytotoxic activity in a brine shrimp lethality bioassay test. The LC50 values of the crude methanol extract of leaves, seeds and stem-bark were 25.82, 110.92 and 179.89 µgm/ml respectively. Crude methanol extract and methanol fraction of leaves showed a very promising cytotoxic activity.	198
	DLA cell line	The ethanolic extract was evaluated for its *in vitro* cytotoxic and antioxidant activities. The extract showed potent cytotoxic activity against DLA cell lines with EC50 value of 305µg/ml and exhibited a dose dependent decrease in cell count for all the concentrations tested (0.0196-10 µg/ml).	199
	Dalton's lymphoma (DLA) induced in mice	The anticancer activity of *Clitoria ternatea* was evaluated in Dalton's lymphoma (DLA) bearing mice. Methanol extract was administered at doses of 100 and 200mg/kg body weight for 14 consecutive days. Treatment with extract decreased tumour volume, packed cell volume and viable count. It also increased the non-viable cell count and mean survival time, thereby increasing the life span of EAC bearing mice.	200
Convolvulus arvensis	human tumor cell line (Hela)	The cytotoxic effects of chloroform, ethyl acetate and hydroalcoholic extracts of arial parts of the plant were evaluated in human tumor cell line (Hela). Chloroform extract showed the highest cytotoxic effect among the extracts (IC_{50} was 15 µg/ml), whereas ethyl acetate and hydroalcoholic extracts were less cytotoxic against Hela cells (IC_{50} was 25 and 65µg/ml, respectively).	201-202
	lymphoblastic leukemia, Jurkat cells	The cytotoxic effect of ethanol extract of aerial parts of *Convolvulus arvensis* was evaluated against lymphoblastic leukemia, Jurkat cells. The cells were exposed to different concentrations (10, 25, 50, 75 and 100 µg/ml) of the extract to determine cell viability, cell proliferation and apoptosis. The results showed that ethanol extract decreased the number of living cells in a concentration-dependent fashion., while the results of FACS analysis showed that the lowest concentration of the extract (10 µg/ml) was most effective for the induction of apoptosis as it induced maximum apoptosis (85.34 %).	203
	Human Rhabdomyosarcoma (RD) tumor cell line	The cytotoxicity of (aqueous and methanol) crude leaves, stems and roots extracts as well as proteoglycan and glycoside fraction I (FI) of *Convolvulus arvensis* was evaluated against human Rhabdomyosarcoma (RD) tumor cell line *in vitro*. The cytotoxic concentration 50% (CC 50%) of Glycoside FI was 1.775, 0.870 and 0.706 mg/ml after 24, 48, and 72 h, respectively. The root aqueous extract had less cytotoxic effect after 72 h than other extracts; the CC 50% was 7.437 mg/ml.	204
	skin carcinogenesis protocol, by tumor initiator, 7-12-dimethyl benz(a)antheracene (DMBA)	The cytotoxic effect of *Convolvulus arvensis* (methanolic extract) was evaluated against 2 stage skin carcinogenesis protocol, by tumor initiator, 7-12-dimethyl benz(a)antheracene (DMBA) and tumor promoter, croton oil in Swiss albino mice. Local application of the extract at 300 mg/kg/day inhibited the tumor incidence up to 20% in 16 weeks.	205

Convolvulus scammonia	bone marrow cells multiplication in mice implanted with hepatic cancer cells (hepatic cell H22)	The effect of aqueous and alkaloid crude extracts of *Convolvulus scammonia* on bone marrow cells multiplication was studied in mice implanted with hepatic cancer cells (hepatic cell H22). The inhibitory effect of crude aqueous *Convolvulus scammonia* dried extracts was compared with crude alkaloidal extract, on the bone marrow cells multiplication in mice at doses of 10, 20, 40, 80 160 mg/kg. The crude alkaloid extract showed arresting percent of metaphase more than aqueous extract in the small doses, in high doses (160 mg/kg), both achieved 70% of the inhibitory effect of Colchicine.	206
	Mice hepatocarcinoma cell line (H22)	The ability of crude alkaloids extracted from the leaves of *Convolvulus scammonia* was evaluated in mice hepatocarcinoma cell line (H22), which is an invasive metastasis cell line. The extract concentration of 1mg/Kg bw efficiently inhibited H22 cell line tumor growth *in vivo* to 97.14% in mice after three weeks treatment .The apoptotic cell have been observed when the concentration of the alkaloid extract elevated up to 80 and 100 µg/ml.	207
	CHO cell lines	CHO cell lines were treated with alkaloid and aqueous extraction from roots of *Convolvulus scammonia* at various concentrations 2 µg/l to 800 µg/l for 60 min, or with crude alkaloid at a concentration of 4615 µg/l and 9230 µg/l for 60 min. Differences in the arrangement of microtubules were assessed by means of quantification of the cytoskeleton changes in cells treated with alkaloid at a concentration of 20 µg/l. Cells exposed to alkaloid and aqueous extraction from roots at concentrations of 2 µg/l for 60 min did not show considerable changes in the regularity of microtubules. The network damage increased with the increasing concentration of extracts.	208
Corchorus aestuans	Epidermal carcinoma of nasopharynx cells	The alcoholic extract of the entire plant was found to have anticancer activity against epidermal carcinoma of nasopharynx in tissue culture.	209-210
	human breast cancer cell lines (MDA-MB-231 and MCF-7)	Saikosaponin-A inhibited the proliferation or viability of the human breast cancer cell lines (MDA-MB-231 and MCF-7) in a dose-dependent manner. Saikosaponin-A treatment of MDA-MB-231 for 3 hours and of MCF-7 cells for 2 hours, respectively caused an obvious increase in the sub-G1 population of cell cycles. Apoptosis in MDA-MB-231 cells was independent of the P53/p21 pathway mechanism and was accompanied by an increased ratio of Bax to Bcl-2 and c-myc levels and activation of caspase-3.	211
	Melanoma cells (B16F10, SK-MEL-28, and A375)	Corchorusin-D (COR-D) showed maximum inhibition of B16F10 cells *in vitro*. COR-D induced mitochondrial dysfunction and altered the Bax/Bcl-2 ratio with down regulation of pro-caspases 9 and activation of caspase 3 in B16F10 cells, triggering intrinsic pathway of apoptosis.	212
	leukemic cell lines U937 and HL-60	Methanol extract and its fractions and corchorusin-D (COR-D), was investigated in leukemic cell lines U937 and HL-60. Methanolic extract, its n-butanolic fraction and COR-D inhibited cell growth and produced significant cytotoxicity in leukemic cell lines U937 and HL-60. COR-D produced apoptotic cell death via mitochondrial disfunction and was found to pursue the intrinsic pathway by inciting the release of apoptosis-inducing factors (AIFs) from mitochondria. COR-D-induced translocation of Bax from cytosol to mitochondria facilitating caspase-9 activation and up regulation of downstream pathways leading to caspase-3 activation and PARP cleavage, which resulted in the subsequent accumulation of cells in the sub-G0 phase followed by DNA fragmentation.	213
	myelogenous leukemic cell line K562	The anticancer effect of corchorusin-D (CORD), was studied in the chronic myelogenous leukemic cell line K562. COR-D inhibited cell growth in K562 cells and showed increasing number of Annexin V FITC binding cells. Characteristic apoptotic changes were recorded under phase contrast and confocal microscopes with accumulation of cells in the sub-G0 phase. The apoptosis involved drop in Bcl-2/Bax ratio, loss of mitochondrial membrane potential, release of cytochrome c in cytosol followed by activation of caspases 9 and 3, and cleavage of PARP. Down-regulation of pro-caspase 10 was observed along with formation of death-	214

		inducing signaling complex between TNF-R1 and TRADD. COR-D suppressed PDK1 and AKT with activation of MAP kinase family members ERK1/2, JNK1/2 and p38.	
Corchorus capsularis	brine shrimp test	Brine shrimp lethality bioassay was carried out to determine the cytotoxicity of the crude methanolic extract of *Corchorus capsularis* (leaves) and its fructions. Butanol extract was the most potent extract (71.14% inhibition at a concentration of 1.25 mg/ml), followed by ethyl acetale (28.57% inhibition at a concentration of 1.25 mg/ml) and methanol extract (14.28% inhibition at a concentration of 1.25 mg/ml).	215-216
Coriandrum sativum	brine shrimp test	The cytotoxicity of the plant was investigated by brine shrimp lethality bioassay which revealed that coriander LC50 was 2.25 mg/ml.	217
	MCF-7 cell line	Among the extracts of the plant root, leaf and stem ,the ethyl acetate extract of *Coriandrum sativum* roots showed the highest antiproliferative activity on MCF-7 cells (IC50 = 200.0 ± 2.6 µg/ml). Ethyl acetate extract of *Coriandrum sativum* root inhibited DNA damage and prevented MCF-7 cell migration induced by H2O2, suggesting its potential in cancer prevention and metastasis inhibition.	218
	L5178Y-R lymphoma cells	The aqueous extract of *Coriandrum sativum* (leaf), caused significant (P<0.05) 24, 39 percent L5178Y-R lymphoma cells toxicity at 31.2 µg/ml (MIC), whereas the methanol extract of *Coriandrum sativum* (seed and leaf) caused 40 and 31 percent cytotoxicity at 7.8, 62.5 µg/ml (MICs), respectively.	219
	BMK (kidney), KHOS-2405 (bone), and WRL-68 (liver)	The three lines showed decreased proliferation and number of cells proportional to the concentrations. The cell cycle analysis showed that *Coriandrum sativum* arrested the WRL-68 cells in the (S) phase; the BMK cells were arrested in the G2 and M phase, and the KHOS cells in the G1 phase.	220
Coronilla scorpioides	brine shrimp and potato disk assays	The cytotoxic study of the cardiac glycosides which were isolated from *Coronilla scorpioides* and other plants, were examined by brine shrimp. Their lethal concentration 50 (LC50) was 18.84ppm. The antitumor activity potato disk assays of the cardiac glycosides had shown good activity : 30.8%.	221-222
Coronilla varia	potato disk assay	Antitumour activity of *Coronilla varia* aerial parts extracts was assessed with the potato disc method. *Coronilla varia* extracts caused 66.7% growth inhibition and significantly decreased the mean number of tumours to 11.92 ± 2.15 in comparison with the negative control (water) 35.75 ± 4.54.	223-224
	MCF7 cell line	*Corohilla varia* ethanol extract inhibited the proliferation of MCF7 cell lin , 5mg/ml was the optimum concentration of extract of *Coronilla varia* which inhibited cell line growth.	225-226
	KB cells	An alcoholic extract of the seeds of *Coronilla varia* showed inhibitory activity against KB cells. In fructionation, hyrcanoside, daphnoretin, scopoletin, and umbelliferone hyrcanoside, extract from the seeds of *Coronilla varia*, showed the anticancer activity against KB.	227
Cotoneaster racemiflora	brine shrimp test	The methanolic extract of *Cotoneaster racemiflora* showed strong toxicity in the shrimp lethality test. The methanolic extract was subsequently divided into n-hexane, ethylacetate, nbutanol, and water soluble extracts. Out of these extracts, ethylacetate soluble fraction showed strong toxicity in brine shrimp lethality test.	228-229
Crocus sativus	HeLa cells	Extract of saffron (Crocus sativis) inhibited colony formation and cellular DNA and RNA synthesis by HeLa cells *in vitro*.	230-232
	colorectal cancer cell lines (HCT-116, SW-480, and HT-29)	The anti-proliferative effect of *Crocus sativus* extract and its major constituent, crocin, was studied on three colorectal cancer cell lines (HCT-116, SW-480, and HT-29). Significant concentration-related inhibitory effects of the extract on all three colorectal cancer cell lines were observed (p<0.01). The proliferation was reduced most significantly in HCT-116 cells (to 45.5%) at 1 mg/ml and (to 6.8%) at 3 mg/ml. Crocin at 1 mM, significantly reduced HCT-116, SW-480, and HT-29 cell proliferation to 2.8%, 52%, and 16.8%, respectively (p<0.01).	233

	carcinomic human alveolar basal epithelial cells	The potential of the ethanolic extract of saffron to induce antiproliferative and cytotoxic effects was tested in cultured carcinomic human alveolar basal epithelial cells in comparison with non-malignant (L929) cells. The results showed that the ethanolic extract of saffron decreased cell viability in malignant cells in a concentration and time-dependent manner. The IC_{50} values against the lung cancer cell line were determined as 1500 and 565 µg/ml after 24 and 48 h, respectively.	234-235
	Two p53 isogenic HCT116 cell lines (HCT wildtype and HCT p53-/-)	Two p53 isogenic HCT116 cell lines (HCT wildtype and HCT p53-/-) were treated with different doses of Saffron extract and analyzed cell proliferation and apoptosis in a time-dependent manner. Saffron extract induced a p53-dependent pattern of cell cycle distribution with a full G2/M stop in HCT116 p53 wildtype cells. However, it induced a remarkable delay in S/G2 phase transit with entry into mitosis in HCT116 p53 -/- cells. The apoptotic Pre-G1 cell fraction as well as Annexin V staining and caspase 3 cleavage showed a more pronounced apoptosis induction in HCT116 p53 wildtype cells.	236
	HepG2 and HeLa cell lines	The cytotoxic effect of saffron extract was evaluated on HepG2 and HeLa cell lines. Saffron decreased cell viability in malignant cells in a concentration and timedependent manner. The IC50 values against HeLa and HepG2 were determined as 800 and 950 microg/ml after 48 h, respectively. Saffron induced a sub-G1 peak in flow cytometry histogram of treated cells compared to control, which indicated that apoptotic cell death was involved in saffron toxicity.	237
	human transitional cell carcinoma (TCC) and mouse non-neoplastic fibroblast cell lines	The cytotoxic effect of aqueous extract of saffron was evaluated in human transitional cell carcinoma (TCC) and mouse non-neoplastic fibroblast cell lines. After 24 hours, morphological observations showed growth inhibitory effects at saffron extract concentrations higher than 200 microg/ml for mouse non-neoplastic fibroblast (L929) cells and at concentrations of 50 to 200 microg/ml for the TCC cells.	238
	human cell lines: A549 cells (derived from a lung tumor), WI-38 cells (normal lung fibroblasts) and VA-13 cells (WI-38 cells transformed *in vitro* by SV40 tumor virus).	The effect of saffron on extract was studied on macromolecular synthesis in three human cell lines: A549 cells (derived from a lung tumor), WI-38 cells (normal lung fibroblasts) and VA-13 cells (WI-38 cells transformed *in vitro* by SV40 tumor virus). It appeared that the malignant cells were more sensitive than the normal cells to the inhibitory effects of saffron on both DNA and RNA synthesis.	239
	wide spectrum of murine tumors and human leukemia cell lines included squamous cell carcinoma, sarcoma , leukemia andpapilloma cell lines.	The anticancer activity of saffron extract (dimethyl-crocetin) against a wide spectrum of murine tumors and human leukemia cell lines was studied. Dose-dependent cytotoxic effect to carcinoma, sarcoma and leukemia cells *in vitro* were noted. Saffron delayed ascites tumor growth and increased the life span of the treated mice compared to untreated controls by 45-120%. In addition, it delayed the onset of papilloma growth, decreased incidence of squamous cell carcinoma and soft tissue sarcoma in treated mice. It appeared that saffron (dimethylcrocetin) disrupted DNA-protein interactions e.g. topoisomerases II, important for cellular DNA synthesis.	240-241
	5 different malignant and 2 nonmalignant prostate cancer cell lines	The antiproliferative effects of saffron extract (SE) and its major constituent crocin was investigated on 5 different malignant and 2 nonmalignant prostate cancer cell lines. In a time- and concentration-dependent manner, both SE and crocin reduced cell proliferation in all malignant cell lines with IC50 values ranging between 0.4 and 4 mg/ml for SE and 0.26 and 0.95 mM/ml for crocin. Flow cytometry profiles revealed that most cells were arrested at G0/G1 phase with a significant presence of apoptotic cells. Western blot analysis revealed that the expression of Bcl-2 was strikingly downregulated. Analysis of caspase activity indicated a caspase-dependent pathway with involvement of caspase-9 activation, suggesting an intrinsic pathway.	242
	1-Methyl -3- nitro -1- nitroso guanidine (MNNG)-induced gastric cancer in rats	The beneficial effect of saffron (*Crocus sativus*) aqueous extract (SAE) on the 1-Methyl -3- nitro -1- nitrosoguanidine (MNNG)-induced gastric cancer was investigated in rats. Pathologic data indicated that the induction of cancer at different stages from hyperplasia to adenoma in rats, was inhibited by SAE administration; 20% of cancerous rats treated with higher doses of SAE was completely became	243

		normal at the end of experiment and there was no rat with adenoma in the SAE treated groups.	
	lung cancer cells (A549)	The potential of saffron to induce cytotoxic and apoptotic effects in lung cancer cells (A549) and the caspase-dependent pathways activation of saffroninduced apoptosis against the A549 cells were investigated.. The proliferation of the A549 cells were decreased after treatment with saffron in a dose and time-dependent manner. The percentage of apoptotic cells were increased with saffron concentrations. Saffron induced morphological changes, decreased percentage of viable cells, and induced apoptosis.	244
	against transplanted sarcoma-180 (S-180), Ehrlich ascites carcinoma (EAC) and Dalton's lymphoma ascites (DLA) tumours in mice	Antitumor activity of saffron (*Crocus sativus*) extract was studied against intraperitoneally transplanted sarcoma-180 (S-180), Ehrlich ascites carcinoma (EAC) and Dalton's lymphoma ascites (DLA) tumours in mice. Oral administration of 200 mg/kg bw of the extract increased the life span of S-180, EAC, DLA tumour bearing mice to 111.0%, 83.5% and 112.5%, respectively.	245
	Inhibition of inductioon of papillomas in mice	Saffron treatments were given both before and after the induction of skin carcinogenesis. Standard histological examination of mice skin demonstrated that saffron ingestion inhibited the formation of skin papillomas and reduced their size also.	246
	ovarian cancer HO-8910 cells	The anticancer effects of crocin was studied on the proliferation of ovarian cancer HO-8910 cells. Crocin significantly inhibited the growth of HO-8910 cells. Additionally, flow cytometry illustrated that crocin raised the proportion of HO-8910 cells in the G0/G1 phase and increased their apoptosis rate. Furthermore, Western blot analysis revealed that crocin up-regulated the expression of p53, Fas/APO-1, and Caspase-3.	247
Cuminum cyminum	Hela cells	At a concentration of 0.1 microl/ml, oil of *Cuminum cyminum* destructed Hela cells by 79%.	248-249
	benzo(α)pyrene [B(α)P]-induced forestomach tumorigenesis and 3-methylcholanthrene (MCA)-induced uterine cervix tumorigenesis in mice	Cancer chemopreventive potentials of different doses of a cumin seed-mixed diet were evaluated against benzo(α)pyrene [B(α)P]-induced forestomach tumorigenesis and 3-methylcholanthrene (MCA)-induced uterine cervix tumorigenesis. Results showed a significant inhibition of stomach tumor burden by cumin. Tumor burden was 7.33 ± 2.10 in the B(α)P treated control group, whereas it reduced to 3.10 ± 0.57 ($p<0.001$) by a 2.5% dose and 3.11 ± 0.60 ($p<0.001$) by a 5% dose of cumin seeds. Cervical carcinoma incidence, compared with the MCA-treated control group (66.67%), reduced to 27.27% ($p<0.05$) by a diet of 5% cumin seeds and to 12.50% ($p<0.05$) by a diet of 7.5% cumin seeds.	250
	B[*a*]P-induced neoplasia and 3'MeDAB induced hepatomas in Rats	Cumin seeds decreased significantly the incidence of both B[*a*]P-induced neoplasia and 3'MeDAB induced hepatomas in rats.	251-252
Cupressus sempervirens	melanotic melanoma C32 cells and on renal adenocarcinoma cells	Antiproliferative activity of *Cupressus sempervirens* ssp. pyramidalis essential oils was tested on a melanotic melanoma C32 cells and on renal adenocarcinoma cells. *Cupressus sempervirens* ssp. pyramidalis leaf oil exerted the highest cytotoxic activity with an IC50 value of 104.90 microg/ml against C32.	253-254
	human BPH-stromal cells	The ethanolic fruit extract of *Cupressus sempervirens* (CS), inhibited proliferation of human BPH-stromal cells and the activity was localized to its chloroform-soluble, diterpene-rich fraction. Eight major diterpenes isolated from this fraction exhibited moderate to potent activity and the most active diterpene (labda-8(17),12,14-trien-19-oic acid) exhibited an IC50 of 37.5 μM (antiproliferative activity against human BPH-stromal cells). It significantly inhibited activation (phosphorylation) of Stat-3 in BPHstromal cells and prevented trans-activation of androgen sensitive KLK3/ PSA and TMPRSS2 genes in LNCaP cells.	255
Cuscuta planiflora	brine shrimp test	The minimum inhibitory concentration and cytotoxic activities of the methanolic extract were carried out using brine shrimp lethality bioassay. The methanol extract showed lethality against brine shrimp nauplii (LC50 was 36.31 μg/ml and LC90 was 83.18 μg/ml).	256-257

	human breast carcinoma cell line (MDA-MB-468), human colorectal adenocarcinoma cell line (HT29) and human uterine cervical carcinoma (Hela)	The cytotoxic effects of chloroform and hydroalcoholic extracts of the plant was evaluated on human breast carcinoma cell line (MDA-MB-468), human colorectal adenocarcinoma cell line (HT29) and human uterine cervical carcinoma (Hela). The results showed that the hydroalcoholic extracts of *C.* epithymum only significant decreased the viability of MDA-MB-468 cells (IC50 = 340 µg/ml).	258
Cydonia oblonga	human HepG2, A549, and HeLa cell lines	The cytotoxic effects of lipophilic quince wax extract (QWE) and an aqueous fermented one (QAFE) of *Cydonia oblonga* were investigated against human HepG2, A549, and HeLa cell lines. The two preparations exerted a different inhibitory effect on the proliferation of the three tested cell lines. Noteworthy, QAFE was almost always more active than QWE but, sometimes, its effects seemed to be strongly dependent on exposure time.	259-260
	human kidney and colon cancer cells	The antiproliferative properties of quince (*Cydonia oblonga* Miller) leaf and fruit (pulp, peel, and seed) was investigated against human kidney and colon cancer cells. Quince leaf and fruit extracts exhibited distinctive antiproliferative activities. The extracts from quince leaf showed concentration-dependent growth inhibitory activity toward human colon cancer cells (IC50 = 239.7 ±43.2 microg/ml), while no effect was observed in renal adenocarcinoma cells.	261
Cynodon dactylon	Ehrlich ascites carcinoma in mice	Anticancer activity of *Cynodon dactylon* extract was evaluated in mice after inoculated with Ehrlich ascites carcinoma cells. The extract were administered orally as three doses, 100, 200 and 400 mg/kg bw for ten consecutive days. Life span of extract treated mice was increase based on mean survival time.	262-263
	Ascitic lymphoma (ELA) in mice	The anticancer activity of methanolic extracts of leaves of *Cynodon dactylon* was studied in ascitic lymphoma (ELA) in mice. . The result revealed that methanolic extract of *Cynodon dactylon* possessed significant antitumor and hepatoprotective effect.	264
	(COLO 320 DM, MCH-7, AGS, A549) and a normal cell line (VERO) and DMH-induced colon carcinogenesis	The antiproliferative , apoptotic and antioxidant potentials of *Cynodon dactylon* were investigated by 1,1-diphenyl-2-picrylhydrazyl (DPPH) assay, nitric oxide radical scavenging activity (NO-) and MTT assay on four cancer cell lines (COLO 320 DM, MCH-7, AGS, A549) and a normal cell line (VERO). *In vivo* chemopreventive property of the plant extract was studied in DMH-induced colon carcinogenesis. The methanolic extract of *Cynodon dactylon* was found to be antiproliferative and antioxidative at lower concentrations and induced apoptotic cell death in COLO 320 DM cells. Treatment with methanolic extract of *Cynodon dactylon* also increased the levels of antioxidant enzymes and reduced the number of dysplastic crypts in DMH-induced colon of albino rats.	265
Cyperus rotuntdus	Brine shrimp test	Brine shrimp bioassay was used to investigate the toxic action of *Cyperus routunds* ethanolic extract. *Cyperus routunds* ethanolic extract showed non toxic significant effects at 10, 100, 1000 µg/ml concentrations.	266-267
	Ehrlich ascites carcinoma cells, (brain tumor cell line) and Hela (cervix carcinoma cell line)	Different concentrations of oil of *Cyperus rotuntdus* (100, 50 and 25 µg/ml) were screened *in vitro* using Ehrlich ascites carcinoma cells. Oils were also tested for cytotoxic activity against the human tumor cell lines (brain tumor cell line) and Hela (cervix carcinoma cell line) at concentration between 1-10 µg/ml. Ehrlich ascites carcinoma cells *in vitro* showed that the oil exerted significant antitumour activity. *Cyperus rotuntdus* essential oils showed 100% inhibition of tumour cells at all concentrations tested (25, 50 and 100 µg/ml). when the oils tested against the human tumour cell lines (U 251 and Hela), they showed negative results.	268
	ovarian cancer (A2780, SKOV3 and OVCAR3) and endometrial cancer (Hec1A and Ishikawa) cells	The n-hexane fraction of an ethanol extract of *Cyperus rotundus* rhizomes was found to inhibit cell growth in ovarian cancer (A2780, SKOV3 and OVCAR3) and endometrial cancer (Hec1A and Ishikawa) cells. Among the thirteen sesquiterpenes isolated from the n-hexane fraction, some patchoulanetype compounds, but not eudesmane-type compounds, showed moderate cytotoxic activity in human ovarian cancer cells.	269
	human breast carcinoma MDA-	To investigated the mode of anticancer effect of *Cyperus*	270

	MB-231 cell model	*rotundus*, the pro-apoptotic effects of *Cyperus rotundus* rhizomes was studied in a human breast carcinoma MDA-MB-231 cell model. Treatment of MDA-MB-231 cells with an ethanol extract (EECR) and a methanol extract of *Cyperus rotundus* rhizomes (MECR), but not a water extract of *Cyperus rotundus* rhizomes, resulted in potent antiproliferative activity. The induction of apoptosis by the EECR was associated with upregulation of death receptor 4 (DR4), DR5 and pro-apoptotic Bax, as well as down-regulation of anti-apoptotic survivin and Bcl-2. EECR treatment also down-regulated Bid expression and activated caspase-8 and -9, the respective initiator caspases of the extrinsic and intrinsic apoptotic pathways.	
Dactyloctenium aegyptium	human hepatocellular carcinoma cells (HepG-2), colon carcinoma cells (HCT-116) and breast carcinoma cells (MCF-7)	The cytotoxicity of the *n*-hexane, ethyl acetate and *n*-butanol fractions was evaluated against human hepatocellular carcinoma cells (HepG-2), colon carcinoma cells (HCT-116) and breast carcinoma cells (MCF-7). The ethyl acetate and *n*-hexane extracts were the most active extracts as cytotoxic agents against the tested cell lines with IC_{50} values from 6.1 to 9.6µg/ml compared to that of *n*-butanol.	271-272
	human lung cancer (A549) and cervical cancer (HeLa) cells	The hexane and butanol extracts exhibited selective growth inhibitory effect on human lung cancer (A549) and cervical cancer (HeLa) cells relative to normal human lung MRC-5 fibroblasts with IC_{50} values in a range of 202 to 845 mg/ml. Moreover, all the extracts induced lethality in both cancer cell lines at concentrations close to 1,000 mg/ml, indicating their selective cytotoxicity effects.	273
Datura metel	A549 (lung), BGC-823 (gastric), and K562 (leukemia) cancer cell lines	Methanol extract of the flowers has led to isolation of 10 new withanolides, withametelins I-P. Four of 10 withanolides exhibited cytotoxic activities against A549 (lung), BGC-823 (gastric), and K562 (leukemia) cancer cell lines, with IC_{50} values ranging from 0.05 to 3.5 microM.	274-275
	vero cell line	The IC_{50} of a methanolic cold extract of datura fruit was found to be 3 mg/ml against vero cell line.	276
	human lung carcinoma cells (A549) and human colorectal adenocarcinoma cells (DLD-1)	The cytotoxicity of withanolides was evaluated against human lung carcinoma cells (A549) and human colorectal adenocarcinoma cells (DLD-1), respectively. 12α-hydroxydaturametelin exhibited cytotoxicity against A549 and DLD-1 cell lines, with IC_{50} values of 7 and 2.0 µM, respectively. However, Two compounds possessed higher cytotoxic effects against DLD-1 cells with IC_{50} values of 0.6 and 0.7 µM respectiely. Both compounds blocked the cell cycle in the S-phase and induced apoptosis.	277
	HepG-2, HeLa and SGC-7901 cell lines	The roots and stems showed inhibitory effects against HepG-2 with IC_{50} levels of 613.88 and 341.12 mg/l. The leaves and roots showed inhibitory effects against HeLa with IC_{50} levels of 267.76 and 348.35 mg/l. All the six parts possessed inhibitory effects against SGC-7901 cell lines.	278
Daucus carota	lung, skin, breast and glioblastoma cancer cell	The effect of *Daucus carota* fraction, pentane/diethyl ether (50:50), on was investigated in lung, skin, breast and glioblastoma cancer cell motility and invasion. A pronounced decrease in cancer cell motility was observed in the 4 cell lines. The treatment also led to a decrease in cancer cell invasion and an increased cell adhesion. Additionally, the *Daucus carota* fraction decreased the activation of the ρ-GTPases Rac and CDC42, a finding which may partially explain the decrease in cell motility.	279-280
	myeloid leukemia (AML) cells	The cytotoxic effect of *Daucus carota* oil extract was studied in acute myeloid leukemia (AML) cells. All the AML cell lines tested were sensitive to the extract.	281
	7,12-dimethyl benz(a)anthracene (DMBA)-induced skin papilloma in mice	The chemopreventive effects of oil extract from *Daucus carota* umbels was investigated on 7,12-dimethyl benz(a) anthracene (DMBA)-induced skin papilloma in mice. Topical 100% treatment delayed tumor appearance, and inhibited tumor incidence and yield by 40 and 89%, respectively. Topical 50% treatment inhibited tumor incidence and yield by 30 and 83%, respectively, whereas the 5% treatment inhibited tumor yield by 36%. Tumor volume was decreased by 99, 91, and 70% following topical treatments with 100, 50, and 5% oil, respectively. Intraperitoneal treatment inhibited tumor yield by 43%, and decreased tumor volume by 85%, whereas gavage treatment showed minimal effects.	282

	CaCo-2 cells	Falcarinol from carrots at concentrations above 10 µM decreased cell proliferation of CaCo-2 cells after 48 and 72 h.	283
	human lymphoid leukaemia cell lines	The effects of five fractions from carrot juice extract (CJE) [three polyacetylenes (falcarinol, falcarindiol and falcarindiol-3-acetate) and two carotenoids (beta-carotene and lutein)] were studied in human lymphoid leukaemia cell lines. Treatment of all three lymphoid leukaemia cell lines with the fraction from carrot extracts contained polyacetylenes and carotenoids showed that they were significantly cytotoxic.	284
	azoxymethane induced colon preneoplastic lesions in male rats	The effect of falcarinol was studied in the development of azoxymethane induced colon preneoplastic lesions in male rats. Feeding of rats with freeze-dried carrots containing 35 µg falcarinol per gram, or the same dose of falcarinol, delayed the development of tumours and aberrant crypt foci following 18 weeks.	285
	myeloid and lymphoid leukemia cell lines	The effect of carrot juice extracts was studied in myeloid and lymphoid leukemia cell lines together with normal hematopoietic stem cells. Treatment of leukemia cell lines with carrot juice extract induced apoptosis and caused cell cycle arrest. Lymphoid cell lines were affected to a greater extent than were myeloid cell lines.	286
	brine shrimp test	The major flavonoids isolated from the methanol extract of *Daucus carota* seeds (luteolin, luteolin 3'-O-beta-D-glucopyranoside and luteolin 4'-O-beta-D-glucopyranoside) were tested for cytotoxicity towards brine shrimp. The LD_{50} value of luteolin was 5.3×10^{-2} mg/ml, and that of its 3'-O-glucoside and 4'-O-glucoside were > 1.0 mg/ml.	287
	human breast adenocarcinoma cell lines MDA-MB-231 and MCF-7	The anticancer effect of *Daucus carota* oil extract fractions was studied on the human breast adenocarcinoma cell lines MDA-MB-231 and MCF-7. The pentane fraction (F1) and 1:1 pentane:diethyl ether fraction (F2) possessed the highest cytotoxicity against both cell lines. Flow cytometric analysis revealed that both fractions induced the accumulation of cells in the sub-G1 phase and increased apoptotic cell death and chromatin condensation.	288
	human colon adenocarcinoma cell lines (HT-29 and Caco-2)	The anticancer activity of the pentane fraction (F1) and the 1:1 pentane:diethyl ether fraction (F2) of the *Daucus carota* oil extract was evaluated against human colon adenocarcinoma cell lines (HT-29 and Caco-2). Treatment of cells with various concentrations of F1 or F2 fractions produced a dose-dependent inhibition of cell proliferation. Flow cytometric analysis indicated that both fractions induced sub-G1 phase accumulation and increased apoptotic cell death.	289
	HT-29, Caco-2 and breast (MCF-7, MDA-MB-231) cancer cell lines	The anticancer activity of the oil extract was evaluated against human colon (HT-29, Caco-2) and breast (MCF-7, MDA-MB-231) cancer cell lines. Oil extract caused significant increase in cell death and decrease in cell proliferation.	290
	HepG-2 cell line	Highest cytotoxic activity was observed against HepG-2 cell with IC_{50} values ranging from 163-172 µg/ml for the essential oils from the fruits of *Daucus carota* var. sativus (yellow carrot) and var. boissieri (red carrot).	291
Delphinium brunonianum	Vero and MDCK cell lines	The methanol extracts of whole *Delphinium brunonianum* exhibited strong cytotoxicity in Vero cells with CC_{50} (the concentration that causes the reduction of viable cells by 50%) ranging from 11 to 25 µg/ml. Similarly, in MDCK cells extracts of *Delphinium brunonianum* showed strong toxicity with CC_{50} ranging from 19 to 25 µg/ml.	292
	hepatoma cell line	Thapring, a Tibetan herbal formulation, used as an anticancer and hepatoprotective, was investigated for anticancer activity. The plant used in Thapring were: *Terminalia chebula*, *Sassurea lappa*, *Acorus calamus*, *Aconitum ferox*, *Oxytropis microphylla*, *Commiphora mukul*, *Acacia Catechu* and *Delphinium brunonianum*. It possessed a strong anti-cancer activity (growth inhibition, cell cycle arrest, pro-apoptotic activity) in hepatoma cells and showed cytotoxic effect on non-hepatoma cells and nontransformed AML12 hepatocytes.	293
Desmostachya bipinnata	brine shrimp test	Four different concentrations of hydroalcoholic extract of *Desmostachya bipinnata* (10, 100, 500 and 1000 ppm) was screened for cytotoxicity *in vivo* using brine shrimp lethality	294-295

		test. The plant induced 17.4 and 42 % death at 500 and 1000 ppm respectively with an LD_{50} value of 1215.929 ppm.	
	HCT-116 colon cancer cell line	A new xanthenes (2,6-dihydroxy-7-methoxy-3H-xanthen-3-one) isolated from the methanolic extract of *Desmostachya bipinnata*, exhibited inhibitions of signal transducer and activator of transcription 3-dependent luciferase activity in HCT-116 colon cancer cell line with IC_{50} value of 5µM and low-density lipoprotein-oxidation with IC_{50} value of 27.2 µM.	296
	human cervical cancer cell lines (HeLa), human laryngeal epithelial carcinoma cells (HEp-2) and NIH 3T3	The *in vitro* cytotoxic study of different concentrations of 70% methanolic extract of the roots of *Desmostachya bipinnata* were studied on the human cervical cancer cell lines (HeLa), human laryngeal epithelial carcinoma cells (HEp-2) and NIH 3T3. The methanolic extract possessed significant *in vitro* anticancer activity at 400 µg/ml and showed inhibition in concentration dependant manner of range between 25 – 400 µg/ml on all the cell lines.	297
Dianthus caryophyllus	colon cancer cells	Kaempferide triglycoside isolated from *Dianthus caryophyllus* proved to inhibit the proliferation of native and estrogen receptor β overexpressing colon cancer cells through a mechanism not mediated by ligand binding dependent estrogen receptor activation.	298
	colon carcinoma model	A combined application of dianthin coupled to EGF and saponin SO-1861 was tested in a xenograft model of colon carcinoma. *In vitro* results demonstrated a high-receptor specificity and the *in vivo* experiment showed a progressive reduction of the tumor volume and glycolytic activity in the treated group (>95% reduction; $P < 0.05$).	299
Digitalis lanata* and *Digitalis purpurea	myeloma cell line RPMI 8226/5 and its sublines RPMI8226/DOX40 and RPMI 8226fLR-5, the lymphoma cell lines U-937GTB and U-937Vcr, the small-cell lung cancer cell line NCI-H69 and its subline NCI-H69AR, the re- nal adenocarcinoma cell line ACHN, and the leukemia cell line CCRF-CEM and its subline CCRF-CEM/VM- 1	Extracts of *Digitalis lanata* and *Digitalis purpurea* were examined for anticancer activity in 10 human tumor cell lines. They produced cytotoxic effects, but the activity profiles were uncorrelated with those of the standard drugs, possibly indicating new pathways of drug-mediated cell death.	300-301.
	primary cultures of tumor cells from patients and a human cell line panel (representing different cytotoxic drug-resistance patterns)	The saponin digitonin, the aglycone digitoxigenin and five cardiac glycosides were evaluated for cytotoxicity using primary cultures of tumor cells from patients and a human cell line panel (representing different cytotoxic drug-resistance patterns). Of these compounds, proscillaridin A was the most potent (IC_{50}: 6.4--76 nM), followed by digitoxin, and then ouabain, digoxin, lanatoside C, digitoxigenin and digitonin. Correlation analysis of the log IC_{50} values for the cell lines in the panel showed that compound cytotoxicity was only slightly influenced by resistance mechanisms that involved P-glycoprotein, topoisomerase II, multidrug resistance-associated protein and glutathione-mediated drug resistance. Digitoxin and digoxin expressed selective toxicity against solid tumor cells, while proscillaridin A expressed no selective toxicity against either solid or hematological tumor cells.	302
	HL-60 leukemia and HepG2 cells	The cytotoxic activity of 15 cardenolide glycosides isolated from *Digitalis purpurea* seeds was evaluated against HL-60 leukemia cells. 4 compounds showed potent cytotoxicity against HL-60 cells with IC_{50} values of 0.060, 0.069, 0.038, and 0.034 µM. Three of these compounds also exhibited potent cytotoxic activity against HepG2 human liver cancer cells with IC_{50} values of 0.38, 0.79, and 0.71 µM.	303
	prostate: PC-3, DU145; lung: A549, EKVX, central nervous system: SF-268, renal: CAKI-1, melanoma: SK-MEL28, MDA-MB-435; ovarian: OVCAR-3, OVCAR-5 and NCI-ADRES; colon: HCT-116. Normal human fibroblast cells	The steroidal cardiac Na^+/K^+ ATPase inhibitors were potent anti-cancer compounds in multiple cell lines from different tumor panels including multi-drug resistant cells. Of many synthetic steroidal cardiac, the most potent compound identified was 3-[(R)-3- pyrrolidinyl]oxime derivative, it showed outstanding potencies (as measured by GI_{50}, TGI and LC_{50} values) in most cells *in vitro*.	304
	Cell lines of prostate, melanoma, pancreatic, leukaemia, neuroblastoma, and tumors of	Numerous other studies have confirmed the antiproliferative and apoptotic effects of cardiac glycosides in several cancer cell lines, including prostate, melanoma, pancreatic,	305-321

	urinary and respiratory systems	leukaemia, neuroblastoma, and tumors of urinary and respiratory systems.	
	breast cancer tissue samples	Many epidemiological studies revealed that breast cancer tissue samples from congestive heart failure patients treated with cardiac glycoside therapy showed more benign characteristics and need less mastectomy than samples taken from patients who were not used cardiac glycosides.	322
Dodonaea viscosa	breast carcinoma cell line	Cytotoxic activities of *Dodonaea viscosa* extracts were examined on breast carcinoma cell line (MCF7). The results showed that the 80% ethanolic extract of *Dodonaea viscosa* possessed strong cytotoxic activity, with IC_{50} of 19.4 µg/ml, compared with the standard drug (cisplatin), which showed IC_{50} of 5.48 µg/ml.	323-324.
Lablab purpureus	brine shrimp test	The cytotoxic effect of methanol extracts of two Bangladeshi bean pods *Lablab purpureus* sweet white and purple was studied using brine shrimp lethality test. In Cytotoxicity test LC_{50} value was 960.06 µg/ml for *Lablab purpureus* sweet purple and 66.5 µg/ml for *Lablab purpureus* sweet white, so *Lablab purpureus* sweet white was more potent.	325-326
	brine shrimp test	The cytotoxic activity of crude extracts (chloroform, n-hexane, ethyl acetate) of leaves of *Lablab purpureus* were studied using brine shrimp lethality bioassay and compare with LC_{50} values of standard Vincristin sulphate as a positive control. The results revealed significant cytotoxicity against *A. salina*, with LC_{50} 13.88µg/ml, 19.17µg/ml and 17.97µg/ml for n-hexane, chloroform and ethyl acetate extracts respectively.	327
Echinochloa crus-galli	MCF-7 (breast cells), HCT-116 (colon cells), HELA (cervical cells) and HEPG-2 (liver cells)	Bioassay-guided fractionation of the seeds of *Echinochloa crus-galli* lead to isolation of two cytotoxic flavonoids. They showed cytotoxic effect when screening against four human cancer cell lines [MCF-7 (breast cells), HCT-116 (colon cells), HELA (cervical cells) and HEPG-2 (liver cells)] using the sulforhodamine B (SRB) colorimetric assay. Different extracts of the seeds of *Echinochloa crus-galli* showed a dose dependent inhibition in a range of 5–50µg/ml. The ethanolic extract (95%) proved to be the most active extract against HELA cell line (IC_{50}=12µg/ml). On the other hand, the hexane and chloroform fractions exhibited moderate activities against HEPG-2 (IC_{50}=15.5µg/ml) and HCT-116 (IC_{50}=17.1µg/ml) cell lines, respectively.	328-329
	HCT-116 and HELA cell lines	The ethanolic extract (70%) was the most active extract against HCT-116 and HELA cell lines (IC_{50} = 11.2 ± 0.11 and 12.0 ± 0.11 µg/ml, respectively). The chloroform and ethyl acetate fractions exhibited highest activities against HCT-116 cell lines.	330-332
Equisetum arvense	human cancer cell lines HeLa, HT-29, and MCF7	The antiproliferative activity of different extracts was studied against human cancer cell lines HeLa, HT-29, and MCF7. The antiproliferative of the extracts was depended on cell line, type of extract, and extract concentration. Ethyl acetate extract exhibited the most prominent antiproliferative effect.	331-332
	human leukemic U 937 cells	The water extract from sterile stems of *Equisetum arvense* exerted dose dependent cytotoxic effects on human leukemic U 937 cells. DNA fragmentation, externalisation of phosphatidilserine, the colapse of mithocondrial transmemhrane potential, were all observed in cells cultured for 48 h with the herb extract.	333
	melanoma B16 cells	The antiproliferative effect of *Equisetum arvense* extract was tested on melanoma B16 cells. At a concentration of > 0.5mg/ml, it showed significant antiproliferative effect.	334
	cervical adenocarcinoma, lung fibroblast, breast adenocarcinoma, and human embryonic kidney cells	The cytotoxicity of *the* methanolic extract of the dried aerial part of *Equisetum arvense* was tested against various cancer cell lines including cervical adenocarcinoma, lung fibroblast, breast adenocarcinoma, and human embryonic kidney cells. The extract induced death on the four tested cell lines with the greatest effect on human embryonic kidney cells followed by breast adenocarcinoma.	335
	L-1210 (mouse derived leukemia cells), 3T3 (mouse derived SV-transformed fibroblasts) and HMV-1 (human derived melanin producing melanoma cells)	The crude *Equisetum arvense* protein extract inhibited cancer cell proliferation in cell culture of L-1210 (mouse derived leukemia cells), 3T3 (mouse derived SV-transformed fibroblasts) and HMV-1 (human derived melanin producing melanoma cells). It also caused life prolongation in mice in an *in vivo* study using L-1210 and B16F1 (mouse melanoma	336-337.

		cells).	
Erigeron canadensis	HeLa (cervix epithelial adeno carcinoma), A431 (skin epidermoid carcinoma) and MCF7 (breast epithelial adenocarcinoma) cells	Aqueous and organic extracts of *Erigeron canadensis* were screened *in vitro* for antiproliferative activity against HeLa (cervix epithelial adenocarcinoma), A431 (skin epidermoid carcinoma) and MCF7 (breast epithelial adenocarcinoma) cells. Extracts from the roots were more effective than those from other organs and the MCF7 cells were slightly more sensitive than the other two cell lines, as demonstrated by the IC_{50} values. The *n*-hexane extracts of the roots of *Erigeron canadensis*exhibited the highest activity.	338-341.
	human cervix adenocarcinoma (HeLa), skin carcinoma (A431), and breast adenocarcinoma (MCF-7) cells	Many compounds isolated from the plant were evaluated for their antiproliferative activities. They were exerted considerable cell growth-inhibitory activity against human cervix adenocarcinoma (HeLa), skin carcinoma (A431), and breast adeno carcinoma (MCF-7) cells. Some of the active components, including conyzapyranone B; 4 E,8 Z-matricaria- γ-lactone and spinasterol, proved to be substantially more potent against these cell lines than against noncancerous human foetal fibroblasts (MRC-5).	342
	HaCaT keratinocyte cell line	Studying of cytotoxicity of the plant essential oil showed that the IC_{50} value of the essential oil was 0.027 against HaCaT keratinocyte cell line.	343
Erodium cicutarium	colon cancer cells (Caco-2)	The ethanolic leaves extracts of *Erodium cicutarium* possessed significant antiproliferative activity against colon cancer cells (Caco-2) . It caused 10% proliferation inhibition at 100 µg/ml.	344
Eryngium creticum	MCF7 breast cancer cell line	The cytotoxic effects of three extracts (aqueous, methanolic and ethyl acetate) from fresh leaves and stems of *Eryngium creticum*, were studied on MCF7 breast cancer cell line. The results showed that the aqueous and ethyl acetate extracts of both leaves and stems of the plant inhibited the growth of cancer cell line from 68 % to 72 %.	345-346
	MCF-7 cell line	The anticancer activity of the extracts of leaves and stems of *Eryngium creticum* was evaluated in MCF-7 cell line and MDA-MB-468 cells after treatment for 24 and 48 hours with increasing concentrations (5, 25, 50, 100, and 200 µg/ml) of these extracts. Extracts caused partial inhibition of the proliferation of cancer cells, the maximum inhibition of the proliferation was occurred at low concentrations (50 and 100 µg/ml).	347
	HeLa cell line	The anti-proliferative and cytotoxic activities of the aqueous and ethanolic extracts from different parts (leaves, stems, roots, and the whole plant) of the fresh plant from the first and second harvest, were performed. The results showed that the 4 parts of this plant inhibited the viability of HeLa cell line in a time-dependent (0–72 h) and dose-dependent (0–250 µM) manner. The ethanolic extracts from leaves of the second harvest were the most potent (at 48 h) with an IC_{50} value of $\leq$ 47.24 µg/ml.	348
***Eucalyptus* species**	human colon cancer cell lines HCT116 and RKO	The anti-proliferative effect of 1, 8-cineole was studied on human colon cancer cell lines HCT116 and RKO. In *in vivo* study, RKO cells were injected into the mice and the effect of 1, 8-cineole was investigated. Specific induction of apoptosis, not necrosis, was observed in human colon cancer cell lines HCT116 and RKO by 1, 8-cineole. The treatment with 1, 8-cineole was associated with inactivation of survivin and Akt and activation of p38. These molecules induced cleaved PARP and caspase-3, finally causing apoptosis. In mice, 1, 8-cineole significantly inhibited tumor progression.	349
	human ECV-304 cell lines	*Eucalyptus camaldulensis* possessed a remarkable cytotoxic activity against human ECV-304 cells.	350
	WEHI-3, HT-29 and HL-60 cell lines	*Eucalyptus camaldulensis* leaves essential oil demonstrated cytotoxic effects in three tested cancer cell lines; WEHI-3, HT-29 and HL-60. WEHI-3 was the most sensitive with IC_{50}=16.10µg/ml. The essential oil exhibited less cytotoxic effects in HT-29 and HL-60 cells (IC_{50}=50.5 and 42.10µg/ml, respectively). Essential oil also exhibited a weak cytotoxic effect in RAW 264.7 cells.	351
	MCF-7, Hep-2, HepG-2, HeLa, HCT-116 and Caco-2 cell lines	The cytotoxicity of the aqueous acetone extract of *Eucalyptus camaldulensis* was evaluated on MCF-7, Hep-2, HepG-2, HeLa, HCT-116 and Caco-2 cell lines. The	352

		extract reduced the viability of all cell lines in a dose-dependent manner, and was more active on MCF-7 and HCT-116 cell lines. IC_{50} ranged from 33.3 to 57.7 µg/ml.	
	liver , lung, prostate, breast cell lines and normal epithelial and skin fibroblast cell	The essential oil of *Eucalyptus camaldulensis* showed high potent cytotoxic effect on colon, prostate and breast cancer cell lines as well as moderate potency against liver and lung cell lines with IC_{50} 19.8, 31.5, 34.9, 51.7 and 64.0µg/ml respectively. In the same pattern, the oil showed high cytotoxic effect on normal epithelial retina cell line and moderate effect on normal skin fibroblast cell with IC_{50} 41.3 and 60.6µg/ml respectively.	353
	human breast cancer cell lines (MCF 7 and MDA-MB-231)	*In vitro* cytotoxicity of methanol, ethyl acetate, *n*-buthanol, and water extracts of *Eucalyptus camaldulensis* leaves was examined against two human breast cancer cell lines (MCF 7 and MDA-MB-231). The results showed that the extracts possessed significant cytotoxic potential with IC_{50} values ranging from 3 to 250 µg/ml.	354
	Ehrlich ascites carcinoma	Anticancer activities of *p*-menth-1-ene-4,7-diol (EC-1) isolated from *Eucalyptus camaldulensis* were studied on Ehrlich ascites carcinoma (EAC) cells. *p*-menth-1-ene-4,7-diol (EC-1) significantly inhibited proliferation of EAC cells *in vivo* and restored the altered hematological parameters of EAC-bearing mice. Cytological observation by fluorescence microscope showed apoptosis of EAC cells upon treatment with EC-1.	355
	L20B (a genetically engineered mouse cell line) and human rhabdomyo sarcoma (RD) cells	The cytotoxic effect of the crude methanolic extracts of *Eucalyptus camaldulensis* was investigated against L20B (a genetically engineered mouse cell line) and human rhabdomyo sarcoma (RD) cells. The results showed that the extract possessed moderate cytotoxicity.	356
	Ehrlich's ascites carcinoma in mice	The *in vivo* antitumor effect of *Eucalyptus camaldulensis* stem bark methanol extract was studied against Ehrlich's ascites carcinoma (EAC) in Swiss albino mice. *Eucalyptus camaldulensis* stem bark methanol extract showed 96% ($P < 0.001$) cell growth inhibition and reduced tumor burden significantly (81.4%; $P < 0.01$) when compared with control mice. It also increased the lifespan of EAC-bearing mice significantly (71.36%; $P < 0.01$).	357
Eupatorium cannabinum	colon cancer cell line HT29	The cytotoxic effects of *Eupatorium cannabinum* ethanolic extract was studied in colon cancer cell line HT29. Severe loss of HT29 cell viability was detected for 50 µg/ml *Eupatorium cannabinum* ethanolic extract after 24 h of exposure.	358-359
	Leukaemia and ZNS tumor cells (V 251)	Eupatoriopicrin showed significant cytotoxic activity at a concentration of 1.0–5.2 molar, particularly against leukaemia tumor and ZNS tumor cells (V 251).	360
	FIO 26 cell line and *in vivo* by tumour growth delay in FIO 26 and Lewis lung tumour-bearing mice	The cytostatic effect of eupatoriopicrin was studied against FIO 26 cells *in vitro* with the aid of a clonogenic assay and *in vivo* by tumour growth delay in FIO 26 and Lewis lung tumour-bearing mice. *In vitro* the IC_{50} for 1 h exposure to eupatoriopicrin was 1.5 microgram/ml (4.1 nmol/ml). Growth inhibition of the Lewis lung carcinoma and the FIO 26 fibrosarcoma, solidly growing in C57Bl mice, was found after iv injection of 20 or 40 mg/kg eupatoriopicrin.	361
	Ehrlich ascites tumour cells	After 2 hr incubation of Ehrlich ascites tumour cells with eupatoriopicrin, the DNA damage, was observed at concentrations only slightly higher than those causing cell death (1-10 micrograms/ml).	362
	Jurkat cell line	The hydrochloric extract significantly inhibited the growth of Jurkat cells in a dose- and time-dependent manner. The inhibitory capacity of extract at the dose of 250 µg/ml was comparable to 5-FU (200µg/ ml). The IC_{50} value of the extract determined at 48 hours was 73.3 µg/ml.	363
	DLD-1, CCRF-CEM, and HL-60 cell lines	Among the isolated compounds, thymol derivatives (9-acetoxy-8,10-epoxythymol 3-O-tiglate) was the most cytotoxic with IC_{50} values of 0.02±0.01, 1.02±0.07, and 1.36±0.12 µg/ml, respectively, against DLD-1, CCRF-CEM, and HL-60 cell lines.	364.
	brine shrimp test	The cytotoxic effect of essential oils of *Eupatorium cannabinum* was studied using brine shrimp (Artemia sp.) assay. The determined LC_{50} value was 16.3-22.0 µg/ml.	365

	Ehrlich Ascites test	Hispidulin, eupafolin and rutin, isolated from the aerial parts of *Eupatorium cannabinum*, were screened for cytotoxicity *in vitro* against Ehrlich Ascites tumour (EAT). The lowest active dose of the flavonoids causing growth inhibition of the EAT cells was 2.6 nmol/ml for rutin, 9.8 nmol/ml for eupafolin and > 21 nmol/ml for hispidulin.	366
Euphorbia hirta	Brine shrimp test	Brine shrimp lethality assay was used to study the cytotoxicity of *Euphorbia hirta*. The results showed that the LC_{50} of ethyl acetate and acetone extract of *Euphorbia hirta* were 71.15 and 92.15 ug/ml respectively.	367
	human epidermoid carcinoma KB 3-1 cells	flavonol glycosides (afzelin, quercitrin and myricitrin) isolated from the methanolic extract of the aerial parts of *Euphorbia hirta*, exhibited little cytotoxic property against human epidermoid carcinoma KB 3-1 cells.	368
Euphorbia macroclada	MDA-MB-468cell line	The dichlormethane and ethylacetate extracts showed cytotoxic effects on MDA-MB-468cell line at concentrations of 30 and 50 µg/ml, whereas methanol extract and latex revealed no cytotoxicity even at highest concentrations (100 and 200µg/ml). The dichloromethane extract showed the most cytotoxic effect against tested cell line (IC_{50}= 30 µg/ml).	369
Fagopyrum esculentum	Hep G2 (hepatoma) cells, L1210 (leukemia) cells, breast cancer (MCF-7) cells, and liver embryonic WRL 68 cells	An anticancer peptide with a molecular mass of approximately 4 kDa was isolated from buckwheat. It inhibited proliferation of Hep G2 (hepatoma) cells, L1210 (leukemia) cells, breast cancer (MCF-7) cells, and liver embryonic WRL 68 cells with an IC_{50} of 33, 4, 25, and 37 microM, respectively.	370
	human mammary cancer cell Bcap37	The antitumor effects of tartary buckwheat protein fractions were studied against human mammary cancer cell Bcap37. The fraction of a protein of tartary buckwheat TBWSP31 showed that it possessed high time- and concentration-dependent antitumor effects.	371
	hepatic cancer cells	The *in vitro* and *in vivo* anti-tumoral effects of recombinant buckwheat trypsin inhibitor was studied on hepatic cancer cells. The recombinant buckwheat trypsin inhibitor decreases cell viability by inducing apoptosis and DNA fragmentation.	372
	human leukemia U937 cells	The results of the treatment of human leukemia U937 cells with tartary buckwheat-derived lectin in doses of 12.5, 25, 50, and 100 µg/ml showed that tartary buckwheat-derived lectin induced apoptosis in a dose-dependent manner.	373
	development of mammary tumor caused by administration of 7,12-dimethyl benz [alpha] anthracene	Buckwheat protein extract decrease the incidence of 7,12-dimethylbenz [alpha] anthracene induced mammary tumors and serum estradiol in female rats.	374
	dimethylhydrazine (DMH)-induced colon tumor in rats	The effect of consumption of buckwheat protein product (BWP) on 1,2-dimethylhydrazine (DMH)-induced colon tumor was studied in in rats. Dietary BWP caused a 47% reduction in the incidence of colonic adenocarcinoma ($P < 0.05$).	375
Ficus carica	esophageal cancer line	There was a significant anticancer effects for 10 mg/ml treatment of latex after 72 hours on esophageal cancer line (P: 0.025). Ten mg/ml was the optimum concentration in the inhibition of cell line growth.	376
	breast cancer cell lines (MCF7)	The ethanolic extract showed strong anti-cancer activities against breast cancer cell lines (MCF7). At a concentration of 1000 µg/ml, 85.5 and 89 % inhibition were recorded after 24 and 48 hours, at a concentration of 1000 µg/ml, 85.5 and 89 % inhibition were recorded after 24 and 48 hours.	377
	(Hep3b: Hepatocellular carcinoma; Hela: cervical epithelial cancer; and PC-3*:* prostate cancer) cell lines	The effect of crude water extracts of *Ficus carica* upper parts was investigated against (Hep3b: Hepatocellular carcinoma; Hela: cervical epithelial cancer; and PC-3*:* prostate cancer). The results showed a concentration-dependent reduction in the final number of cancer cells in consequence to treatment.	378
	MCF-7, HepG-2, and U2OS cell lines	Nine new tirucallane-type triterpenoids, ficutirucins A-I, were isolated from the fruit of *Ficus carica*, and were evaluated for their cytotoxic activities against three human cancer cell lines, MCF-7, HepG-2, and U2OS. Ficutirucins A, B, C, F,G and I exhibited moderate cytotoxic activities with IC_{50} values of 11.67 - 45.61 µM against one or more of the three cancer cell lines.	379
	T98G, U-138 MG, and U-87 MG Glioblastoma multiforme cell lines	*Ficus carica* latex alone and incombination with temozolomide showed anti-proliferative activity against T98G, U-138 MG, and U-87 MG Glioblastoma multiforme	380

		cell lines.	
	human melanoma cells	The aerial components of *Ficus carica* showed anti-proliferative activity of human melanoma cells.	381
	human tumor cell line A375 (melanoma)	Latex obtained from the leaves showed antiproliferative activity with an IC_{50} value of 1.5 µg/ml on the human tumor cell line A375 (melanoma) after irradiation at a specific UVA dose (1.08 J/cm^2).	382-383
Ficus cunia	the protection from the formation of micronuclei cells induced by cyclophosphamide in bone marrow of mice	The anticancer effect of *Ficus cunia* was studied based on the protection from the formation of micronuclei cells induced by cyclophosphamide in bone marrow of mice. The results indicated that the number of micronuclei cells in *bone marrow* of mice treated by the tested substances were less than of control group (55.55%).	384
Ficus religiosa	brine shrimp test (*Artemia salina*) and in the potato disc bioassay	*F. eligiosa* fruit extract demonstrated activity in the brine shrimp test (*Artemia salina*) and in the potato disc bioassay.	385
	brine shrimp test	The percent mortality of shrimp was increased with the increase of the doses of the ethanolic extracts. LC_{50} and LC_{90} values were found to 2.7 and 4.62 µg/ml.	386
	brine shrimp test	The oil leaf of *Ficus religiosa* was marginally active in the brine shrimp lethality test (LC_{50} = 50 µg/ml) and also showed *in vitro* cytotoxic activity against MCF-7 human breast tumor cell line (80±5% kill at 100 µg/ml).	387
	cervical cancer cell lines SiHa (HPV16 positive) and HeLa (HPV18 positive)	Both aqueous and ethanolic extracts of the bark showed significant cytotoxicity in cervical cancer cell lines SiHa (HPV16 positive) and HeLa (HPV18 positive) wherein ethanolic extract showed cytotoxicity at much lower doses compared to aqueous extract.	388
	human cervical cancer cell lines, SiHa and HeLa	The anti-neoplastic potential of aqueous extract of *Ficus religiosa* bark was studied in human cervical cancer cell lines, SiHa and HeLa. The aqueous extract of *Ficus religiosa* altered the growth kinetics of SiHa (HPV-16 positive) and HeLa (HPV-18 positive) cells in a dose-dependent manner. It blocked the cell cycle progression at G1/S phase in SiHa that was characterized by an increase in the expression of p53, p21 and pRb proteins with a simultaneous decrease in the expression of phospho Rb (ppRb) protein. In HeLa, aqueous extract of *Ficus religiosa* induced apoptosis through an increase in intracellular Ca^{2+} leading to loss of mitochondrial membrane potential, release of cytochrome-c and increase in the expression of caspase-3.	389
	human MCF 7 and normal epithelial cell lines	Different fractions of *Ficus religiosa* showed anticancer effects against human MCF 7 and normal epithelial cell lines. The IC_{50} value for FRI was 160.3 µM, whereas the IC_{50} value for FRIII was found to be 222.7 µM in the normal epithelial cells.	390
	human breast cancer cells	The potential effect of acetone extract of *Ficus religosa*leaf (FAE) in multiple apoptosis signaling was studied in human breast cancer cells. FAE treatment significantly induced dose and time dependent, irreversible inhibition of breast cancer cell growth with moderate toxicity to normal breast epithelial cells.	391

CONCLUSION:

The paper reviewed the anticancer effects of the medicinal plants to open the door for their utilization in medical applications as a result of effectiveness and safety**.**

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