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### Review Article

## Medicinal plants: used in Anti-cancer treatment

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#### ABSTRACT:

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. The plant kingdom produces naturally occurring secondary metabolites which are being investigated for the anticancer activities for the development of new clinical drugs. For many years herbal medicines have been used and are still used in developing countries as the primary source of medical treatment. Plants have been used in the medicine for their natural antiseptic properties. Thus, research has developed into the investigating the potential properties and uses of terrestrial plants extracts for the preparation of potential nanomaterial drugs for diseases including cancer. Many plant species are already being used to treat or prevent development of cancer. This review discusses the demand for naturally derived compounds from medicinal plants and their properties which make them targets for potential anticancer treatments.

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#### INTRODUCTION

Cancer continues to be and is increasingly a serious health problem and one of the leading causes of death in the world. Aging and the growth of the world population changes in life style and the adoption of cancer causing behavior are some of the reason for this prevalence.

According to cancer statistics in 2013, stomach and liver cancer are the most common in Asia and both are associated with high mortality rates, while bladder cancer is the most common in USA. Colorectal and breast cancers have high incidence rates in all countries.

Cancer has been a constant battle globally with a lot of development in cures and preventative therapies. The disease is characterized by cells in human body continually multiplying with the inability to be controlled or stopped. Consequently, forming tumors of malignant cells with the potential to be metastatic.

Current treatments include chemotherapy, radiotherapy and chemically derived drugs. Treatments such as chemotherapy can put patient under a lot of strain and further damage their health. Therefore, there is a focus on using alternative treatments and therapies against cancer.

For many years herbal medicines have been used and are still used in the developing countries as the primary source of medical treatment. Plants have been used in medicine for their natural antiseptic properties. Thus, research has developed into investigating the potential properties and uses of terrestrial plants extracts for the preparation of potential nanomaterial drugs for diseases including cancer.

Many plant species are already being used to treat or prevent development of cancer. Multiple researchers have identified species of plants that have demonstrated anticancer properties with a lot of focus on those that have been used in herbal medicine in developing countries.

Compounds which are characteristic to the plant kingdom and are necessary for the plant survival and “housekeeping” of the

organism are being investigated for their ability to inhibit growth and initiate apoptosis of cancerous cells. This article aims to take an overview of current plant derived compounds that have anticancer therapeutic properties and their developments in the fields.

#### HERBAL PLANT USED IN TREATMENT OF ANTICANCER ACTIVITY:

**Chew et al (1999)**, evaluated the comparison of the anticancer activities of dietary beta-carotene, canthaxanthin and astaxanthin in the mice in vivo against the growth of mammary tumors. The result shows that mammary tumor growth inhibition by astaxanthin was dose dependent and was higher than that of canthaxanthin and beta-carotene. Mice fed 0.4% beta-carotene or canthaxanthin did not show further increases in tumor growth inhibition compared to those fed 0.1% of each carotenoid. Lipid peroxidation activity in tumors was lower ( $P < 0.05$ ) in mice fed 0.4% astaxanthin, but not in those fed beta-carotene and canthaxanthin [1].

**Jua et al (2004)**, evaluated the antioxidant and anticancer activity of metabolic extract of *Betulaplathyphylla var. japonica* against human promyelocytic leukemia (HL- 60) cells. Result showed that the extract has high 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging activity (IC<sub>50</sub> 2.4 Ag/ml) and lipid peroxidation inhibitory activity (IC<sub>50</sub> below 4.0 Ag/ml). Furthermore, *B. platyphylla var. japonica* extract reduced the number of V79-4 cells arrested in G2/M in response to H<sub>2</sub>O<sub>2</sub> treatment and increased the activities of several cellular antioxidant enzymes, including superoxide dismutase, catalase and glutathione peroxidase. Treatment with *B. platyphylla var. japonica* extract gradually increased the expression of proapoptotic bax and led to the activation of caspase-3 and cleavage of PRAP [2].

**Shoemaker et al (2005)**, evaluated the aqueous extracts of 12 Chinese medicinal herbs (*Anemarrhenaasphodeloides*, *Artemisia argyi*, *Commiphoramyrtha*, *Duchesneaindica*, *Gleditsiasinensis*, *Ligustrum lucidum*, *Rheum palmatum*, *Rubiocordifolia*, *Salvia chinensis*, *Scutellariabarabata*, *Uncariarhynchophylla* and *Vaccariasegetalis*) for antiproliferative activity on eight cancer cell lines as well as on normal human mammary epithelial cells. Five human and three murine cancer cell lines representing different tissues (breast, lung, pancreas and prostate) were used. The result showed that all the crude aqueous extracts demonstrated growth inhibitory activity on some or all of the cancer cell lines, but only two showed activity against the normal mammary epithelial cells [3].

**Chen et al (2006)**, evaluated the in vitro and in vivo studies of a novel potential anticancer agent of isochailulacetone on human lung cancer A549 cells. Crude acetone extract of *Blupleurunscorzonrifolium*(BS-AE) 60 mg/ml has anti-proliferation activity and apoptotic effects on A459 non-small cell lung cancer (NSCLC). A novel lignin, isochailulacetone (4-benzo [1,3] dioxol-5-ylmethyl-3(3,4,5-trimethoxybenzylidene)-dihydrofuran-2-one), was isolated from BS-AE and identified from spectral evidence (1H NMR, 13C NMR, IR and MS) and by comparison with authentic synthetic standards. Isochailulacetone was cytotoxic (IC<sub>50</sub> = 10-50 mM) in a

variety of human tumor cell lines. G2/M arrest was correlated with increased p21/WAF1 levels, down regulation of the checkpoint proteins cyclin B1/cdc2 and mobility shift of cdc25C. Moreover, isochailulacetone (30 and 50 mg/kg) inhibited the growth of non-small cell lung carcinoma A549 xenograft in nude mice [4].

**Yan et al (2009)**, evaluated the in vitro and in vivo anticancer activity of steroid saponins of *Paris polyphylla var. yunnanensis*. The result showed that steroid saponins remarkable cytotoxicity and caused typical apoptosis in a dose dependent manner. They were evaluated in vivo by their effect on tumor developed in T739 inbred mice. The oral administration to T739 mice bearing LA795 lung adenocarcinoma of compound 1 and diosgenin significantly inhibited tumor growth, by 29.44% and 33.94% respectively. HE staining showed that lungs and livers of treated mice underwent various levels of histopathological alterations. It was demonstrated by TUNEL assay that apoptosis rate in tumor cells was increased in comparison to cells in control mice. The 3-O-glycoside moiety and spirostanol structure played an important role in anticancer activity of steroid saponins and the number and variety of glycosides of compounds strongly influenced on their anticancer activity [5].

**Yadav et al (2010)**, evaluated the in vitro anticancer activity of the ethanol extract of root, stem and leaves of *Withaniasomnifera* against various Human cancer cell lines i.e. PC-3, DU-145 (prostate), HCT-15 (colon), A-549 (lung) and IMR-32 (neuroblastoma). Result showed that root, stem and leaves extracts showed cytotoxicity activity ranging 0-98% depending on the cell lines but maximum activity was found in 50% ethanol extract of leaves of *Withaniasomnifera*. Ethanol extract leaves obtained from treatments T2, T3, T4 and T5 showed strong activity against PC-3 and HCT-15 with 80-98% growth inhibition, while the 50% ethanol extract of leaves from T1 treatment showed a minimum of 39% and T3 treatment showed maximum of 98% growth inhibition against HCT [6].

**Wathanachaiyingcharoen et al (2010)**, evaluated the proteins from *Mirabilis jalapa* possess anticancer activity via an apoptotic pathway. Proteins which were partially purified by ammonium sulfate precipitation were investigated to determine the mechanisms of anticancer and cytotoxic effects. SDS-PAGE showed two major proteins at 27 kDa and 62.5 kDa in size. The cytotoxicity test on brine shrimp exhibited an LD<sub>50</sub> of 95.50-489.78 µg/ml at 24 and 48 hours. The result showed that proteins on Vero cells indicated its potent anticancer activity through apoptotic pathway. Its activity was confirmed by DNA fragmentation and cell morphology change methods [7].

**Naama et al (2010)**, evaluated the anticancer activities of ethanolic extract of *Curcumin* against the cell line of human hepato cellular liver carcinoma. Result showed that the extract showed a considerable anticancer activity against the cell line of human hepato cellular liver carcinoma [8].

**Moulisha et al (2010)**, evaluated the anti-leishmanial and anticancer activities of a pentacyclic triterpenoid isolated from *Terminalia arjuna combretaceae*. Result showed that a pentacyclic triterpenoid, characterized as 3β-hydroxyurs-12-en-

28-oic acid (together with  $\beta$ -D-glucoside) and designated ursolic acid was successfully isolated.

The structure was determined on the basis of spectroscopic analysis. In vitro anti-leishmanial activity against promastigotes of *Leishmaniadonovani* (strain AG 83) and anticancer activity on K562 leukaemic cell line were shown by the isolated ursolic acid [9].

**Mohamed et al (2010)**, evaluated the anticancer activities of some new synthesized Thiazolo[3,2-a]Pyrido[4,3-d]Pyrimidine derivatives. The result showed that some of the tested compounds exhibited better in vitro antitumor activities at low concentration ( $\log_{10}$  GI50 = -4.7) against the used human tumor cell lines. It was concluded that pyrimidine moieties fused to N-methylpipredine ring are essential for antitumor activities. The anticancer activity is due to the presence of nitrogen heterocyclic rings and the presence of sulfur atom generally enhancing the activity [10].

**Jevtovic et al (2010)**, evaluated the anticancer activity of new copper (II) complexes incorporating a pyridoxal-semicarbazone ligand against breast cancer cells (MCF7 and MDA MB 231) and proliferative cells (MCF7). Result showed that as ligand PLSC is biologically active [11].

**Gomez et al (2010)**, evaluated the antibacterial and anticancer activities of extract from the seaweeds *Egrediamenziesii*, *Codiumfragil*, *Sargassummuticum*, *Endarachnebinghamiae*, *Centrocerasclavulatum* and *Laurenciapacificac* collected from Todos Santos Bay, Mexico. Pathogen strains of *Staphylococcus aureus*, *Klebsiella pneumonia*, *Proteus mirabilis* and *Pseudomonas aeruginosa* were used to test antibacterial activity and HCT-116 colon cancer cells for anticancer activity. Thirty-five bacterial strains were isolated from the surface of seaweeds and molecular identified as belonging to the phyla Firmicutes, Proteobacteria and Actinobacteria by 16S rDNA sequencing. The strains Cc51 isolated from *Centrocerasclavulatum*, Sm36 isolated from *Sargassummuticum* and Eb46 isolated from *Endarachnebinghamiae* showed anticancer activity with IC<sub>50</sub> values of 6.492, 5.531 and 2.843  $\mu$ g/ml respectively. Likewise, the extracts from the seaweed associated bacteria inhibited the growth of the Gram-negative bacterium *Proteus mirabilis* [12].

**Thomas et al (2011)**, evaluated the in vitro anticancer activity of microbial isolates from diverse habitats against HeLa and MCF-7 cell lines. Nuclear staining and flow cytometric studies were carried out to assess the potential of the extracts in arresting the cell cycle. The result showed that crude ethyl acetate extract of isolate F-21 showed promising results by MTT assay with IC50 as low as 20.37 $\pm$ 0.36  $\mu$ g/ml on HeLa and 44.75 $\pm$ 0.81  $\mu$ g/ml on MCF-7 cells, comparable with Cisplatin. The isolate F-21 was identified as *Aspergillus* sp. Promising results were also obtained with B-2C and B-4E strains. Morphological studies, biochemical tests and preliminary chemical investigation of the extracts were also carried out [13].

**Sakthivel et al (2012)**, evaluated the anticancer activity of *Acacia nilotica* (L.) wild Ex. Delile subsp. indica against dalton's ascetic lymphoma induced solid and ascetic tumor model. Result showed that *A.nilotica* extract significantly decreased the development of tumor and percentage increase in

body weight when compared to DAL induced solid tumor control group, also increasing the life span, restoring the total white blood cell count and hemoglobin content and significantly decreasing the levels of serum aspartate transaminase (SGPT), alanine transaminase (SGOT), alkaline phosphatase (ALP), gamma alutamyl transferase (GGT) and nitric oxide (NO) when compared to DAL induced ascetic tumor controls. The treatment also reduced significantly the cellular glutathione (GSH) and nitric oxide levels in treated animals [14].

**Purushoth et al (2012)**, evaluated the invitro anticancer activity of *Merremiaemarginataburm. F.* The different solvent fraction of whole plant *Merremiaemarginataburm. F.* was subjected for MTT assay. The result showed that ethylacetate fraction of whole plant was found to be cytotoxic against human cervical carcinoma HeLa cell lines and human breast carcinoma MCF cell lines. The IC50 value of ethylacetate fraction was 51.57  $\mu$ g/ml against HeLa cell lines and 39.6  $\mu$ g/ml against MCF-7 cell lines [15].

**Premanathan et al (2012)**, evaluated the antioxidant and anticancer activities of isatin (1H-indole-2,3-dione), isolated from the flower of *Couroupitaguianensisabulag* against human promyelocytic leukemia (HL60) cells by MTT assay. Result showed antioxidant activity with the EC50 value of 72.80  $\mu$ g/ml. It also exhibited cytotoxicity against human promyelocytic leukemia HL60 cell in dose dependent manner with the CC50 value of 2.94  $\mu$ g/ml. The isatin-treated cells underwent apoptosis and DNA fragmentation. Apoptosis was confirmed by the FACS analysis using FITC-annexin V markers. It was concluded that Isatin showed antioxidant activity and was cytotoxic to the HL60 cells due to induction of apoptosis [16].

**Plengsuriyakam et al (2012)**, evaluated cytotoxicity, toxicity and anticancer activity of *Zingiberofficinale roscoe* against Cholangiocarcinoma (CCA). Cytotoxic activity against a CCA cell line (CL-6) was assessed by calcein-AM and Hoechst 33342 assays and antioxidant activity was evaluated using the DPPH assay. Investigation of apoptotic activity was performed by DNA fragmentation assay and induction of genes that may be involved in the resistance of CCA to anticancer drugs (MDR1, MRP1, MRP2 and MRP3) was examined by real-time PCR.

Results showed that *in vitro* and *in vivo* studies thus indicate promising anticancer activity of the crude ethanolic extract of ginger against CCA with the absence of any significant toxicity. Moreover, MDR1 and MRP3 may be involved in conferring resistance of CCA to ginger extract [17].

**Mulla and Swamy (2012)**, evaluated the anticancer activity of ethanol and polyphenol extracts of *Portulacaquadrifidalinn*. on human colon cancer cell lines. The proliferation of Human colon cancer HT-29 and normal L-6 cell lines were investigated by MTT assay and Trypan blue dye exclusion assay followed by DNA fragmentation assay.

Result showed that both ethanol and polyphenol extracts efficiently decreased the proliferation of HT-29 cell lines. In addition, the polyphenol extract exhibited fragmentation of



DNA in HT-29 cell lines efficiently. It concluded that both extracts exhibited significant effect against HT-29 cell lines and is found less effective against normal L-6 cell lines indicating the cancer specific effect of *Protulacaquadrifidalinn* [18].

**Lalee et al (2012)**, evaluated the anticancer activity of ethanolic and aqueous extracts of *Aervasanguinolenta* (L.) (*Amaranthaceae*) on Ehrlich's Ascites cell induced Swiss mice. Result showed that ethanolic extract produced remarkable reduction in number of viable cells ( $p < 0.01$ ) and increased the percentage of life span. It concluded that the ethanolic extract of the plant has potent dose dependent antitumor activity and that is comparable to that of vinblastine [19].

**Kang et al (2012)**, evaluated the anticancer activity of Undecapeptide Analogues derived from Antimicrobial Peptide, *Brevinin-1EMa*. In this investigated the anticancer activity of four undecapeptides against seven tumor cell lines such as A498 (kidney), A549 (lung), HCT116 (colon), MKN45 (stomach), PC-3 (prostate), SK-MEL-2 (skin) and SK-OV-3 (ovary). Result showed that the GA-K4 (FLKWLFKWAKK-NH<sub>2</sub>), which had the most potent antimicrobial activity of the four undecapeptides, also exhibited the most potent anticancer activity snf synergistic effect in combination with doxorubicin [20].

**Duraipandiyam et al (2012)**, evaluated anticancer activity of Rhein isolated from ethyl acetate extract of *Cassia fistula* (*C.fistula*) flowers against colon cancer cell lines. Rhein was tested against human colon adenocarcinoma cell line COLO 320 DM and normal cell line VERO. Result showed that Rhein was found to be cytotoxic toward COLO 320 DM cells in a concentration and time dependent manner. Rhein exhibited 40.59%, 58.26%, 65.40%, 77.92% and 80.25% cytotoxicity at 200 µg/ml concentration for 6, 12, 24, 48 and 72 hours incubation time respectively. The IC<sub>50</sub> values of Rhein were 100, 25, 15 and 12.5 µg/ml for 12, 24, 48 and 72 hours incubation time respectively. The COLO 320 DM cells treated with Rhein showed the characters of apoptosis at 24-hour period of treatment at 6.25 and 12.5 µg/ml. Apoptosis in early stages was 2.29% at 6.25 µg/ml and at late stages it was 1.94%. When the concentration was increased to 12.5 µg/ml, apoptosis was 4.36% at early stages and 5.61% at late stages respectively [21].

**Dantu et al (2012)**, evaluated the hydroalcoholic extract of the flowers of the *Tabernaemontanadivaricata* for anticancer activity. The in vitro anticancer studies were performed against human cancer cell lines (HeLa) and MTT assay was used to analyze the cell growth inhibition. The results showed that the hydroalcoholic extract of flowers of *T.dicaricata* possessed a moderate amount of anticancer activity and the IC<sub>50</sub> value was greater than 100 µg/ml [22].

**Chaudhari et al (2012)**, evaluated the anticancer activity of heterocyclic ligand-0platinum metal complexes. Result showed that out of the various ligands used, the alkylating agents are found to be highly active with respect to cancer chemotherapy. Nitrogen mustards, ethylenamines, alkylsulfonates, nitrosourea and triazines are all members of the alkylating agents. The presence of active nitrogen atom in a particular structure

enhances the binding efficacy of number of metals and hence forms metal complexes. Cytotoxicity of various palatinatate and other metal complexes which are effectively formed by platinum and other metals respectively by obtaining the lone pair of electrons from nitrogen. Also in support of the anticancer activity, the derivatives obtained by metal complexation with the number of nitrogen containing heterocyclic ligands [23].

**Balasubramanian and Ragunathan (2012)**, evaluated the study of antioxidant and anticancer activity of natural sources. The study was conducted to determine antioxidant activity of *Streptomyces* spp. *PDS1*, commercially available Red Wine and *Saccharomyces cerevisiae* MTCC-187 using the Ferric reducing assay and to study the anticancer activity of Green Tea and Citrus limetta against human lung carcinoma cell line A549 using the MTT assay. The isolates of *Streptomyces* spp. *PDS1* was found to have more antioxidant activity *Saccharomyces cerevisiae*. The antioxidant potential was then correlated with the total phenol and flavinoid content. The filtrates of Green Tea showed maximum anticancer activity against cancer cell line A549 as compared to that of Citrus limetta [24].

**Wyrezbska et al (2013)**, evaluated the cytotoxicity and anticancer activity of new synthetic  $\alpha$ -methyl- $\gamma$ -lactones against two breast cancer cell lines, invasive, hormone-independent MDA-MB-231 and hormone-dependent MCF-7. Cytotoxicity was examined using MTT assay. Results showed that all four analogues to be highly cytotoxic. The most potent compound of the series, 1-isopropyl-2-methylene-1,2-dihydrobenzochromen-3-one, designated DL-3 which reduced the number of viable MDA-MB-231 and MCF-7 cells with the IC<sub>50</sub> values of 5.3 IM and 3.54 IM respectively. DL-3 activated the intrinsic pathway of apoptosis associated with the loss of mitochondrial membrane potential and changes in Bax/Bcl-2 ratio. DL-3 also inhibited the movement of both types of breast cancer cells. Suppression of cell migration and invasion was the result of the decreased secretion of enzymes responsible for the degradation of the extracellular matrix, MMP-9 and uPA [25].

**Wadhwa et al (2013)**, evaluated the anticancer activity in the water extract of Ashwagandha leaves (ASH-WEX) was detected by in vitro and in vivo assays. Bioactivity-based size fractionation and NMR analysis were performed to identify the active anticancer component(s). Result showed that its active anticancer component was identified as triethylene glycol (TEG). Molecular analysis revealed activation of tumor suppressor proteins p53 and pRB by ASH-WEX and TEG in cancer cells. In contrast to the hypophosphorylation of pRB, decrease in cyclin B1 and increase in cyclin D1 in ASH-WEX and TEG-treated cancer cells (undergoing growth arrest), normal cells showed increase in pRB phosphorylation and cyclin B1 and decrease in cyclin D1 (signifying their cell cycle progression) [26].

**Sankara et al (2013)**, evaluated the in vitro anticancer activities of few plant extracts (*Rubiaccordifolia*, *Plumbago zeylanica*, *Calophylluminophyllum*) against MCF-7 and HT-29 cell lines. Result showed that *Rubiaccordifolia* and *Plumbago zeylanica* showed nearly 50% MCF-7 cell line inhibition at 200 µg/ml tested dose, whereas three plant species did not display

much anticancer activities against HT-29 colon cancer cell line [27].

**Ma et al (2013)**, evaluated the anti-inflammatory and anticancer activities of extracts and compounds from the mushroom *Inonotus obliquus* against human prostatic carcinoma cell PC3 and breast carcinoma cell MD-MB-231. Result showed that the six main constituents were isolated from these two fractions and they were identified as lanosterol (1), 3 $\beta$ -hydroxy-8,24-dien-21-al (2), ergosterol (3), inotodiol (4), ergosterol peroxide (5) and trametenolic acid (6).

Compound ergosterol, ergosterol peroxide and trametenolic acid showed anti-inflammatory activities and ergosterol peroxide and trametenolic acid showed obviously cytotoxicity on human prostatic carcinoma cell PC3 and breast carcinoma MDA-MB-231 cell [28].

**Laungsuwon and Chulalaksananuku (2013)**, evaluated the antioxidant and anticancer activities of freshwater green algae, *Cladophoraglomerata* and *Microsporafloccosa* from Nan River in northern Thailand using DPPH free radical scavenging assay and inhibition of proliferation of the KB human oral cancer cell lines respectively. Results showed that the ethyl acetate extract of *C.glomerata* showed the highest total phenol content ( $18.1 \pm 2.3$  mg GAE/g), radical scavenging activity ( $49.8 \pm 2.7\%$  DPPH scavenging at 100  $\mu$ g/ml) and in vitro growth inhibition ( $IC_{50} = 1420.0 \pm 66$   $\mu$ g/g) of the KB cell lines. It concluded that *C.glomerata* could be a source of valuable bioactive materials [29].

**Balamurugan et al (2013)**, evaluated the antitumor activity of ethanol extract of leaves of *Melastomamalabathricum* on DAL (Dalton Ascites Lymphoma) model in Swiss Albino mice. Result showed decrease in tumor volume and cell viability. Hematological studies revealed that the Hb count decreased in DAL treated mice whereas it was induced by the drug treated animals and showed an increase in Hb near to normal levels. It concluded that the extracts of leaves of *Melastomamalabathricum* exhibited significant antitumor activity on DAL bearing mice [30].

**Asirvatham et al (2013)**, evaluated the in vitro antioxidant and anticancer activities of ethanol and aqueous extracts of *Drosera indicalin*. Dalton's Ascitic Lymphoma (DAL) and Ehrlich Ascitic Carcinoma (EAC) cell lines were used as the in vitro cancer models for the trypan blue dye and LDH leakage assays.

Result showed that both extracts at 250 mcg/ml dose showed remarkable increase in the percentage of dead cancer cells (90% by ethanol extracts of *D.indicalinn*. and 86% by aqueous extracts of *D.indicalinn*.) in DAL model and 89% by EEDI (ethanol extracts of *D.indicalinn*.) and 80% by AEDI (aqueous extracts of *D.indicalinn*.) in EAC model. It is concluded that *Drosera indicalin*. exhibited excellent antioxidant activity against the different in vitro antioxidant models and anticancer activity against the two different cell lines tested [31].

**Sumithra et al (2014)**, evaluated the anticancer activity of ethanolic extract of flowers of *Annona squamosa* and *Manikarazapota* against MCF-7 breast cancer cell lines. The

results showed that *M.zapota* flowers showed potent cytotoxic activity as compared to *A. squamosa* flower extract [32].

**Sharma et al (2014)**, evaluated the in vitro anticancer activity of plant-derived cannabidiol on prostate cancer cell lines (LNCaP, DY145, PC3). The result showed that prostate cancer cell lines clearly indicate that cannabidiol is a potent inhibitor of cancer cell growth with significantly lower potency in non-cancer cells. The mRNA expression level of cannabinoid receptors CB1 and CB2, vascular endothelial growth factor (VEGF), PSA (prostate specific antigen) are significantly higher in human prostate cell lines [33].

**Senawong et al (2014)**, evaluated the phenolic and composition and anticancer activity of two commercialized *H. cordata* fermentation products. Reversed phase HPLC was used to identify and quantify phenolic acids. MTT and Annexin V. staining assays were used to investigate anti-proliferative and apoptosis induction activities. The results showed that commercially available fermentation products of *H. cordata* contain several anticancer phenolic acids that may be beneficial in the treatment of human cancer [34].

**Moharib et al (2014)**, evaluated the anticancer activities of mushroom polysaccharides on chemically induced colorectal cancer in rats. Polysaccharides from mushroom *Pleurotussajorajju* (PS1) and *Lactuca sativa* (PS2) were isolated and purified (22.40 and 26.80 g/100g respectively). Cytotoxic activities of PS1 and PS2 were examined in vitro using colon (HCT 116), liver (HEPG2), cervical (HELA) and breast (MCF7) carcinoma cell lines. The results indicated that these polysaccharides (PS1 and PS2) have more inhibitory effects on HCT-116 than the other carcinoma cell line (HEPG2, HELA AND MCF7). Polysaccharides (PS1 and PS2) treated HCT-116 cells showed a high percentage of cell death, indicating promising anti-tumorigenic properties and demonstrate their direct effect on colon cancer cell proliferation [35].

**Devi et al (2014)**, evaluated the anticancer activity of Gallic acid on cancer cell lines the finding estimated the  $IC_{50}$  of the compound against the two cell lines. The present study also predicted the possible mechanism of the activity to be apoptosis HCT15, human colon cancer cell line and MDA-MB-231, human breast cancer cell line. The finding estimated the  $IC_{50}$  of the compound against the two cell lines. The present study also predicted the possible mechanism of the activity to be apoptosis [36].

**Chandrappa et al (2014)**, evaluated the anticancer activity of Quercetin isolated from an ethanol extract of *Carmona retusa* (Vahl.) masam and HepG2 cell lines by MTT assay, Hoechst 33342 staining and Caspase-3 colorimetric assay. Result showed significant and concentration dependent anticancer activity at 100  $\mu$ g/ml and 80  $\mu$ g/ml doses after 24 and 48 hours of treatment on HepG2 cell line in MTT assay, significant cell apoptosis have shown at 53  $\mu$ g/ml concentration of extract yield of flavinoid quercetin from *Carmona retusa* (Vahl.) masamin Hoechst 33342 staining and a significant activation of caspase-3 observed at 100  $\mu$ g/ml of extract yield of flavinoid quercetin from *Carmona retusa* (Vahl.) masamafter 24 hour and even 48 hour incubation [37].

**Amruthraj et al (2014)**, evaluated the in vitro anticancer activity of capsaicinoids from capsicum Chinese against human hepatocellular carcinoma cells. The result showed that acetonitrile extract of capsicum Chinese on HepG2 cells showed reduction in the cell viability through MMT assay and it also significantly suppressed the release of LDH, LPO and NO production in a dose-dependent manner [38].

**Aboul-Enein et al (2014)**, evaluated the ethanolic extracts of *Cassia italic* and *Solanum nigrum* leaves for potent anticancer and antioxidant activities using Ehrlich ascites carcinoma cell (EACC) line and Hepatoma cell (HepG2) line.

The antioxidant activity of each active compound was determined using the 2,2-diphenyldipicryl hydrazine (DPPH) method. Result showed that the compounds variable antioxidant and anticancer activities [39].

**Supraja and Arumugam (2015)**, evaluated the antibacterial and anticancer activity of Silver nanoparticles synthesized from *Cynodon dactylon* leaf extract against HepG2 cells. The result showed that the AgNPs showed dose-dependent cytotoxicity against HepG2 cells. Antimicrobial activity of synthesized nanoparticles was tested against *Escherichia coli*, *Staphylococcus aureus*, *Micrococcus luteus* and *Salmonella typhimurium*. The zone of inhibition increased with the increase in the concentration of silver nanoparticles [40].

**Shahwara et al (2015)**, evaluated the anticancer activity of *Cinnamon tamalaleaf* constituents towards human ovarian cancer cells. Fractionation of *Cinnamon tamalaleaf* extracts yielded bornyl acetate (1), caryophyllene oxide (2), p-coumaric acid (3) and vanillic acid (4) using A-2780 human ovarian cancer cell lines. The structures of the isolated compounds were confirmed through spectroscopic techniques (EIMS, 1H and 13C NMR). Result showed that compound 1 exhibited highest cytotoxicity with  $90.16 \pm 1.06\%$  inhibition ( $IC_{50} = 5.30 \times 10^{-4}$  mg/ml) followed by compound 2 ( $84.40 \pm 1.53\%$  inhibition;  $IC_{50} = 8.94 \times 10^{-3}$  mg/ml) while compounds 3 and 4 were inactive in the bioassay [41].

**Semary and Fouda (2015)**, evaluated the anticancer activity of eight cyanobacterial hydrophilic extracts on Ehrlich ascites carcinoma cell line. Result showed that extracts from four cyanobacterial strains had higher cytotoxic activities scoring 76.68%, 77.70%, 76.70% and 74.45% respectively. A considerable anticancer effect was only detected when the concentrated extracts were used.

One cyanobacterial extract gave the highest anticancer activity on human breast adenocarcinoma cell line (57.6% of inhibition) as compared to control. The isolate was best matched to *Cyanothece* sp. With sequence resemblance 98% to *Cyanothece* sp. Strain PCC7564 and the phylogenetic analysis confirmed its close identity to the *Cyanothece* genus [42].

**Sarteshnizi et al (2015)**, evaluated the ethanolic extract of propolis (EEP) obtained from *Dinarian area (Iran)* on AGS human gastric cancer cell line. The result showed that the ethanolic extract of propolis (EEP) inhibited the growth and proliferation of AGS human gastric cell lines. The antiproliferative effects were revealed in a dose and time-

dependent manner. The  $IC_{50}$  values were recorded as 60, 30 and 15  $\mu$ g/ml in treatment times of 24, 48 and 72 hours respectively. It was concluded that the native EEP has strong antiproliferative effects against cancerous AGS cells [43].

**Ramesh et al (2015)**, evaluated the in vitro anticancer activity of green synthesized nanoparticles of *Abutilon indicum* leaf extract using MCF-7 breast cancer cell line. Result showed that the green synthesized silver nanoparticles of *Abutilon indicum* leaf extract possesses antioxidant and anticancer activities [44].

**Rajesh Kumar et al (2015)**, evaluated the anticancer properties of water, ethanol and acetone extract of *Andrographis paniculata* leaves against neuroblastoma (IMR-32) and human colon (HT-29) cancer cell line. The results were found that ethanol extract showed nearly 50% i.e. inhibition concentration ( $IC_{50}$ ) for IMR-32 and HT-29 cell lines at 200  $\mu$ g/ml, where other extracts display 50% inhibition at 250  $\mu$ g/ml concentration for HT-29 cell lines. Anticancer activity of water, ethanol and acetone extracts of *A. paniculata* leaves against Ht-29 cancer cell lines shows 50% inhibition at 200  $\mu$ g/ml concentration [45].

**Muruganatham et al (2015)**, evaluated the anticancer activity of various concentrations of ethanolic extract of flowers of *Cassia auriculata* against human liver cancer. Result showed the  $CTC_{50}$  value of sample was 352.4  $\mu$ g/ml against liver cancer HePG2 cell lines.

**Awady et al (2015)**, evaluated the anticancer activities of *Pomegranate (Punicagranatum)* and *harmal (Rhazya stricta)* plants grown in Saudi Arabia against Colon cancer (CACO) and Hepatocellular carcinoma (HepGII) cell lines. Results showed that all extracts showed a significant reduction in cell proliferation with dose dependent response. The extracts showed different antiproliferative profiles regarding extract type and concentrations. However, the *Rhza H* extract showed the highest cytotoxic effect among all extracts with HepG2 and CACO cells ( $IC_{50}$  25  $\mu$ g/ml and 35  $\mu$ g/ml) respectively [46].

**Muruganatham et al (2016)**, evaluated the ethyl acetate fraction of *Cucumis sativus* flowers for anticancer activity against liver cancer HePG2 cell line by MTT assay. The result showed that  $CTC_{50}$  value of sample was 103.7  $\mu$ g/ml against liver cancer HePG2 cell lines. It was concluded that significant results were observed [47].

## REFERENCES:

1. Chew B.P., Park J.S., Wong M.W. and Wong T.S., "A comparison of the anticancer activities of dietary beta-carotene, canthaxanthin and astaxanthin in mice *in vivo*", *Anticancer Res.* 1999;19(3A): 1849-1853.
2. Jua E.M., Leea S.E., Hwangb H.J. and Kima J.H., "Antioxidant and anticancer activity of extract from *Betula platyphylla* var. japonica", *Life Sciences* 2004; 1013-1026.
3. Shoemaker M., Hamilton B., Dairkee S.H., Cohen I. and Campbell M.J., "In vitro anticancer activity of twelve Chinese medicinal herbs", *Phytotherapy Research* 2005;19(7): 649-651.

4. Chiy-Rong Chen, "D.C- Friedooleanane-Type Triterpenoids from *Lagenariasiceraria* and their Cytotoxic Activity", *Chem. Pharm. Bull* 2008; 56(3): 385-388.
5. Yan L.L., Zhang Y.J., Gao W.Y., Manm S.L. and Wang Y., "In vitro and in vivo anticancer activity of steroid saponins of *Paris polyphylla* var.", *Experimental Oncology* 2009; 31: 27-32.
6. Yadav B., Bajaj A., Saxena M. and Saxena A.K., "In vitro anticancer activity of the root, stem and leaves of *Withaniasomnifera* against various human cancer cell lines" *Indian journal of Pharmaceutical Sciences* 2010;72(5): 660-663.
7. Watthanachaiyingcharoen R., Utthasin P., Potaros T. and Suppakatana P. "Proteins from *Mirabilis jalapa* possess anticancer activity via an apoptotic pathway", *J Health Res* 2010; 24(4): 161- 165.
8. Naama J.H., Al-Temimi A.A. and Al-Amiery A.H., "Study the anticancer activities of ethanolic curcumin extract", *African Journal of Pure and Applied Chemistry* 2010; Vol. 4(5): 68-73.
9. Moulisha B., Kumar G.A. and Kanti H.P., "Anti-leishmanial and Anti-cancer activities of a Pentacyclic Triterpenoid isolated from the leaves of *Terminalia arjuna* Combretaceae", *Tropical Journal of Pharmaceutical Research* 2010;9(2): 135-140.
10. Mohamed A.M., Galil E.A., Alsharari M.A., Husam R.M., Germoush M.O. and Al-Omar M.A., "Anticancer Activities of some New Synthesized Thiazolo[3,2-a]Pyrido[4,3-d]Pyrimidine Derivatives", *American Journal of Biochemistry and Biotechnology* 2011; 7(2): 43-54.
11. Jevtovic V., Ivkovic S., Kaisarevic S. and Kovacevic R., "Anticancer activity of new copper (II) complexes incorporating a pyridoxal-semicarbazone ligand", *Original scientific papers* 2010; 133-137.
12. Gomez L.J.V., Soria-Mercado I.E., Guerra-Rivas G. and Ayala-Sanchez N.E., "Antibacterial and anticancer activity of seaweeds and bacteria associated with their surface", *Revista de Biologia Marina Oceanografia* 2010; 45(2): 267-275.
13. Thomas A.T., Rao J.V., Subrahmanyam V. M., Chandrashekhar H.R., MAliyakkal N., Kisan T.K., Joseph A. and Udupaln N., "In vitro anticancer activity of microbial isolated from diverse habitats", *Brazilian Journal of Pharmaceutical Sciences* 2011; 47(2): 280-287.
14. Sakthivel K.M., Kannan N., Angeline A. and Guruvayoorappan C., "Anticancer Activity of *Acacia nilotica* (L.) Wild Ex. Delile Subsp. indica against Dalton's Ascitic Lymphoma induced solid and Ascitic Tumor Model" *Asian Pacific Journal of Cancer Prevention* 2012;13(8): 3989-3995.
15. Purushoth P.T., Panneerselvam P., Selvakumari S., Udhumansha U. and Shantha A., "Anticancer activity of *Merremia marginata* (Burm.f) against human cervical and breast carcinoma", *International Journal of Research and Development in Pharmacy and Life Sciences* 2012;1(4): 189-192.
16. Premanathan M., Radhakrishnan S., Kulangiappar K., Singaravelu G., Thirumalaiaarasu V., Sivakumar T. and Kathiresan K., "Antioxidant & anticancer activities of isatin (1H-indole-2,2-dione), isolated from the flowers of *Couroupitaguianensis Aubl*", *Indian J. Med. Res.* 2012;136: 822-826.
17. Plengsuriyakarn T., Viyanant V., Eursitthichai V., Tesana S., Chaijaroenkul W., Itharat A. and NaBangchang K., "Cytotoxicity, Toxicity and Anticancer Activity of *Zingiber officinale* Roscoe against Cholangiocarcinoma", *Asian Pacific Journal of Cancer Prevention* 2012;13(9): 4597-4606.
18. Mulla S.K. and Swamy P., "Anticancer activity of ethanol and polyphenol extracts of *Portulacaquadrifidalinn*. on human colon cancer cell lines", *Int. J. Pharm. Bio. Sci.* 2012;3(3): 488-498.
19. Lalee A., Pal P., Bhattacharaya B. and Samanta A., "Evaluation of anticancer activity of *Aerva sanguinolenta* (L.) (amaranthaceae) on Ehrlich's ascites cell induced swiss mice", *International Journal of Drug Development & Research* 2012,4(1): 203-209.
20. Kang S.J., Ji H.Y. and Lee B.J., "Anticancer Activity of Undecapeptide Analogues Derived from Antimicrobial Peptide, Brevinin-1E", *Arch Pharm Res* 2012; 35(5): 791-799.
21. Duraipandiyar V., Baskar A.A., Ignacimuthu S., Muthukumar C. and Harbi N.A., "Antitumor activity of Rhein isolated from *Cassia fistula* L. flower", *Asian Pacific Journal of Tropical Disease* 2012;S517-S523.
22. Dantu A.S., Shankarguru P. and Vedha Hari B.N., "Evaluation of in vitro anticancer activity of hydroalcoholic extract of *Tabernaemontana divaricata*", *Asian Journal of Pharmaceutical and Clinical Research* 2012;5(3): 59-61.
23. Chaudhari B.N., Gide P.S., Kankate R.S., Zenish J., Jain Z.J., Kakas Rohini D., "Anticancer activity of hepatocyclic ligand-platinum metal complexes", *International Journal of Pharmaceutical Chemistry* 2012;2(2).
24. Balasubramanian K, and Ragunathan R., "Study of antioxidant and anticancer activity of natural sources", *Nat, Prod. Plant Resour* 2012; 2(1): 192-197.
25. Wyrezbska L.A., Gach K., Lewandowska U., Szewczyk K., Hrabec E., Modranka J., Jakubowski R., Janecki T., Szymanski J. and Jancka A., "Anticancer activity of New Synthetic a-Methylene-d-Lactones on Two Breast Cancer", *Cell Basic & Clinical Pharmacology & Toxicology* 2013;113: 391-400.
26. Wadhwa R., Singh R., Gao R., Shah N., Widodo N., Nakamoto T., Ishida Y., Terao K., and Kau S.C., "Water extract of Ashwagandha leaves has anticancer activity: identification of an active component and its mechanism of action", *Plos one* 2013; 8(10).
27. Sankara A.J., Kumar N.L., Mokkaapati A., "6810 in vitro anticancer activities of few plants extract against MCF-7 and HT-29 cell lines", *International Journal of Pharma Science* 2013;3(2): 185-188.
28. Ma I. O. L., Chen H., Peng Dong P. and Lu X., "Anti-inflammatory and anticancer activities of extracts and compounds from the mushroom", *Food Chemistry* 2013;139:503-508.



29. Laungsuwon R. and Chulalaksananukul W., "Antioxidant and anticancer activities of freshwater green algae, *Cladophoraglomerata* and *Microspora floccose*, from Nan River in northern Thailand", *Maejo Int. J. Sci. Technol* 2013;7(02): 181-188.
30. Balamurugan K., Nishanthini A. and Mohan V.R., "Anticancer Activity of Ethanol Extract of *Melastomamalabathricum* linn. Leaf against Dalton Ascites Lymphoma", *Pharm. Sci & Res.* 2013; 5(5).
31. Asirvatham R., Christina A.J.M., Murali A., "In vitro Antioxidant and Anticancer Activity Studies on *Drosera* indicallinn. (Droseraceae)", *Advanced Pharmaceutical Bulletin*, 2013;3(1): 115-120.
32. Sumithra P., Gricilda Shoba F., Vimala G., Sathya J., Sankar V. and Saraswathi R., "Anticancer activity of *Annona squamosa* and *Manilkarazapota* flower extract against MCF-7 cell line", *DerPharmacica Sinica* 2014;5(6): 98-100.
33. Sharma M. Hudson J.B., Adomat H., Guns E. and Cox M.E., "In vitro anticancer Activity of Plant derives Cannabidiol on Prostate Cancer Cell Lines", *Pharmacology & Pharmacy* 2014;5: 806-820.
34. Senawong T., Khaophaa S., Misunaa S., Komaikula J., Senawonga G., Wongphakhama P. and Yunchalard S., "Phenolic acid composition and anticancer activity against human cancer cell lines of the commercially available fermentation products of *Houttuynia cordata*", *Science Asia* 2014;40: 420-427.
35. Moharib S.A., El Maksoud N.A., Ragab H.M. and Shehata M.M., "Anticancer activities of mushroom polysaccharides on chemically induced colorectal cancer in rats", *Journal of Applied Pharmaceutical Science* 2014;4 (07): 054-063.
36. Devi Y.P., Uma A., Narasu M. L. and Kalyani C., "Anticancer activity of gallic acid on cancer cell lines, HCT15 and MDA-MB-231", *International Journal of Research in Applied Natural and Social Sciences* 2014;2(5): 269-272.
37. Chandrappa C. P., Govindappa M., Anil Kumar N.V., Channabasava R., Sadananda T. S. and Sharanappa P., "In vitro Anticancer Activity of Quercetin Isolated from *Carmona retusa* (Vahl.) masamon Human Hepatoma Cell Line", *IOSR Journal of Pharmacy and Biological Sciences* 2014;9(6): 85-90.
38. Amruthraj N. J., Preetam J. P., Saravanan S. and Lebel L. A., "In vitro studies on anticancer activity of capsaicinoids from *Capsicum Chinese* against human hepatocellular carcinoma cells", *International journal of Pharmacy and Pharmaceutical Sciences*, 2014;6(4): 254-558.
39. Aboul-Enein A. M., EL-Ela F.A., Shalaby E. and EL-Shemy H., "Potent Anticancer and Antioxidant activities of active Ingredients separated from *Solanum nigrum* and *Cassiaitalica* Extracts", *Journal of Arid Land Studies* 2014; 24(1), 145-152.
40. Supraja S. and Arumugam P., "Antibacterial and Anticancer Activity of Silver Nanoparticles Synthesized from *Cynodondactylom* leaf extracts", *Journal of Academia and Industrial Research (JAIR)* 2015; 3(2): 629-631.
41. Shahwara D., Ullahab S., Khana M.A, Ahmada N., Saeeda A. and Ullaha S., "Anticancer activity of *Cinnamon tamalalea* constituents towards human ovarian cancer cells", *Pak. J. Pharm. Sci.* 2015;28(3): 969-972.
42. Semary N.A. and Fouda M., "Anticancer activity of *Cyanothece sp.* Strain extracts from Egypt: First record", *Asian Pac. J. Trop. Biomed* 2015;5(12): 992-995.
43. Sarteshnizi N.A., Dehkordi M.M, Farsani S.K., Teimori H., "Anticancer activity of ethanolic extract of *Propolis* on AGS cell line", *J HerbMed Pharmacol* 2015; 4(1): 29-34.
44. Ramesh B. and Rajeshwari R., "Anticancer activity of green synthesized silver nanoparticles of *Abutilon indicum* linn. leaf extract", *Asian Journal of Phytomedicine and Clinical Research* 2015; 3(4): 124-131.
45. Rajesh kumar S., Nagalingam M., Ponnaniakamideen M., Vanaja M. and Malarkodi C., "Anticancer activity of *Andrographispaniculata* leaves extract against neuroblastoma (IMR-32) and human colon (HT-29) cancer cell lines", *World Journal of Pharmacy and Pharmaceutical Sciences* 2015; 4(06): 1667-1675.
46. EL-Awady M.A., Nabil S. Awad N.S. and EL-Tarras A.E., "Evaluation of the anticancer activities of *Pomegranate (Punicagranatum)* and *harmal (Rhazyastricta)* plants growth in Saudi Arabia", *International Journal of current Microbiology and Applied Sciences* 2015;4(5): 1158-1167.
47. Muruganantham N., Solomon S. and Senthamilselvi M.M., "Anticancer activity of *Cucumissativus* (Cucumber) flowers against Human Liver Cancer", *International Journal of Pharmaceutical and Clinical Research* 2016;8(1): 39-41.

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