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RESEARCH ARTICLE

Natural sources as potential anti-cancer agents: A review

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Abstract:
Cancer is the second leading cause of death worldwide. Conventional cancer therapies cause serious side effects and at best, merely extend the patient's lifespan by a few years. Cancer control may therefore benefit from the potential that resides in alternative therapies. The demand to utilize alternative concepts or approaches to the treatment of cancer is therefore escalating. However, the potential treatment of cancer is still under investigation. In fact the plants occupy a good place in the treatment. With the advanced knowledge of molecular science and the refinement in isolation and structural elucidation techniques, we are now in much better position to identify various anticancer plants. The medicinal plants and their products, particularly vegetables have antioxidant activity leading to anti cancer effect. Many doctors recommend that people wish to reduce the risk of cancer must eat vegetables everyday in their diet. The vegetables contain many phytochemicals having antioxidant activity. The antioxidant protects the cells from damaged caused by free oxygen radicals. Here the present article gives a better therapeutic approach to cancer by the maximum use vegetables against different cancers.

Keywords: Cancer, alternate therapies, antioxidant, phytochemicals.

Introduction

The natural approach to treating cancer should be first, not the last method of treatment. Cancer patients are always confronted by seemingly impossible dilemmas where the available choices seem less than optimal. The tendency is to put one's faith in an outer authority, such as an oncologist or even natural healer. However, the first order of business is to realize that these people are only allies, and that ultimately we must take responsibility and charge of our own decision. To do this we require a certain amount of soul searching solitude. If at all possible, providing there is a window of time and opportunity, embark on a natural treatment approach before committing to heroic measures such as surgery, chemotherapy and radiation. The reason is that these latter injure the body's immune healing capabilities and may impair any opportunity for natural healing to occur. Further, one needs to weigh carefully the question of life extension versus life quality [1].

The plant kingdom serves as a food and medicinal source, and thus maintains the vitality of human beings as well as animals without causing any toxicity. India is the largest producer of medicinal plant and is rightly called as "Botanical garden of the world". In the indigenous or traditional system of medicine, many medicinal plants and their preparation are now used for the treatment of different diseases, including cancer [2]. More than 50% of all modern drugs in clinical use are of natural products, many of which have been recognized to have the ability to include apoptosis in various tumour cells [3].Medicinal plants, including vegetables are known to have good immunomodulatory antioxidant activities, leading to anticancer effect. They act by stimulating both non specific and specific immunity and may promote the host resistance against infection by re-stabilizing body equilibrium amid conditioning the body tissue.

Hence the consumption of vegetables is widely accepted as lowering the risk of different type of cancer. Vegetables contain several phytochemicals having potent antioxidant activities. The antioxidant vegetables prevent from cancer by protecting cells from damaged caused by free radicals. Thus the consumption of diet rich in vegetables with antioxidant activity may protect from the occurrence of cancer [4].

This review article contains 26 anticancer vegetables which have been described. However, the particular phyto constituent (phyto chemicals) present in these plants, their mechanism of action and uses against the various cancers as reported by different authors have been cited under each medicinal plant/herb. Many reports describe that the anticancer activity of the medicinal plants is because of the presence of certain phyto constituents, which possess strong antioxidant activities. The main phyto constituent antioxidants with anticancer activity includes vitamins (e.g., A, C, E and K), carotenoids or carotene, terpenoids, flavonoids, polyphenols, enzymes, minerals, polysaccharides, alkaloids, saponins, lignins, xanthones and certain pigments [5].

SOME IMPORTANT ANTICANCER VEGETABLES USED IN DIET:

Beet root:

(Biological source: - Beta vulgaris Family: - Amaranthaceae)

The beet root contains FDA approved red food color E162, which can be effective in suppressing the development of multi-organ tumors in experimental animals. It decreases the growth rate of the PC-3 cells (androgenindependent human prostate cancer cells). Beetroot extract have showed significant cytotoxic effect normal human skin FC and liver HC cell lines. Betanin, the major betacyanin constituent, may play an important role in the cytotoxicity exhibited by the red beetroot extract [6]. The molecular components of a phenolic fraction of beta vulgaris were found to be vitexin- 2″O-rhamnoside, its demethylated form 2″- xylosylvitexin, isorhamnetin 3- gentiobioside, and rutin. The phenolic fraction inhibited MCF-7 cell proliferation.

Vitexin-2″O-rhamnoside strongly inhibited DNA synthesis in MCF-7 cells, whereas 2″- xylosylvitexin and isorhamnetin 3- gentiobioside were activators; combinations of activators and inhibitors maintained the over-all inhibitory effect [7]. In beet root vitamin C content was found to be 33,840 mg/100g. and in juices it was found to be 68 mg/100ml suc. The reaction speed of DPPH of beet root juice was found to be 5087 μM/s [8].

Bitter gourd:

(Biological source: - Momordica charantia Family: - Cucurbitaceae)

Administration of bitter gourd significantly reduced the incidence of ACF (Aberrant Crypt Foci). The ability of bitter gourd to reduce the incidence of ACF may be due to the compound momordin, which is found in bitter gourd. It was also observed that rats fed with bitter gourd had higher activities of hepatic detoxification enzymes (GST) and antioxidant enzymes (SOD and CAT). The treatment groups had significantly higher GST, SOD and CAT activity compared to the control. The GSH levels in the rats fed with bitter gourd were also found to be significantly higher compared to the control. GSH is utilized by GST as a substrate in the detoxification process.[9,10] Superoxide dismutase catalyzes the dismutation of superoxides, which are potent carcinogens. The animal groups fed 2 and 4% bitter gourd diets had significantly higher CAT and SOD activities. It was observed that bitter gourd had phenolic content, indicating that it may play a role in the cancer prevention as the results from the animal study showed. Reduction of ACF by bitter gourd in the animal study could have been due to its antioxidative potential [11]. Ribosome inactivating proteins (RIP) of bitter gourd displayed strong apoptosis-inducing activity and suppressed cancer cell growth [12].

Broccoli:

(Biological source: - Brassica oleracea var. botrytis Family: - Brassicaceae)

Broccoli contains sulforaphane (SFN) induces time- and dose-dependent decline in survival of barrett esophageal adenocarcinoma cells (BEAC). SFN increases intracellular accumulation of drug in BEAC cells. SFN significantly enhances the antiproliferative effect of chemotherapeutic and telomerase-inhibiting agents in BEAC cells. SFN inhibits cell cycle progression and enhances the ability of paclitaxel to induce cell cycle arrest [13]. The anticancer activity of broccoli was the highest, and the IC50 value of the extract inhibiting on the growth of A549, LAC, HELA and HepG2 were 14.38 ± 0.35, 10.38 ± 0.34, 19.45 ± 1.72 and 26.75 ± 0.82 mg/g, respectively. 3-BITC (3-butenyl isothiocyanate) and sulforaphane were found as the major isothiocyanates in broccoli for anticancer activities [14]. Selenium-enriched broccoli sprouts could potentially be used as an alternative selenium source for prostate cancer prevention and therapy [15].

Bottle gourd:

(Biological source: - Lagenaria siceraria Family: - Cucurbitaceae)

The methanolic extracts of Lagenaria siceraria significantly inhibited the tumor volume, packed cell volume, tumor (viable) cell count. There is delayed in cell division and thereby increased in survival time in the animal studies. The oral administration of L. siceraria restore the haemoglobin content and maintain the normal values of RBC and WBC and supports its

haematopoietic protecting activity. The level of lipid peroxide was reduced to normal which was elevated during cancerous stage, when treated with extract of L. siceraria. This reflects the decrease in free radical production and the subsequent reduction in oxidative stress. Reduced glutathione was significantly improved to normal which was reduced during disease stage [16].

Cabbage:

(Biological source: - Brassica oleracea Linne (capitata var. alba L.) Family: - Cruciferae).

The cabbage (Brassica oleracea) was cultivated with supplementation of sulphur salts; as a result there is increase in total glucosinolates contents. The antioxidant properties of these sulphur supplemented cabbage was also higher than that of the normal sprout due to the increases of phenolic compounds. Consequently, the glucosinolates fortified sprout has higher anti-proliferative activity against HepG2 human hepatocarcinoma cells than the normal sprout and the cell viability decreased by 22–35%. Also in CT26 mouse colorectal cancer cells, the cell viability decrease by 34–59% [17].

Carrots:

(Biological source: - Daucus carota Family: - Apiaceae)

The treatment of leukemia cell lines with carrot juice extract induces apoptosis and inhibits the progression through the cell cycle. Lymphoid cell lines were affected to a greater extent than myeloid cell lines and normal hematopoietic stem cells were less sensitive than most cell lines [18]. Carrot having phenylpropanoids extract 2-epilaserine shows significant cytotoxicity against HL-60 [19]. The potential anticancer effect of falcarinol extract of carrot may be due to the enhancement of the immune system which stimulates the production of T-lymphocytes and inactivates proteins/enzymes that are responsible for the proliferation of cancer cells [20].

Cauliflower:

(Biological source: - Brassica oleracea Family: - Brassicaceae)

3, 3′-Diindolylmethane (DIM), an indole derivative produced on consumption of Brassica oleracea can inhibit vascular endothelial growth factor (VEGF)-induced cell proliferation and DNA synthesis in human umbilical regulated kinase (ERK1/2) phosphorylation was greatly reduced. DIM inhibits RAS signaling induced by VEGF and other growth factors, which interferes with its downstream biological effects necessary for angiogenesis [21].

Chives:

(Biological source: - Allium schoenoprasum Family: - Amaryllidaceae)

Chives do exhibit anticancer, anticlotting, hypolipidemic, antibacterial, antiviral, and decongestant properties, but they are somewhat weaker than the properties of onions. The following volatile components have been identified: dipropyl disulfide, methyl pentyl disulfide, penthanethiol, penthyl-hydrodisulfide and cis/trans-3, 5-diethyl-1, 2, 4-trithiolane. Chives also contain significant amounts of the vitamin A and C. Chives are rich in a number of vitamins and minerals, which strengthen the immune system and improve the overall health. Antioxidants present in chives reduce the harmful effects of free radicals on the body, and protects from various diseases, even cancer [22].

Drumstick:

(Biological source: - Moringa oleifera Family: - Moringaceae)

Methanolic extracts of Moringa is having greater anticancer activity with ID50 value of 0.32 µg mL-1. Neutral red dye uptake assay showed drastic antiproliferation of cells with less dye uptake that refers to the active participation of methanol extracted compounds present in Moringa leaves [23]. M. olifera ethanolic extract has the highest antioxidant activity at 77% inhibition of radical formation. This high antioxidant capacity may be due to the high concentration of phenolics and flavonoids in M. olifera extracts. A remarkable destruction of lymphoblast was found in treatment of methanolic extract on acute myeloid leukemia cells and acute lymphoblastic leukemia cells [24]. The methanolic extract of Moringa shows the strong scavenging effect in DPPH radical and reducing power assay. The methanolic extract of Moringa shows stronger hydrogen peroxide scavenging activity and higher SOD activity [25]. The aqueous extract of M. oleifera activates the apoptotic pathway in HeLa cells. The key bioactive compounds present in the aqueous fraction show a good anticancer activity and are relatively nontoxic to the normal healthy lymphocytes [26].

Garlic:

(Biological source: - Allium sativum Family: - Amaryllidaceae)

Garlic has anticancer activity against WEHI- 164 tumor cells but the activity reduces on heating. The anticancer activities of different kinds of garlic are related to the level of allicin, flavonoid, and phenolic components. Therefore, fresh garlic has the highest content of bioactive components and the greatest anticancer efficacy[27]. Diallyl disulfide (DADS), a sulfur compound derived from garlic shows anti-proliferative effects on colon cancer HT-29 cells [28]. Diallyl- and dipropyl- tetra sulfides have emerged as interesting irreversible inhibitors of the CDC25 (cell division cycle 25 phosphatases) isoforms A and C in-vitro. Furthermore, growth of both sensitive (MCF-7) and resistant (VCR-R) human breast carcinoma cells was significantly decreased by these tetra sulfides. The observed

antiproliferative effect arrests a G2-M cell cycle.[29]

Ginger:
(Biological source: - Zingiber officinale Family: - Zingiberaceae)
Antioxidant activities found in ginger increases with increasing CO2 concentration. Enriched ginger extract (rhizomes) exhibits the highest anticancer activity on MCF-7 cancer cells [30]. Ginger is an excellent source of several bioactive phenolics, including non-volatile pungent compounds such as gingerols, paradols, shogaols and gingerones. Ginger has been known to display anti-inflammatory, antioxidant and antiproliferative activities, indicating its promising role as a chemopreventive agent. Whole ginger extract (GE) exerts significant growth-inhibitory and death-inductory effects in a spectrum of prostate cancer cells [31]. 6-Shogaols, active constituent of ginger inhibits phorbol 12-myristate 13- acetate (PMA) - stimulated MDA-MB-231 breast cancer cell invasion with an accompanying decrease in matrix metalloproteinase-9 (MMP-9) secretion. 6- Shogaol was identified to display the greatest anti-invasive effect in association with a dose-dependent reduction in MMP-9 gene activation, protein expression and secretion. The NF-κB transcriptional activity was decreased by 6-shogaol. In addition, 6-shogaol was found to inhibit JNK activation [32].

Lady finger:
(Biological source: - Abelmoschus esculentus (L) Moench. Family: - Malvaceae)
The ripe fruits of lady finger contain quercetin, hyperin (hyperoside), hydrolysate of precipitated mucilage, proanthocyanidins, D-glucose, D-glucuronic and galacturonic acids which helps in anticancer activity. Fatty fraction of the fresh watery extract of the seeds causes destruction of cancerous cell growth in vitro. The pods are reported to exhibit antitumour activity [33].The inhibitory effect of polysaccharides extracted from okra, Abelmoschus esculentus (L.) Moench was investigated on different human cancer cell lines, OVCAR- 3, MCF-7, Hela and MCG-803 cells. Raw polysaccharide (RPS) had a significant inhibition effect on the proliferation of OVCAR-3 cells in a dose-dependent manner, and the lowest survival rates were 72.30% and 52.31%, respectively [34].

Little gourd:
(Biological source: - Coccinia grandis. Family: - Cucurbitaceae)
The antioxidant principles present in Coccinia grandis causes the reduction of Fe3+/ Ferricyanide complex to the ferrous form, and proves to be good antioxidant activity. C. grandis scavenges hydrogen peroxide in presence of phenolic groups and thereby neutralizes into water. Nitric oxide (NO) is a free radical which plays an important role in the pathogenesis of pain, inflammation, etc. C. grandis decreases the amount of nitrite generated from the decomposition of sodium nitroprusside in vitro. This may be due to the antioxidant principles which compete with oxygen to react with NO and inhibits the generation of nitrite [35].

Neem:
(Biological source: - Azadirachta indica Family: - Meliaceae)
Aqueous Azadirachta indica leaf extract significantly reduce the tumor incidence (33%), tumor multiplicity (42%), and increase in survival (34%) upon administration of Aqueous A. indica leaf extract to N-nitrosodiethylamine(NDEA)- abused mice [36].Ethanol extract of neem leaves contains 2',3'-dehydrosalannol, 6-desacetyl nimbinene, and nimolinone. Treatment of C4-2B and PC-3M-luc2 prostate cancer cells with ethanolic extract inhibits the cell proliferation. The suppression of tumor growth is associated with the formation of hyalinized fibrous tumor tissue and the induction of cell death by apoptosis [37].Azadirachtin , active constituent of neem, interacts with retinoic acid receptors and suppresses ATRA(all trans-retinoic acid) binding, inhibits falling off the receptors, and activates transcription factors like cAMP-response element-binding protein (CREB), Sp1, nuclear transcription factor κB (NF-κB), etc. Thus, azadirachtin exerts anti-inflammatory and anti-metastatic responses by a novel pathway that would be beneficial for anti-inflammatory and anticancer therapies [38].

Olive:
(Biological source: - Olea europaea Family: - Oleaceae)
The chief active components of olive oil include oleic acid, phenolic constituents, and squalene. The main phenolics include hydroxytyrosol, tyrosol, and oleuropein, which occur in highest levels in virgin olive oil and have demonstrated antioxidant activity. Oleic acid, a monounsaturated fatty acid, and squalene have shown activity in cancer prevention. Olive oil consumption has benefit for colon and breast cancer prevention [39]. Olive fruit extract composed of pentacyclic triterpenes, maslinic acid (73.25%) and oleanolic acid (25.75%). Oleanolic acid shows moderate antiproliferative activity and moderate cytotoxicity at high concentrations on human HT-29 colon cancer cells. Maslinic acid inhibits cell growth without necrotic effects on human HT-29 colon cancer cells. Maslinic acid increases caspase-3-like activity. Maslinic acid generated superoxide anions. Completion of apoptosis by maslinic acid was confirmed by the increase in plasma membrane permeability, and detection of DNA fragmentation. Therefore Maslinic acid shows the chemoprevention of colon cancers [40]. Pinoresinol, the main phenol component of extra virgin olive oil affects the cell viability, which was significantly more pronounced in p53- proficient cells. A P53-proficient

cell shows increased apoptosis and G (2)/M arrest. In p53-proficient cells, ataxia telangiectasia mutated (ATM) and its downstreamcontrolled proteins were upregulated after treatment, with a parallel decrease of cyclin B/cdc2 [41].

Onion:

(Biological source: - Allium cepa Family: - Amaryllidaceae)

The potential anticarcinogenic action of onions is related to their high content of organosulfur compounds or to their high antioxidant activity, which is principally due to their wide content of flavonoid. However, there are important varietal differences in the composition, concentration, and beneficial activities of these bioactive compounds, which also result by modalities of cooking. Some studies found that there is a protective role of a moderate frequency of onion consumption against colorectal, laryngeal, and ovarian cancers [42]. Polish white and red onions were subjected to blanching, boiling, frying, and microwaving for different periods of time, and then their bioactive compounds (polyphenols, flavonoids, flavanols, anthocyanins, tannins, and ascorbic acid) and antioxidant activities were determined. It was found that blanching and frying and then microwaving onions did not decrease significantly the amounts of their bioactive compounds and the level of antioxidant activities [43]. Myricetin is one of the principal phytochemicals in onions. Topical treatment with myricetin inhibited repetitive UVBinduced neovascularization in SKH-1 hairless mouse skin. The induction of vascular endothelial growth factor, matrix metalloproteinase (MMP)-9 and MMP-13 expression by chronic UVB irradiation was significantly suppressed by myricetin treatment. Thus myricetin suppresses UVBinduced angiogenesis by regulating PI-3 kinase activity in vivo [44].

Papaya:

(Biological source: - Carica papaya Family: - Caricaceae)

In the leaves of Carica papaya (CP), components reported to have potential antitumor activity include tocopherols, lycopene, flavanoids, and benzylisothiocyanate. CP extract inhibited the proliferative responses of solid tumor cell lines derived from cervical carcinoma (Hela), breast adenocarcinoma (MCF-7), hepatocellular carcinoma (HepG2), lung adenocarcinoma (PC14), pancreatic epithelioid carcinoma (Panc-1), and mesothelioma (H2452) in a dose-dependent manner. In addition, CP extract inhibits the proliferative responses of haematopoietic cell lines, including T cell lymphoma (Jurkat), plasma cell leukemia (ARH77), Burkitt's lymphoma (Raji), and anaplastic large cell lymphoma (Karpas-299). CP extract enhance the production of anti-tumor cytokines, such as IL-12p40, IL-12p70, IFN- γ and TNF-α. Cytotoxicity of pre-activated PBMC (human peripheral blood mononuclear cells) against K562 was significantly enhanced by treatment of CP extracts at 25:1 and 12.5:1 effector–target ratio (E: T ratio) [45].

Pumpkin:

(Biological source: - Cucurbita maxima Family: - Cucurbitaceae)

Preliminary phytochemical study shows the presence of flavonoid, polyphenolics, saponins, protein and carbohydrate in Cucurbita maxima extract. Many such compounds are known to possess potent antitumor properties, particularly some proteins and polysaccharide fractions in Cucurbita maxima fruits and seeds. The ascitic fluid is essential for tumor growth, since it constitutes a direct nutritional source for tumor cells. Cucurbita maxima significantly reduce tumor volume probably by lowering the ascitic nutritional fluid volume. Further, the packed cell volume and the number of viable cells in peritoneum were significantly low. These results indicate either a direct cytotoxic effect on tumor cells or an indirect local effect, which may involve macrophage activation and vascular permeability inhibition. The increase of life span is seen in animal study. The level of lipid peroxide in liver was significantly reduced to near normal. This reflects the decrease in free radical production and the subsequent reduction in oxidative stress, one of the main risk factors for the disease. Glutathione, a potent inhibitor of neoplastic process plays an important role as an endogenous antioxidant system that is found particularly in high concentration in liver and is known to have key function in the protective process [46].

Pointed gourd:

(Biological source: - Trichosanthes dioica Family: - Cucurbitaceae)

Trichosanthes dioica possess potential cytotoxic activity including marked antimitotic effect in plant study. It possesses possess antioxidant properties due to the presence of phenolic acids, polyphenols and flavonoids scavenge free radicals such as peroxide, hydroperoxide or lipid peroxyl and thus inhibit the oxidative mechanisms that lead to degenerative diseases and could serve as free radical inhibitors or scavengers, acting possibly as primary antioxidants [47].

Radish:

(Biological source: - Raphanus sativus Family: - Brassicaceae)

Active substance indole-3 carbinole in radish can be use as anti tumor, preventing carcinogenesis against cell line estrogen responsive, serves as immunomodulatory and increase TNF (tumor necrosis factor). The antioxidant properties of radish sprouts in which the glucosinolates glucoraphasatin (GRH) shows antioxidant activity [48]. Radish leaf inhibits the proliferation of MDA-MB231

through induction of apoptosis and down-regulate Erb B2 signaling and the Akt pathway, making EKRL a potent candidate as new-anti cancer food components [49].

Ridge gourd:

(Biological source: - Luffa acutangula Family: - Cucurbitaceae)

Fruits of L .acutangula methanolic extract show significant antiproliferative activity on human lung adenocarcinoma epithelial cell line (A-549). VEGF (Vascular endothelial growth factor) is shown to be the most potent angiogenic factor. Studies demonstrated that the expression of VEGF was reduced in a time-dependent manner by L .acutangula extract. Matrix metalloproteinases (MMPs), a family of zincdependent endopeptidases, play a crucial role in ECM (extra cellular matrix) degradation associated with tissue repair, cancer cell invasion, metastasis and angiogenesis. Among members of the MMP family, MMP-2 (gelatinase-A) and MMP-9 (gelatinase-B) are particularly up-regulated in malignant tumors. L .acutangula extract shows significant inhibition on MMP-2 and MMP-9 indicating the effective role of extract in the prevention of angiogenesis [50]. L .acutangula leaf extract have potent hepatoprotective action against carbon tetrachloride induced hepatic damage in rats. Hepatoprotective action is due to free radical scavenging and antioxidant activities which may be due to the presence of flavonoids in the extract [51].

Soyabean:

(Biological source: - Glycine max Family: - Fabaceae)

A 5% dietary supplementation with selectively hydrogenated soybean oil (SHSO) inhibits the growth of prostate cancer by 80% in vivo. SHSO induces apoptosis in prostate cancer cell of rats. DNA fragmentation analysis in vitro further confirms the apoptotic activity of SHSO on the MAT-LyLu prostate cancer cells. The SHSO also shows strong cytotoxicity on human prostate cancer cells (DU145 and PC3) [52]. Glyceollins were major bioactive compounds present in soybean elicited by fungi and shown to have antifungal and anticancer activities. Glyceollins shows a strong reducing power and inhibit lipid peroxidation, with significant scavenging activities of radicals including singlet oxygen, superoxide anion, 2,2'-azinobis(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS), and 2,2-diphenyl-1-picrylhydrazyl (DPPH). It was also found that glyceollins significantly suppresses H2O2-induced ROS production in HEPA1C7 cells. Therefore, glyceollins deserve further study as natural antioxidants and nutraceuticals [53].

Spinach:

(Biological source: - Spinacia oleracea Family: - Amaranthaceae)

Spinach contains the largest amount of sulfoquinovosyl diacylglycerol (SQDG). Spinach had the strongest inhibitory effect on DNA polymerase alpha activity and human cancer cell proliferation. The inhibition of polymerase alpha activity by SQDG may lead to cell growth suppression. Therefore the glycolipids fraction from spinach is potentially a source of food material for a novel anticancer activity [54]. On oral administration of glycoglycerolipid fraction from spinach as preliminary medication, colon tumor growth was delayed, and the protein expression level of proliferating cell nuclear antigen (PCNA) was decreases in tumor tissue. It also suppresses sarcoma formation with no adverse reactions in mice [55].

Tomato:

(Biological source: - Solanum lycopersicum Family: - Solanaceae)

The combined effects of low concentration of lycopene, a major component in tomato and eicosapentaenoic acid (EPA) may synergistically inhibit the proliferation of human colon cancer HT-29 cells. The inhibitory mechanism was associated with suppression of phosphatidylinositol 3- kinase/Akt signaling pathway. Furthermore, treatment of lycopene and EPA also synergistically blocked the activation of downstream mTOR molecule. Immunocytochemical staining results revealed that lycopene and EPA could also up-regulate the expression of apoptotic proteins such as Bax and Fas ligand to suppress cell survival [56].Lycopene have potential antitumorigenic activity in skin carcinogenesis assay. 16 % skin carcinoma was observed in DMBA + Croton oil + tomato juice group as compared to DMBA + Croton Oil in which 100 % papillomas were obtained. It seems that topical application of tomato juice prevents the 84 % development of carcinomas. It was observed that DMBA + croton oil is working in initiation and promotion protocol in skin carcinogenesis assay. 24 hours prior applications of tomato extract by i.p. has significantly prevents the micronucleus formation in bone marrow cells of mice & chromosomal aberration [57].Tomato extracts causes 50% inhibition of cancer cell growth against the proliferation of the cultured cancer cell line HT-29. The high cytotoxicity for HT-29 cells might be due to the simultaneous presence in the extract of both carotenoids and glyceryl esters of fatty acids [58].

Turnip:

(Biological source: - Brassica rapa var. rapa Family: - Brassicaceae)

Epidemiological studies suggest that intake of cruciferous vegetables is associated with decreased risks of developing cancers. Turnip contains glucosinolates that are sulfur containing secondary metabolites derived from protein and non-protein amino acids. When plant tissue is damaged, the enzyme myrosinase hydrolyzes glucosinolates into glucose, sulfate, isothiocyanates, nitrile, and thiocyanate. The breakdown products of

certain glucosinolates have been shown to protect against lung, colon, liver and stomach cancers. In particular, β-Phenylethyl isothiocyanate, abundant in the peel of turnip shows anti cancer property. HepG2 cells treated with β-phenylethyl isothiocyanate shows a concentrationdependant decrease in cell viability. It is found that isothiocyanate-mediated apoptosis in vivo is associated with the removal of chemically-induced cancer [59].

Conclusion:

Natural products have been a prime source for the treatment of many forms of cancer, many of which are consumed daily with the diet. They provide significant protection against various cancers and many other diseases. The antioxidant medicinal plants and their products prevent from the cancer and other diseases by protecting cells from damage. Thus, consuming a diet rich in antioxidant fruits, vegetables, herbs etc. will provide health-protective effects. Microbes and marine organisms also have been offering the great role in the prevention and treatment of cancer. Natural products offer a great opportunity to evaluate not only totally new chemical classes of anticancer agents, but also novel and potentially relevant mechanisms of action. There are more than 270,000 higher plants existing on this planet. But only a small portion has been explored phytochemically. So, it is anticipated that plants can provide potential bioactive compounds for the development of new "leads" to combat cancer diseases.

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