

The Importance of Nutraceuticals in Preventing and Treating Cancer

Amit Kumar Sharma; Dr. Swarup J. Chattarjee
S.N. College of Pharmacy Jaunpur

Abstract:- Nutraceuticals, products Derived from food sources providing benefits above and much more than simple nutrition, have been drawing these nutraceuticals gained attention because of their perceived potential applications in cancer care and prevention. These will include foods, herbs, as well as dietary supplements made with vitamins, minerals, amino acids, polyphenols, and other phytochemicals known for their potential for bioactivity. Here is an overview of how nutraceuticals can contribute to cancer care.

Keywords:- Nutraceuticals, Polyphenols, Prevention Quercetin, Curcumin, Resveratrol Antioxidant Property.

I. INTRODUCTION

Nutraceuticals are bioactive compounds from food that deliver health benefits beyond basic nutrition. Vitamins, minerals, amino acids, fatty acids, fibers, probiotics, and other plant-derived substances, like polyphenols, such as polyphenols, carotenoids, flavonoids, and alkaloids are some of the examples. As more people become interested in complementary and alternative medicine, there has been increasing attention toward nutraceuticals for their possible role in cancer prevention and therapy. Cancer is the uncontrolled cell growth with metastasis that has remained one of the biggest health challenges worldwide and is influenced by several complex etiological factors including genetic mutations, environmental exposures, and lifestyle behaviors. Though conventional Even though cancer treatments such as chemotherapy, radiation, and surgery are effective, they always come with serious side effects; therefore, researchers have sought to discover safer, less toxic, and more effective adjuncts to traditional therapies. The potential to reduce the risk of cancer, enhance the efficacy of conventional treatments, and help improve the quality of life in cancer patients makes nutraceuticals promising candidates for therapy.

II. LITERATURE REVIEW

A. Nutraceuticals:

This, therefore, refers to nutraceutical as food, or a food product that produces an intended health benefit beyond just nutritional value. It comes from the merging of nutrition and pharmaceutical into one, describing the substances which may provide for the prevention of diseases, enhancement of health, and promotion of appropriate body function. Nutraceuticals embrace natural and processed products and may include dietary supplements, functional foods, and even fortified foods.

Nutraceuticals can exist in the form of vitamins, minerals, amino acids, herbs, probiotics, or fish oils. They are mainly used as health promoters, chronic diseases managers, or quality-life improvers. Omega-3 fatty acids found in the fish oil help maintain healthy heart conditions, while probiotics in yogurt help keep digestive health in good condition. Nutraceuticals cannot be compared with pharmaceutical drugs when it comes to strict testing and regulation. Mainly marketed as dietary supplements, several demonstrated health benefits are claimed with minimal scientific evidence compared to their counterparts: pharmaceutical drugs.

The popularity of nutraceuticals has increased in the past few years due to an increasing number of people seeking natural alternatives to conventional medicine, which is motivated by a desire for preventive health care and more emphasis on wellness. Consumers, however, should be careful when using nutraceuticals since efficacy and safety can vary, and it is recommended to consult a healthcare provider before use.

B. Nutraceutical and Cancer:

Nutraceuticals have drawn interest as possible candidates role in cancer prevention, treatment support, and overall well-being for cancer patients. These are bioactive compounds derived from foods or supplements that may offer therapeutic benefits, especially in terms of reducing the risk of cancer. or enhancing conventional cancer therapies. While they do not replace traditional treatments, nutraceuticals can complement medical interventions and promote health by providing essential nutrients, antioxidants, and anti-inflammatory effects. Several nutraceuticals have

been suggested to offer promise in cancer study, because of their antioxidative, anti-inflammatory, as well as immune enhancing capabilities. For example, the active compound in the spice curcumin belongs to a family of active compounds and has been specifically studied in the context of its ability to inhibit inflammation, which prevents cancer cell growth and subsequent tumor formation. Similarly, green tea extract, especially its active component epigallocatechin gallate (EGCG), has been associated with cancer prevention; it is linked with a decreased risk of different Examples include breast, prostate, and colorectal cancers. This is known to prevent proliferation of the cancer cells due to angiogenesis, that is the formation of new blood vessels, which feeds on tumors, and also induces apoptosis or programmed cell death in cancerous cells. Another nutraceutical with great potential is vitamin D. Adequate levels of vitamin D have been associated with lower risks of developing several forms of cancer, including colorectal, breast, and prostate cancers. Vitamin D inhibits cell growth and differentiation; therefore, it may prevent the proliferation of cancer cells.

Besides individual compounds, other nutraceuticals, like omega-3 fatty acids, probiotics, and garlic, Have been examined for their cancer-preventing properties. Omega-3s are thought to reduce inflammation and, therefore, prevent the initiation of cancer, whereas probiotics may help in supporting gut health, which in turn is involved in immune function and resistance to cancer. While many nutraceuticals have promise, their use in cancer treatment should be approached with caution. Scientific evidence is still evolving, and effectiveness can vary between individuals. A healthcare provider should be consulted before using nutraceuticals to ensure they do not interfere with conventional cancer treatments or medications.

C. Natural Compounds and Cancer:

There have always been natural compounds that interested the minds of cancer researchers for their preventive and therapeutic anticancer potentials. A myriad of plantbased natural substances possesses bioactivity and can modulate growth, reduce metastasis, or complement classical treatments of cancer. Natural compounds are typically poly-modal, affecting cells at different stages through gene expression modification, anti-inflammatory, or programmed cell death pathways in cancerous cells. One of the most exhaustively studied natural compounds is the active ingredient in turmeric- curcumin. Curcumin has been shown to have strong anti-inflammatory and antioxidant properties, and research has shown that it has the potential to prevent the initiation as well as progression of various cancers, including breast cancer, colorectal cancer, and pancreatic cancer through inhibition of key pathways involved in cancer cell survival, migration, and invasion.

Resveratrol is a polyphenolic compound which has been isolated from red grapes, berries, peanuts, among others. Its ability to impact proteins that control cell division and programmed cell death results in the suppression of tumor growth and metastasis one of the causes of cancer development.

Green tea extract, especially the active compound, epigallocatechin gallate, has been mentioned to show cancer-fighting effects across different cancers, including breast, prostate, and lung cancers. The compound EGCG inhibits creation of new blood vessels, which tumors rely on to grow, promotes cell death in cancerous cells. There are other natural compounds, such as allicin from garlic, fish-sourced omega-3 fatty acids, and the gingerol content of ginger, among others, that have also been investigated and reported for their ability to prevent cancer or increase the action of chemotherapy. Although promising, Additional clinical studies are required to evaluate their effectiveness and safety in cancer prevention and therapy.. As always, folks should consult with healthcare providers before using any such natural compounds, especially when being treated with conventional cancer therapies.

D. Molecular Targets of Nutraceuticals in Cancer Care:

One of the key approaches in cancer therapy is molecular targeting, and nutraceuticals have received considerable attention for their potential to affect many molecular processes implicated in cancer development, evolution, and metastasis. the following bioactive compounds originate from natural sources, including plants, fruits, and herbs, and target specific molecules that regulate survival, proliferation, apoptosis, and metastasis of cancer cells. Modulating these molecular pathways, nutraceuticals may complement traditional treatments for cancer by helping reduce the risk of developing it, prevent recurrence, and improve outcomes for patients.

E. Key Molecular Targets of Nutraceuticals in Cancer:

➤ *NF-κB Signaling Pathway (Nuclear Factor-kappa B):*

The NF-κB pathway has been demonstrated to be implicated in inflammation and immune response and, importantly, in the survival of cancer cells. Hyperactivation of NF-κB is associated with proliferation of cancer cells, drug resistance, and metastasis. A variety of nutraceuticals have been known for their capability to inhibit the NF-κB pathway, and hence they could lead to the reduction of inflammation and tumor progression. Some examples include curcumin in turmeric, resveratrol present in red wine and grapes, and epigallocatechin gallate in green tea. These agents prevent NF-κB activation, induce enhanced apoptosis of cancerous cells, and reduce cancer cell invasion.

➤ *PI3K-Akt Signaling Pathway*

The PI3K/Akt signaling cascade controls cell growth, survival, and biochemical processes. Aberrant activation of this pathway is the hallmark of many cancers and contributes to uncontrolled cell proliferation and resistance to apoptosis. Nutraceuticals such as curcumin, resveratrol, and sulforaphane present in cruciferous vegetables like broccoli have been shown to inhibit the PI3K/Akt pathway, thereby inhibiting tumor growth and boosting cancer cell reactivity to chemotherapy.

➤ *Mitogen-Activated Protein Kinase Pathway*

The MAPK pathway is a stress-responsive signaling cascade, including growth and differentiation. This pathway is also over expressed in cancer. Curcumin, epigallocatechin gallate (EGCG), and genistein, an isoflavone in soy, have been shown to inhibit MAPK signaling and thereby prevent cancer cell proliferation and spread.

➤ *Angiogenesis and Vascular Endothelial Growth Factor (VEGF):-*

The process of new blood vessel formation (angiogenesis) is critical for tumor development and metastasis.. Nutraceuticals such as flavonoids of citrus fruits, green tea catechins (EGCG), and curcumin can suppress the expression of VEGF, a key regulator of angiogenesis. These compounds suppress angiogenesis, thereby starving the

tumor of blood supply, thereby inhibiting its growth and spread. Apoptosis Pathways Many cancers evade cell death by dysregulating apoptosis. Nutraceuticals such as quercetin (contained in apples and onions) vitamin D can initiate cancer cell death by stimulating pro-apoptotic proteins (like caspases) and inhibiting anti-apoptotic proteins. These effects promote cancer cell death and help in the treatment of cancers like leukemia and breast cancer.

➤ *Epigenetic Modulation*

Nutraceuticals may also modulate epigenetic changes, which regulate gene expression without altering DNA sequences. Such compounds as sulforaphane and curcumin modify histone acetylation and DNA methylation and stimulate the expression of tumor suppressor genes and oncogene silencing. This can restore normal cellular functions and inhibit the process of cancer development.

F. Main Phytochemicals Studied for Cancer Care:

Phytochemicals are naturally occurring compounds in plants that have been investigated for their capacity to prevent or treat cancer. These bioactive molecules can act on various cellular processes associated with development connected to cancer, including inflammation, cell enlargement, apoptosis (programmed cell death), and metastasis. Below are some of the main phytochemicals that have been extensively studied for their cancer care potential:

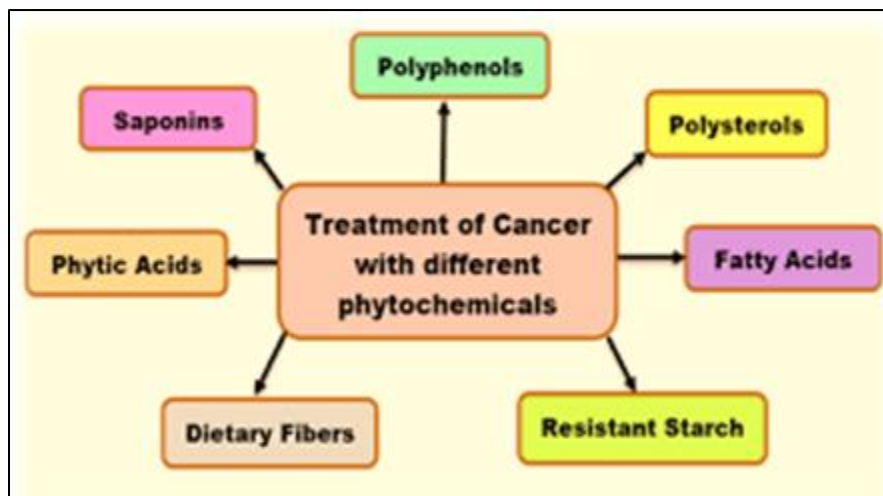


Fig 1 Treatment of Cancer

➤ *Polyphenols:*

Polyphenols constitute a collection of bioactive substances present in plant-based foods. They have shown a very significant antioxidant potential, suggesting Thus, these compounds may play a role in cancer prevention and treatment through modulation of numerous biological pathways, such as inhibition of tumor growth, induction of apoptosis in cancer cells, and anti-inflammatory effects. The potential of polyphenols, including resveratrol, curcumin, and flavonoids, has been seen in focusing on cancer stem

cells and enhancing the effectiveness of chemotherapy and radiation. More clinical studies are required to establish their clinical efficacy and safety in cancer treatment, though current evidence supports their role as promising adjuncts in cancer management.

➤ *Curcumin (from Turmeric):*

Curcumin, the principle molecule found in turmeric, is one of the most studied phytochemicals for cancer prevention and treatment. It has potent anti-inflammatory,

antioxidant, and anticancer properties. Curcumin induces effects by modulating many molecular pathways, including blockade of NF- κ B, PI3K/Akt, and Mitogen-activated protein kinase pathways, which cause cellular multiplication, survival, and tumor migration in cancerous conditions. It also prevents apoptosis and suppresses angiogenesis- or formation of new vessels in a tumor. Curcumin has been evaluated for a variety of cancers, from breast through colorectal and pancreatic to prostate.

➤ *Resveratrol (from Grapes, Berries, and Peanuts)*

Resveratrol is a polyphenol that has been identified in the skin of red grapes and berries, peanuts, or red wine and has been found to have antioxidant and anti-inflammatory properties. Studies on resveratrol have indicated the inhibition of cancer cell growth and metastasis by interfering with cell cycle regulation, promoting apoptosis, and preventing angiogenesis. In addition to these effects, it potentially has synergistic effects during chemotherapy and radiotherapy. Several studies have been conducted on resveratrol in breast, prostate, and colorectal cancer.

➤ *Epigallocatechin Gallate (EGCG) (from Green Tea):*

EGCG is a catechin of green tea that displays a strong antioxidant and anti-inflammatory effect. It is under intensive investigation for its anticancer activities in cancer types, such as breast, prostate, lung, and colorectal cancers, which inhibit the PI3K/Akt and MAPK pathways, suppress angiogenesis, induce apoptosis, and inhibit proliferation. Additionally, it has been presumed that EGCG increases chemotherapy and radiotherapy efficacy.

➤ *Sulforaphane (extracted from cruciferous vegetables):*

Sulforaphane is a compound of the cruciferous family. It can be found in vegetables like broccoli, Brussels sprouts, and cabbage. The compound has been reported to be anticancer with several mechanisms of action: it activates the Nrf2 pathway, detoxifying carcinogens and lowering oxidative stress. It inhibits growth, causes apoptosis, and prevents metastasis. Some research on cancers is involved in breast, prostate, lung, and colorectal cancer.

➤ *Genistein (from Soy):*

Genistein is an isoflavonoid, which is present in soy products, that shows anticancer properties. It is known as an estrogen receptor modulator and has been proven to suppress the growth related to hormones -dependent neoplasms like breast and prostate cancer. It does this by blocking the PI3K/Akt and MAPK signaling routes, causing apoptosis, and also preventing angiogenesis. In addition, genistein may also exert chemo preventive effects in at-risk patients who are prone to hormone-related cancers.

➤ *Quercetin (from Apples, Onions, and Berries):*

Quercetin is a flavonoid that occurs in various fruits, vegetables, and grains, such as apples, onions, berries, and tea. Quercetin is anti-inflammatory, antioxidant, and anticancer. Quercetin was proven to cause apoptosis in cancer cells, to inhibit the growth of the tumor, and to reduce metastasis. It can also potentiate chemotherapy drugs. Quercetin has been explored in its use for lung, breast, colon, and prostate cancer.

➤ *Lycopene (from Tomatoes and Red Fruits):*

Lycopene is a carotenoid pigment found in tomatoes, watermelon, red peppers, and other red fruits; it is highly potent as an antioxidant associated with reduced prostate cancer risk. Lycopene has been shown to scavenge free radicals; it suppresses proliferation of cancer cells while inducing apoptosis. It regulates signaling pathways critical in the development of cancer, such as the PI3K/Akt and MAPK pathways.

➤ *Piperine (from Black Pepper):*

Piperine is an active ingredient that occurs in black pepper, which improves bioavailability of other phytochemicals. It can help to inhibit the growth of cancerous biological cells by making them undergo apoptosis; furthermore, it inhibits inflammatory changes. Piperine also might, in combination with others, increase their absorption and thereby contribute to better efficacy of anticancerous compounds.

G. Vitamins and Minerals in Cancer Management:

Vitamins and minerals play a significant role in cancer management by providing overall health support, enhancing the immune system, and facilitating the repair of damaged cells. Some of the key nutrients complement cancer treatments by improving patient outcomes, reducing side effects, and potentially preventing cancer progression. Vitamin D is known to be able to control cell growth and differentiation; the deficiency of vitamin D is related to a higher risk of cancer. Vitamin C, which is a powerful antioxidant, may reduce oxidative stress that causes cancer and help enhance the immune system. Folate is crucial for DNA synthesis and repair while B vitamins support cell metabolism and function. Elements like selenium and zinc have antioxidant properties that protect cells from damage by DNA and support immunity.

H. Antioxidant Effect of Natural Compounds on Cancer:

Several plant-compounds, especially those naturally available in fruits, vegetables, and herbs, present impressive antioxidant activities that make significant contributions to the mechanism for both cancer prevention and cure. Antioxidants play the role of neutralization through scavenging of free radicals which potentially promote carcinogenic growth or development. Some antioxidants also consist of

polyphenol; flavonoids and other classes: carotenoids with some vitamin C and E being stronger antioxidant.

For example, curcumin, a compound in turmeric, resveratrol, which is found in grapes, and epigallocatechin gallate, which is in green tea, have shown anticancer properties by protecting cells from oxidative stress, reducing inflammation, and inhibiting tumor growth. These compounds also increase the effectiveness of conventional treatments such as chemotherapy and radiation by enhancing the immune system and reducing side effects.

I. Combined Therapy:

Combined therapy, which incorporates conventional treatments such as chemotherapy and radiation with nutraceuticals, has emerged in the management of cancer as promising in increasing efficacy and reducing side effects. Nutraceuticals are bioactive compounds in food that include vitamins, minerals, polyphenols, and other plant-derived compounds, which provide therapeutic benefits beyond basic nutrition. These compounds may synergize with standard cancer treatments to enhance patient outcomes. Nutraceuticals such as curcumin, resveratrol, and green tea extracts have been very promising in cancer prevention and treatment by modulating several molecular pathways involved in tumor growth, inflammation, and metastasis. For example, curcumin has anti-inflammatory and antioxidant properties, which may help in reducing the rate of cancer progression and enhance chemotherapy efficacy. Similarly, apoptosis in cancer cells and suppression of angiogenesis, by the formation of new blood vessels to supply the developing tumor, has been investigated with resveratrol.

J. Present Limitations of Nutraceuticals in Cancer:

While nutraceuticals are promising in preventing and treating cancer, a number of limitations exist for their use and application in the clinical setting:

➤ *Lack of Standardization:*

Nutraceutical products are often of varying quality, potency, and purity. This makes it impossible to guarantee consistent therapeutic effects, leading to unreliable results and difficulties in clinical trials.

➤ *Limited Clinical Evidence:*

Laboratory and animal studies have provided promising results, but many nutraceuticals have yet to be tested in large, carefully planned human clinical trials to confirm their effectiveness and safety in cancer therapy.

➤ *Interactions with Conventional Treatments:*

Some of the nutraceuticals could interact with chemotherapy, radiation, or targeted therapies in such a way that diminishes their effectiveness or even enhances toxicity. For example, antioxidants may reduce the effectiveness of

certain treatments relying on oxidative stress to kill cancer cells.

➤ *Dosing and Safety Concern:*

It is hard to develop safe and effective dosing practices for cancer patients. With some nutraceuticals, high doses can lead to serious adverse effects, such as toxicity and complications, particularly when compounded with other drugs or treatment modalities.

➤ *Regulatory Issues:*

Compared to pharmaceutical drugs, nutraceuticals do not undergo strict regulatory standards from health authorities such as the FDA, making it more difficult to assess its safety and efficacy. Lack of regulation also permits claims on the cancer-fighting ability of the nutraceutical.

➤ *Patient Variability:*

The effectiveness of nutraceuticals can vary greatly between individuals due to factors like genetics, diet, and the type or stage of cancer. This variability makes it difficult to apply a one-size-fits-all approach.

III. CONCLUSION

Nutraceuticals are bioactive compounds associated with a food or nutritional supplement that potentially exert health improvements beyond regular nutrition. Though traditional cancer treatment methods like chemotherapy, radiation, and surgery still hold sway, these nutraceuticals hold promise for supportive or supplemental therapy in the management of cancer. These nutraceuticals can affect numerous biological pathways involved in carcinogenesis, such as inflammation, oxidative stress, apoptosis, cell cycle regulation, and metastasis.

IV. KEY MESSAGES

Preventive measures: Increasingly, nutraceuticals have been demonstrated to assist in the prevention of specific cancers through providing protective antioxidants like vitamins C and E polyphenols, including resveratrol and curcumin; as well as phytochemicals, like flavonoids and carotenoids, all with a similar anticancer effect. These can neutralize free radicals, inhibit inflammation, and boost the immune system, which in turn stops the cells from suffering DNA damage that eventually causes numerous cancers.

➤ *Chemoprevention:*

Many studies show that nutraceuticals can slow the progression of precancerous lesion to cancer. For instance, green tea polyphenols and curcumin have been linked to inhibiting the early stages ending the death of abnormal cells.

➤ *Supplementation of Conventional Therapies:*

Although nutraceuticals are not treatments on their own, they have shown the ability to improve the effectiveness of induced side effects, such as nausea and fatigue. Other compounds sensitize cancer.

➤ *Safety and Side Effects:*

Commonly recognized as safe when taken in appropriate doses, nutraceuticals should be used with care. There are some supplement-drug interactions with chemotherapy agents, so medical supervision is important.

➤ *Clinical Evidence:*

Although there are promising preclinical and observational. Most claims about nutraceuticals remain inconclusive from clinical trials. Therefore, large-scale randomized controlled studies, better-designed, are needed to prove their role and establish the optimal dosage for cancer prevention and treatment.

REFERENCES

- [1]. Sachdeva V, Roy A, Bharadvaja N. Current Prospects of Nutraceuticals: A Review. *Curr Pharm Biotechnol.* 2020;21(10):884-896.
- [2]. Martinović LS, Peršurić Ž, Pavelić K. Nutraceuticals and Metastasis Development. *Molecules.* 2020;25(9):2222.
- [3]. Prasad S, Gupta SC, Tyagi AK. Reactive oxygen species (ROS) and cancer: Role of antioxidative nutraceuticals. *Cancer Lett.* 2017;387:95-105.
- [4]. Maiuolo J, Gliozzi M, Carresi C, Musolino V, Oppedisano F, Scarano F, Nucera S, Scicchitano M, Bosco F, Macri R, Ruga S, Cardamone A, Coppoletta A, Mollace A, Cognetti F, Mollace V. Nutraceuticals and Cancer: Potential for Natural Polyphenols. *Nutrients.* 2021;13(11):3834.
- [5]. Rock CL, Doyle C, Demark-Wahnefried W, Meyerhardt J, Courneya KS, Schwartz AL, Bandera EV, Hamilton KK, Grant B, McCullough M, Byers T, Gansler T. Nutrition and physical activity guidelines for cancer survivors [published correction appears in *CA Cancer J Clin.* 2013 May;63(3):215]. *CA Cancer J Clin.* 2012;62(4):243-274.
- [6]. Aquila G, Re Cecconi AD, Brault JJ, Corli O, Piccirillo R. Nutraceuticals and Exercise against Muscle Wasting during Cancer Cachexia. *Cells.* 2020;9(12):2536.
- [7]. Gupta SC, Kunnumakkara AB, Aggarwal S, Aggarwal BB. Inflammation, a Double Edge Sword for Cancer and Other Age-Related Diseases. *Front Immunol.* 2018;9:2160.
- [8]. Wang Y, Liu Q, Quan H, Kang SG, Huang K, Tong T. Nutraceuticals in the Prevention and Treatment of the Muscle Atrophy. *Nutrients.* 2021;13(6):1914.
- [9]. Ferreri C, Sansone A, Chatgialloglu C, Ferreri R, Amézaga J, Burgos MC, Arranz S, Tueros I. Critical Review on Fatty Acid-Based Food and Nutraceuticals as Supporting Therapy in Cancer. *Int J Mol Sci.* 2022;23(11):6030.
- [10]. Trottier G, Boström PJ, Lawrentschuk N, Fleshner NE. Nutraceuticals and prostate cancer prevention: a current review. *Nat Rev Urol.* 2010;7(1):21-30.
- [11]. Bosutti A, Zanconati F, Grassi G, Dapas B, Passamonti S, Scaggiante B. Epigenetic and miRNAs Dysregulation in Prostate Cancer: The role of Nutraceuticals. *Anticancer Agents Med Chem.* 2016;16(11):1385-1402.
- [12]. Vernieri C, Nichetti F, Raimondi A, Pusceddu S, Platania M, Berrino F, de Braud F. Diet and supplements in cancer prevention and treatment: Clinical evidences and future.
- [13]. De Amicis, F., Perri, A., Vizza, D., Russo, A., Panno, M. L., Bonofiglio, D., ... Ando, S. (2013). Epigallocatechin gallate inhibits growth and epithelial-to-mesenchymal transition in human thyroid carcinoma cell lines. *J Cell Physiol,* 228, 2054-2062. <http://dx.doi.org/10.1002/jcp.24372>
- [14]. McCullough, M. L., & Giovannucci, E. L. (2004). Diet and cancer prevention. *Oncogene,* 23, 6349-6364. <http://dx.doi.org/10.1038/sj.onc.1207716> Misotti, A. M., & Gnagnarella, P. (2013). Vitamin supplement consumption and breast cancer risk: a review. *Ecancermedicalscience,* 7, 365.
- [15]. Moyers, S. B., & Kumar, N. B. (2004). Green tea polyphenols and cancer chemoprevention: multiple mechanisms and endpoints for phase II trials. *Nutr Rev,* 62, 204-211. <http://dx.doi.org/10.1111/j.1753-4887.2004.tb00041.x> Nakata, R., Takahashi, S., & Inoue, H. (2012).
- [16]. Recent advances in the study on resveratrol. *Biol Pharm Bull,* 35, 273-279. <http://dx.doi.org/10.1248/bpb.35.273> Ogilvie, G. K. (1998).
- [17]. Interventional nutrition for the cancer patient. *Clin Tech Small Anim Pract,* 13, 224-231. [http://dx.doi.org/10.1016/S1096-2867\(98\)80007-8](http://dx.doi.org/10.1016/S1096-2867(98)80007-8) Orzechowski, A., Ostaszewski, P., Jank, M., & Berwid, S. J. (200)
- [18]. Bioactive substances of plant origin in food--impact on genomics. *Reprod Nutr Dev,* 42, 461-477. <http://dx.doi.org/10.1051/rnd:2002037> Pericleous, M., Mandair, D., & Caplin, M.E. (2013).
- [19]. Diet and supplements and their impact on colorectal cancer.
- [20]. *J Gastrointest Oncol,* 4, 409-423. Posadzki, P., Watson, L., & Ernst, E. (2013). Herb- drug interactions: an overview of systematic reviews. *Br J Clin Pharmacol,* 75, 603-618. Priyadarsini, R. V., & Nagini, S. (2012).