Journal of Home Economics

Volume 25, Number (1), 2015

http://homeEcon.menofia.edu.eg

Journal of Home Economics

ISSN 1110-2578

Breast cancer in relationship with dietary antioxidant: possible nutritional and biochemical mechanisms of action: Review study

Yousif Elhassaneen[*] and Wedad Saif

Department ofNutrition and Food Science, Faculty of Home Economics,MinoufiyaUniversity, Shebin El-Kom, Egypt

[*]Corresponding Author: Yousif12@hotmail.com

Abstract: Cancer is a leading cause of death worldwide. Breast cancer is one of the most common malignancies and contribute significantly to the societal and economic burden of cancer. Racial disparities are evident for breast cancer survival incidence. The reasons for differences in cancer incidence and survival are not entirely clear. However, diet plays an important role in cancer prevention and survival and may also be implicated in racial and ethnic disparities. Diet high in antioxidant content has been associated with reduced breast cancer risk. According to our knowledge, there is a dearth of information regarding the antitumarogenic effects of phytochemicals. Therefore, the present study aims to: investigate the effect of dietary antioxidant of some plant parts including turmeric, marjoram and on breast cancer cells.

Keywords: Antioxidants – Breast cancer cells- phytochemicals.

Antioxidants

Antioxidants are substances that may protect cells from the damage caused by unstable molecules known as free radicals. Antioxidants interact with free radicals and may prevent some of the damage free radicals might otherwise cause. An antioxidant is a molecule capable of slowing or preventing the oxidation of other molecules. Antioxidants terminate these chain reactions by removing free radical intermediates and inhibit other oxidation reactions by being oxidized themselves. As a result, antioxidants are often reducing agents such as thiols, ascorbic acid or polyphenols (Sies, 1997). Antioxidants are also widely used as ingredients in dietary

supplements in the hope of maintaining health and preventing diseases such as cancer and coronary heart disease. Low levels of antioxidants, or inhibition of the antioxidant enzymes, causes oxidative stress and may damage or kill cells (Bjelakovic *et al*., 2007).The antioxidant hypothesis is strongly sustained to prevent or reduce oxidative damage, their increased uptake from the diet will reduce the risk of chronic diseases. A large part of studies supporting the antioxidant hypothesis against cancer are based on cell lines studies and on animal model where tumors were experimentally induced by high doses of carcinogens (Sporn and Suh, 2002 and Surh, 2003).

Tested plants as antioxidants

Turmeric

Turmeric (*Curcuma longa*) is an Indian spice derived from the rhizomes of the plant and has a long history of use in Ayurvedic medicine as a treatment for inflammatory conditions (Ammon and Wahl, 1991). Turmeric constituents include the three curcuminoids: curcumin (diferuloylmethane; the primary constituent and the one responsible for its vibrant yellow color), demethoxycurcumin, and bisdemethoxy-curcumin, as well as volatile oils (tumerone, atlantone, and zingiberone), sugars, proteins, and resins (Negi *et al.*, 1999).

Effect of turmeric on breast cancer

Curcumin's effect on cancer (from an anti-inflammatory perspective (Ireson *et al.,* 2001). Curcumin has exhibited inhibitory effects on several malignant cancers, including breast cancer (Shishodia *et al*., 2007 and Aggarwal *et al*., 2007).Curcumin, a phenolic compound extract from rhizome of the plant Curcuma longa is found to have inhibitory effects towards a board range of tumors. In breast cancer, curcumin's anticancer effect has been anticipated in relating to induce apoptosis at G2 phase of cell cycle via a p53-dependent pathway (Choudhuri *et al*., 2005).Curcumin, a dietary polyphenol, has been studied extensively as a chemopreventive agent in a variety of cancers, including those of the breast, liver, prostate, hematological, gastrointestinal, and colorectal cancers, and as an inhibitor of metastasis (Kunnumakkara*et al.*, 2008). In a recent report, curcumin was shown to selectively inhibit the growth and self-renewal of breast cancer stem

cells(bCSCs) (Kakarala*et al*., 2010).The antitumor activity of curcumin in mediating the breast cancer cell proliferative rate and invasion by down-regulating the NF-κB inducing genes. Our findings suggest curcumin could be a potentially therapeutic agent for both ER-positive and ER-negative breast cancer (Rochefort *et al*., 2003). Recently, our study indicated that turmeric could be exhibited its therapeutic effects in breast cancer through showing strong antioxidant activity because of its high phenolic content1983 mg GAE.100g-1,decreased the human lymphocyte viability, increasment the percentage of total damaged spots and decreased in maximal optical density of intact DNA in Ehrlich Ascites Carcinoma cell line. Finally, from the all previous studies, proposed pathways for the effect of turmeric on breast cancer could be shown in Figure (1).

Marjoram

Marjoram (*Origanum majorana L.*, Family: *Lamiaceae*) is a common spicy medicinal herb, used as a home remedy for the treatment of different ailments. It is a rich source of polyphenols which are known natural antioxidants. Carvacrol and rosmarinic acid have each been reported to protect DNA from a variety of damaging agents and to suppress proliferation of breast cancer cells or cells with active oncogenes. Rosmarinic acid blocked processes associated with breast cancer invasion and metastasis (Jankun *et al*., 2006 and Karkabounas *et al*., 2006).

Effect of marjoram on breast cancer

Marjoram used to treat cancers (colon cancer, bancriatic cancer and breast cancer) (Esiyok *et al*., 2004).Carvacrol and rosmarinic acid have each been reported to protect DNA from a variety of damaging agents and to suppress proliferation of breast cancer cells or cells with active oncogenes. Rosmarinic acid blocked processes associated with breast cancer invasion and metastasis (Jankun *et al*., 2006 and Karkabounas *et al*., 2006).O. majorana was shown to possess high activity against cancer in in vitro experiments (Goun *et al*., 2002). Al-Kalaldeh *et al*., (2010) detected antiproliferative activity of the ethanol crude extracts of

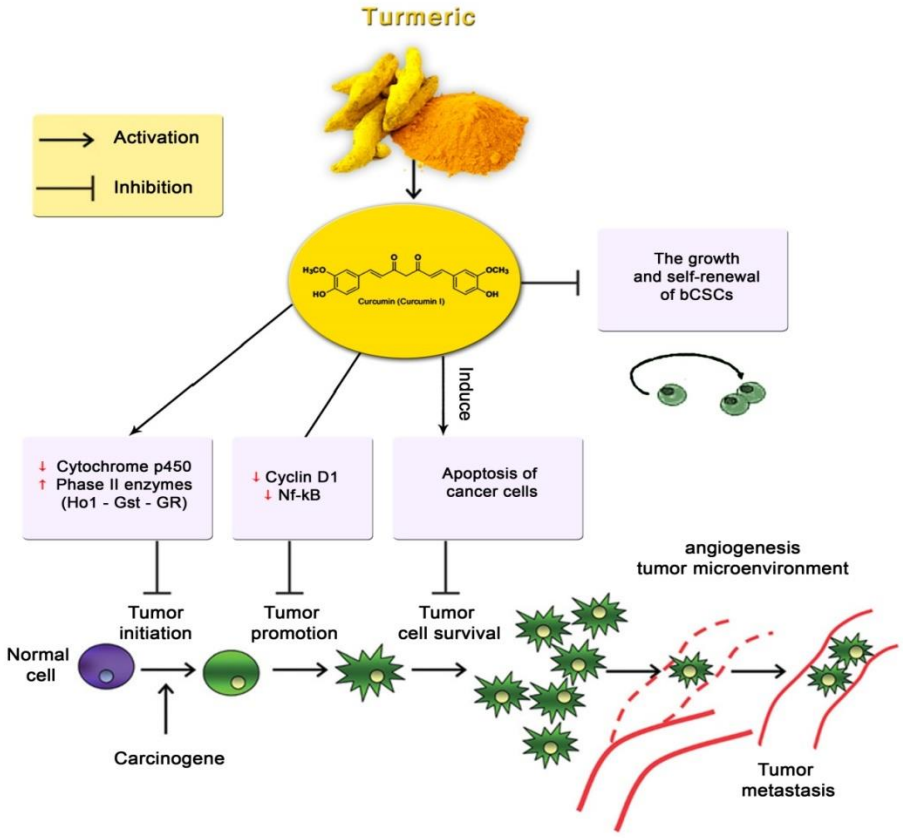

Figure (1): proposed pathways for the effect of turmeric on breast cancer

Origanum syriacum to MCF-7 human breast adenocarcinoma cell line.Recently, we have shown that *Origanum majorana* suppresses the growth of the triple negative MDA-MB-231 breast cancer cells by causing cell cycle arrest and apoptosis (Al Dhaheriet al., 2013).Recently, our study indicated that marjoram could be exhibited its therapeutic effects in breast cancer through showing strong antioxidant activity because of its high phenolic content(2715 mg GAE.100g^{-1}).decreased the human lymphocyte viability, increasment the percentage of total damaged spots and decreased in maximal optical density of intact DNA in Ehrlich Ascites Carcinoma cell line. Finally, from the all previous

studies, proposed pathways for the effect of marjoram on breast cancer could be shown in Figure (2).

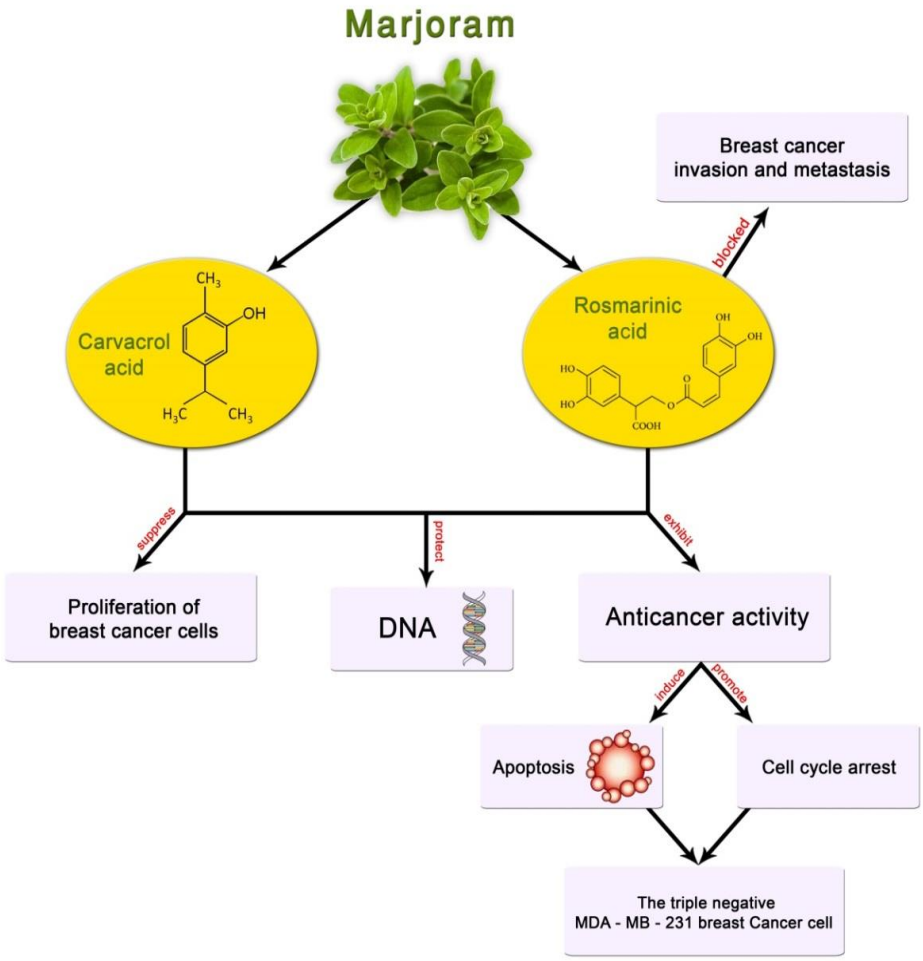

Figure (2): proposed pathways for the effect of marjoram on breast cancer

Sweet Violet

Sweet Violet (*Viola odorata*) is a species of the Family: Violaceae native to Europe and Asia, but has also been introduced to North America and Australasia. It is commonly known as wood violet, sweet violet, English violet (Bruce and Sharon, 2001).Viola odorata L. six solvent extract contained the reducing sugar, terpenoids, tannin and

saponins. Volatile oil, salicylic acid methyl ester, saponins, alkaloids. (Ebrahimzadeh et al., 2010).Various phytochemical constitutes (alkaloids, steroids, tannins, flavonoids, and saponins) has been reported in aerial parts of Viola odorata n-hexane, butanolic, methanolic and aqueous extracts (Vishal et al., 2009). The Methanolic extract of the whole plant of Viola betonicifolia has been reported as rich source of alkaloids, flavonoids, tannins, proteins, phenolic compounds, saponins, sterols and triterpenoids (Muhammad et al., 2012).

Effect of turmeric on breast cancer

A liquid extract of fresh leaves used for cancer of the throat and tongue. In other countries, used for breast and lung cancer (Jennings et al., 2001). Viola was investigated for cytotoxicity and reported as pharmacological tools and possibly as leads to antitumor agents in breast cancer (Lindholm et al., 2002).

The aqueous preparations of V. odorata L. Eugenol, Kaempferol, Quercetin, Scopoletin, also show promise in the treatment of many kinds of cancer such as prostate cancer, breast cancer and colon cancer (Marcussen, 2006). Cycloviolacin O2 from Viola odorata is particular promising because of its selective toxicity to cancer cell lines relative to normal cells, which indicates the possibility of its use as an anticancer agent. Analysis of the proposed mechanism of action of this cyclotide shows that the disruption of cell membranes plays a crucial role in the cytotoxicity of cycloviolacin O2 because the damage to cancer cells (human lymphoma) can be morphologically distinguished within a few minutes, indicating necrosis (Svang et al., 2007).Recently, our study indicated that sweet violet could be exhibited its therapeutic effects in breast cancer through showing antioxidant activity because of its high phenolic content (983 mg GAE/100g-1) decreased the human lymphocyte viability, increasment the percentage of total damaged spots and decreased in maximal optical density of intact DNA in Ehrlich Ascites Carcinoma cell line. Finally, from the all previous studies, proposed pathways for the effect of sweet violet on breast cancer could be shown in Figure (3).

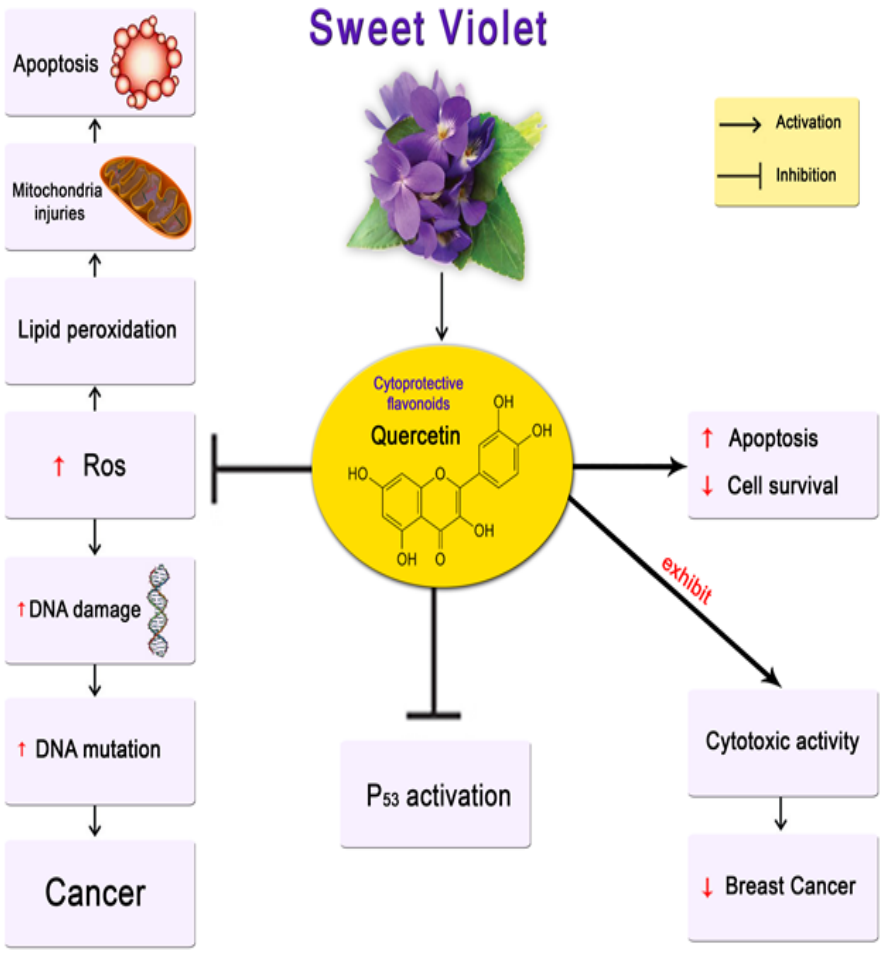

Figure (2): proposed pathways for the effect of sweet violet on breast cancer

References

Al Dhaheri, Yusra.; Samir, Attoub.; Kholoud, Arafat.; Synan, AbuQamar.; Jean, Viallet.; Alaaeldin, Saleh.; Hala, Al Agha.; Ali, Eid. and Rabah, Iratni . (2013). Anti-Metastatic and Anti-Tumor Growth Effects of Origanum majorana on Highly Metastatic Human Breast Cancer Cells: Inhibition of NFκB Signaling and Reduction of Nitric Oxide Production. J. PLoS One. 8 (7): e68808.

Al-Kalaldeh, J.; Abu-Dahab, R. and Afifi, F. (2010). Volatile oil composition and antiproliferative activity of Laurus nobilis, Origanum syriacum, Origanum vulgare, and Salvia triloba against human breast adenocarcinoma cells. Nutr Res.; 30 : 271–278.

Ammon, H.P. and Wahl, M.A. (1991). Pharmacology of Curcuma longa. Planta Med.; 57:1-7.

Bjelakovic, G.; Nikolova, D.; Gluud, L.L.; Simonetti, R.G. and Gluud, C. (2007). "Mortality in randomized trials of antioxidant supplements for primary and secondary prevention: systematic review and meta-analysis". JAMA 297 (8): 842–57.

Choudhuri, T.; Pal, S.; Das, T. and Sa, G. (2005), Curcumin selectively induces apoptosis in deregulated cyclin D1-expressed cells at G2 phase of cell cycle in a p53-dependent manner. J. Biol. Chem., 280, 20.059-20.068.

Esiyok, D.; Otles, S. and Akcicek, E. (2004). Herbs as a food source in Turkey. Asian Pac J. Cancer Prev.; 5(3):334–339.

Goun, E.A.; Petrichenko, V.M. and Solodnikov, S.U. (2002). Anticancer and antithrombin activity of Russian plants. J. Ethnopharmacol ; 81 : 337–342.

Ireson, C.; Orr, S. and Jones, D.J. (2001). Characterization of metabolites of the chemopreventive agent curcumin in human and rat hepatocytes and in the rat in vivo, and evaluation of their ability to inhibit phorbol ester-induced prostaglandin E2 production. Cancer Res; 61:1058-1064.

Jankun, J.; Selman, S.; Aniola, J.; Skrzypczak. and Jankun, E. (2006). Nutraceutical inhibitors of urokinase: potential applications in prostate cancer prevention and treatment.16:341Y346.

Kakarala, M.; Brenner, D.E.; Korkaya, H.; Cheng, C.; Tazi, K.; Ginestier, C.; Liu, S.; Dontu, G. and Wicha, M.S. (2010). Targeting breast stem cells with the cancer preventive compounds curcumin and piperine.Breast Cancer Res. Treat, 122:777–785.

Karkabounas, S.; Kostoula, O. and Daskalou, T. (2006). Anticarcinogenesis and antiplatelet effects of carvacrol. Exp Oncol ;28:121-125.

Kunnumakkara, A.B.; Anand, P. and Aggarwal, B.B. (2008). Curcumin inhibits prolif eration, invasion, angiogenesis and metastasis of different cancers through interaction with multiple cell signaling proteins. Cancer Lett; 269: 199-225.

Negi, P.S.; Jayaprakasha, G.K.; Jagan Mohan Rao. L. and Sakariah, K.K. (1999). Antibacterial activity of turmeric oil: a byproduct from curcumin manufacture. J. Agric Food Chem.; 47:4297-4300.

Rochefort, H. (2003). How to target estrogen receptor-negative breast cancer ? Endocrine-Related Cancer; 10 (2)261-266.

Shishodia, S.; Chaturvedi, M.M. and Aggarwal, B.B. (2007). Role of curcumin in cancer therapy.Curr Probl Cancer; 31(4):243–305.

Sies, H. (1997). Oxidative stress: oxidants and antioxidants. Exp. Physiol; 82(2): 291–295.

Bruce, A. and Sharon, A. (2001). California Gardener's Guide. Cool Springs Press. 38–39.

Ebrahimzadeh, M.A.; Nabavi, S.M.; Nabavi, S.F.; Bahramian, F. and Bekhradnia, A.R. (2010). Antioxidant and free radical scavenging activity of H. officinalis L. var. angustifolius, V. odorata, B. hyrcana and C. speciosum. Pak J Pharm Sci., 23(1):29-34.

Vishal, A.; Parveen, K.; Pooja, S.; Kannappan, N. and Kumar, S. (2009). Diuretic, laxative and toxicity Studies of Viola odorata aerial parts. Pharmacology online 1, 739-748.

Muhammad, N.; Saeed, M.; barkatullah, Ibrar. M. and Khan, H. (2012a). Pharmacognostic studies of Viola betonicifolia African J. Pharmacy and Pharmacology 6, 43-47.

Jennings, C.; West, J.; Waine, C.; Craik, D. J.; Anderson, M. (2001). Biosynthesis and insecticidal properties of plant cyclotides: the cyclic knotted proteins from Oldenlandia affinis. Proc. Natl. Acad. Sci. U.S.A; 98: 10614–10619.

Lindholm, P.; Goransson, U.; Johansson, S.; Claeson, P.; Gulibo, J.; Larsson, R.; Bohlin, L. and Backlund, A. (2002): Cyclotides: a novel type of cytotoxic agents. Mol Cancer Ther.; 1(6): 365-369.

Marcussen, T. (2006). Allozymic variation in the widespread and cultivated Viola odorata (Violaceae) in western Eurasia. J Linn. Soc.;151: 563-571.

Svang, E.ard.; Burman, R.; Gunasekera, S.; ovborg, H.L.; Gullbo, J.; oransson, U.G. (2007). "Mechanism of action of cytotoxic cyclotides: cycloviolacin O2 disrupts lipid membranes" Journal of Natural Products,70(4):643–647.

Sporn, M. and Suh, N. (2002). Chemoprevention: an essential approach to controlling cancer. Nat Rev Cancer, 2: 537–543.

Surh, Y. (2003). Cancer chemoprevention with dietary phytochemicals, Nature Rev. Cancer, 3: 768–780.

Journal of Home Economics, Volume 25, Number (1), 2015

علاقة سرطان الثدى بمضادات الأكسدة الغذائية: آليات غذائية وكيموحيوية: دراسة مرجعية

يوسف عبد العزيز الحسانين , وداد سيف
قسم التغذية وعلوم الأطعمة - كلية الاقتصاد المنزلي- جامعة المنوفية- شبين الكوم - مصر

يمثل السرطان أحد الأسباب الرئيسية للوفاة على مستوى العالم. كما يساهم سرطان واورام الثدى بدرجة كبيرة فى الأعباء الاجتماعية والاقتصادية. وحتى هذه اللحظة فمازالت الأسباب المتعلقة بأنواع السرطانات المختلفة غير واضحة. ولقد أوضحت العديد من الدراسات أن الوجبات الغذائية بما تحتوية تلعب دورا هاما فى الوقاية من السرطان، والتى يرجع غالبا الى محتواها من المركبات الحيوية المضادة للأكسدة. ونظرات لنقص المعلومات المتعلقة بهذا الجانب فإن الدراسة الحالية تهدف الى توضيح تأثير بعض مضادات الأكسدة الطبيعية الموجودة بالأجزاء النباتية مثل الكركم، البردقوش ، الياسمين الحلو بسرطان الثدى وإستيضاح بعض الأآليات الغذائية والكيموحيوية المتعلقة بهذا الخصوص.

الكلمات المفتاحية: مضادات الأكسدة- سرطان الثدى- الكيماويات النباتية.