



Role of Nutraceuticals in Cancer Therapy

Ankit Kumar Gupta (B.Pharm)¹, Mr.Yashwant Singh (Assistant Professor)², Harendra Yadav (B.Pharm)³

ankit854593@gmail.com

hy9639067@gmail.com

College : S.N Collage of Pharmacy

University:Dr.A.P.J.Abdul Kalam Technical University Lucknow

ABSTRACT :

Natural bioactive items with food value and potential therapeutic benefits for a number of illnesses are known as nutraceuticals. Current cancer treatments including chemotherapy, radiation, and surgery have unanticipated side effects that jeopardize patients' health and wellbeing. According to recent research, certain plant-based substances might have an effect on the molecular and cellular mechanisms that underlie the development of tumors. Some of these compounds, meanwhile, may potentially have antagonistic effects on traditional medicinal substances. Reviewing the current research supporting the use of nutraceuticals in cancer prevention and treatment is the goal of this article.

Keywords: nutraceuticals, prevention, cancer, phytochemicals, epigallocatechin-3-gallate, resveratrol, quercetin

1. Introduction

Many studies have shown that what we eat plays a very important role in causing or preventing long-term diseases like heart disease, diabetes, gallstones, brain disorders, cataracts, and various types of cancer (Smith-Warner et al., 2000). This shows that our diet has a direct effect on our health. Cancer is becoming a bigger health issue worldwide because people are living longer, cities are growing, and lifestyles and environments are changing (Andersen, Holst, & Vogel, 2013). Cancer develops when normal cells change step by step into cancerous ones by altering certain genes. Although one single cause cannot explain why cancer occurs, some people have a higher risk due to many combined factors. While genetics plays a role, diet can greatly influence health outcomes (Pericleous, Mandair, & Caplin, 2013).

The most common cancers in the world are lung, breast, colorectal, and prostate cancer (Jemal et al., 2011). These cancers are more frequent in Western countries, but less common in many Asian nations. One reason is that Asian diets usually include more fruits and vegetables and less fat or meat (Fernandes, 1989). This shows that diet and environment have a strong impact on how our cells and body work (Bazzan, Newberg, Cho, & Monti, 2013).

Besides nutrients, plant-based foods also contain hundreds of natural compounds that are not considered nutrients but still help maintain good health. Traditional medicine systems around the world have used these plants for centuries to promote health, although scientific proof for many of these uses is still limited.

2. Nutraceuticals

Phytochemicals are natural chemicals from plants that can improve health by directly affecting certain molecules in our body or indirectly helping our metabolism (Priyadarsini & Nagini, 2012). Plants produce these phytochemicals to protect themselves from harmful substances like free radicals.

In recent years, there has been a growing demand for foods and products containing such bioactive compounds. These special products, which have added plant extracts to provide health benefits, are not just normal foods. They are called **nutraceuticals** — a term first introduced by Dr. Stephen DeFelice in 1989. He defined nutraceuticals as “foods, food ingredients or dietary supplements that provide medical or health benefits, including the prevention or treatment of disease” (Kalra, 2003).

In the early 1900s, food companies started adding nutrients like iodine to salt to prevent goiter — an early example of functional food. Over time, the importance of nutraceuticals grew, and now they are recognized as part of **complementary and alternative medicine (CAM)**.

The ancient Greek physician **Hippocrates** once said, “Let food be thy medicine and medicine be thy food,” emphasizing how closely diet and health are linked. Depending on how they are prepared or extracted, plant-based products can be called foods, food supplements, functional foods, or nutraceuticals. A **pure plant compound** is called a nutraceutical, while a **semi-purified plant product** not usually eaten daily is a **functional food** (Roudebush, Davenport, & Novotny, 2004).

Plants contain many beneficial compounds like vitamins, minerals, fatty acids, and phytochemicals such as flavonoids, polyphenols, phytoestrogens, phytosterols, lignans, terpenes, and more (Orzechowski et al., 2002).

3. The Use of Nutraceuticals in Cancer Patients

It is estimated that about **one-third of cancer deaths** can be prevented by making lifestyle and dietary changes (Danaei et al., 2005). Even though many laboratory studies have shown good results with plant compounds, most have not been properly tested in animals or humans, which caused early clinical trials to fail in the 1990s.

Many cancer drugs used today come from plants — for example, **vincristine** and **vinblastine** from the *Vinca* plant, and **Taxol** from the *Pacific yew* tree (*Taxus brevifolia*). For thousands of years, traditional systems of medicine have used plant extracts to treat diseases, including cancer. Often, the same plants were used by different cultures for the same illnesses, suggesting their effectiveness.

Despite modern advances, cancer remains a global health problem. Plant-based extracts and nutraceuticals may help both in **preventing and treating cancer** (Weisburger, 1999). Diets low in sugar, with moderate amounts of protein, fiber, and healthy fats (especially omega-3 fatty acids), are beneficial for cancer patients (Tuomisto et al., 2004).

Nutraceuticals may also **reduce side effects** of chemotherapy and radiation and **improve quality of life** by decreasing cancer-related weight loss and weakness (Grimble, 2003).

Phytochemicals act through various mechanisms — they work as **antioxidants**, influence **cell signaling pathways**, regulate **hormones**, strengthen the **immune system**, and reduce **inflammation**. Some even help repair or protect DNA.

4. Molecular Targets of Nutraceuticals in Cancer Care

Early studies found that phytochemicals can block cancer-causing agents (carcinogens), stop them from damaging DNA, and prevent abnormal cell growth (Surh, 2003).

Chemoprevention means using natural or synthetic substances to stop or slow down cancer development. Early-stage cancers are often limited to one area (called *carcinoma in situ*), so compounds that prevent further growth and spread — called **anti-promotion** and **anti-progression agents** — are especially valuable.

Even in small amounts, plant bioactive compounds can affect how genes work. Continued research on how nutraceuticals influence gene activity may help prevent diseases like obesity, diabetes, heart disease, high blood pressure, and cancer through diet.

Phytochemicals also protect against fat oxidation (lipid peroxidation) and reduce inflammation (Issa, Volate, & Wargovich, 2006). Since they have low toxicity and many benefits, they are promising in cancer prevention and treatment. However, each compound needs to be studied carefully to find which type of cancer it works best against.

The term **nutritional genomics** describes the study of how food and genes interact (DellaPenna, 1999). Some studies have begun to explore how nutraceuticals work in animals with genetic diseases (Orzechowski et al., 2002).

Besides slowing cancer growth, nutraceuticals and functional foods can help improve nutrition in patients suffering from **cancer cachexia** — a severe weight loss and weakness caused by cancer. Improving diet can help control cancer, reduce treatment side effects, and improve overall well-being (McCullough & Giovannucci, 2004).

Additionally, nutraceuticals can increase the activity of **natural killer (NK) cells** and **tumor necrosis factor (TNFα)** — two important components of the immune system that help fight cancer (See, Mason, & Roshan, 2002).

5. Main Phytochemicals Studied for Cancer Care

Plant-based chemicals, called *phytochemicals*, are grouped based on their structure, source, or biological activity. Many of these natural compounds help fight or prevent cancer.

5.1 Polyphenols

Polyphenols are natural compounds found in plants. They contain one or more *hydroxyl (–OH)* groups attached to a *benzene ring*. More than 8,000 types of polyphenols are known to exist in foods such as *tea, coffee, wine, cocoa, vegetables, and grains* (Lecour & Lamont, 2011).

Polyphenols are divided into several groups based on their structure — including *phenolic acids, flavonoids, stilbenes, and curcuminoids*. These groups are known for their ability to *block cancer initiation* and *slow cancer growth*.

5.1.1 Epigallocatechin-3-gallate (EGCG)

EGCG is the main active compound found in *green tea (Camellia sinensis)*. Regular green tea consumption, especially in Asian countries, has been linked to lower cancer rates. EGCG has shown *anti-tumor activity* in several cancer cell types, including rare cancers like *thyroid carcinoma* (De Amicis et al., 2013) and *mesothelioma* (Ranzato et al., 2012).

Most studies are *preclinical* (lab-based), so more *clinical trials* on humans are needed.

One limitation is that EGCG has *low bioavailability* — the body absorbs it poorly, and it is quickly changed into inactive forms. Also, *human metabolism of green tea compounds differs* from that of mice and rats (Clifford et al., 2013).

Genetic differences in the enzyme *COMT (catechol-O-methyltransferase)* may also affect how EGCG works in different people (Moyers & Kumar, 2004). Despite these limits, EGCG remains a *promising compound* for cancer prevention and treatment, either alone or combined with other drugs or phytochemicals.

5.1.2 Resveratrol

Resveratrol is a natural compound called a *stilbene*, commonly found in grapes, red wine, and peanuts. It acts as a *phytoalexin* — a protective substance plants produce against infection.

Resveratrol has *anti-cancer*, *anti-inflammatory*, and *anti-proliferative* effects (Singh, George, & Ahmad, 2013). One key mechanism involves activating *sirtuin proteins*, which control cell survival and aging (Nakata et al., 2012).

Clinical studies show that resveratrol is *safe and well-tolerated*, but its *absorption is very low (around 1%)* because it is quickly broken down in the body (Scott et al., 2012). Even so, it continues to attract attention for cancer prevention and therapy (Gescher et al., 2013).

5.1.3 Quercetin

Quercetin is a type of *flavonoid* found in many fruits and vegetables. Humans consume about *16–25 mg/day* through the diet (Hertog et al., 1993).

It helps cancer cells undergo *apoptosis (programmed cell death)* through various mechanisms. Animal studies have shown that quercetin can *prevent colon cancer, slow melanoma (skin cancer) growth, and reduce its spread* (Zhang et al., 2012).

Like other phytochemicals, quercetin's *low bioavailability* limits its effectiveness (Dajas, 2012).

6. Vitamins and Minerals in Cancer Management

Vitamins and minerals play an important role in protecting the body from cancer. Studies suggest that *vitamins A, C, E* and *trace elements like selenium* may help *prevent cancer* (Misotti & Gnagnarella, 2013).

Vitamin C (ascorbate) is essential for health and has been used as a natural remedy for centuries (Levine et al., 1999). Research shows that vitamin C can *kill cancer cells* by causing *cell cycle arrest*, activating *apoptosis*, and interfering with *iron uptake* in cells.

Vitamin C works as an *electron donor*, and studies suggest that its *pro-oxidant effect* may help destroy tumor cells (Ranzato et al., 2011). Current research is exploring how vitamin C can be *combined with chemotherapy drugs* for better results (Martinotti et al., 2011; Volta et al., 2013).

7. Combined Therapy: A New Promise

Even though modern chemotherapy uses targeted drugs, their *effectiveness is limited* because of the *genetic diversity of cancer cells* and *complex signaling pathways* (Komarova & Boland, 2013).

Combining several drugs often gives better results, but this can also increase *toxicity*. Hence, there's a need for *personalized treatments* that are both *effective and safe*.

Recently, scientists have been studying *nutraceuticals* as part of combination therapy. These natural compounds can work together with chemotherapy drugs to *enhance anti-cancer effects* and *reduce side effects* (Sarkar & Li, 2006).

For example, studies on *mesothelioma* showed that combining *vitamin C (ascorbate)* with *EGCG (from green tea)* and the chemotherapy drug *gemcitabine* had a *synergistic effect* — meaning they worked better together (Martinotti et al., 2011; Volta et al., 2013).

This combination, called *AND therapy (Active Nutrients/Drugs)*, caused *cell death (apoptosis)* and *cell cycle arrest*, while being safe for the human body. It worked by reducing free calcium in cells, activating *DAPK2*, suppressing *NF-κB*, and stopping cells from dividing (Martinotti et al., 2013).

These findings suggest that *combining nutraceuticals with drugs* may be a powerful way to treat cancers like mesothelioma *without increasing toxicity*.

8. Present Limitations of Nutraceuticals in Cancer

Although nutraceuticals have many benefits, they can sometimes interfere with conventional medicines.

- *Garlic* supplements can increase the effect of *blood thinners*, causing bleeding issues.
- *Ginger* and *ginkgo* can interact with *warfarin*.
- *St. John's Wort* increases the breakdown of some cancer drugs by activating *cytochrome P4503A4*.
- *Soy isoflavones* can reduce the effectiveness of *tamoxifen* (used in breast cancer).
- *Senna, cascara*, and *soluble fibers* like *guar gum* and *psyllium* can reduce the *absorption of drugs* (Fugh-Berman, 2000).

Some plant antioxidants may even *make cancer cells more resistant* to chemotherapy in advanced stages (Zhang, 2010).

Therefore, *careful monitoring* and *medical guidance* are important when using herbal or nutraceutical supplements during cancer treatment (Posadzki, Watson, & Ernst, 2013).

9. Future Directions

Nature continues to be a *rich source of cancer-fighting compounds*. Phytochemicals show many biological effects that can improve human health. The growing nutraceutical industry is developing products containing these active ingredients for cancer prevention and treatment.

Future research should focus on creating *specific dietary supplements* that help prevent or delay diseases in targeted populations. To do this, scientists need a deeper understanding of how these compounds work at the *molecular level*.

Key future research areas include:

- Using *-omics technologies* (like genomics, proteomics, metabolomics) to study how plant compounds affect the body.
- Exploring how *dietary compounds influence epigenetics* (gene regulation) and overall health.
- Identifying *biomarkers* to monitor the effects of dietary components on diseases.

With these advances, nutraceuticals could become an essential part of *future cancer prevention and care* strategies.

10. Conclusions

Cancer is becoming more common every day. As a result of their increased accessibility, phytomedicines are also becoming more and more significant. Even while certain studies have verified the favorable reaction, it is still unclear how they work. Due to their low cost and the fact that the majority of them show no signs of toxicity, nutraceuticals offer a promising supply of chemicals with chemopreventive benefits. To conduct customized clinical studies that yield reliable outcomes for the management of cancer prevention and treatment, more research is needed to identify the most crucial targets for phytochemicals.

REFERENCES

1. Andersen, V., Holst, R., & Vogel, U. (2013). Systematic review: diet-gene interactions and the risk of colorectal cancer. *Aliment Pharmacol Ther*, 37, 383-391. <http://dx.doi.org/10.1111/apt.12180>
2. Bazzan, A. J., Newberg, A. B., Cho, W. C., & Monti, D. A. (2013). Diet and Nutrition in Cancer Survivorship and Palliative Care. *Evid Based Complement Alternat Med*, 2013, 917647. <http://dx.doi.org/10.1155/2013/917647> Clifford, M. N., van der Hooft, J. J., & Crozier, A. (2013).
3. Human studies on the absorption, distribution, metabolism, and excretion of tea polyphenols. *Am J Clin Nutr*, 98, 1619S-1630S. <http://dx.doi.org/10.3945/ajcn.113.058958> Dajas, F. (2012).
4. Life or death: neuroprotective and anticancer effects of quercetin. *J Ethnopharmacol*, 143, 383-396. <http://dx.doi.org/10.1016/j.jep.2012.07.005> Danaei, G., Vander Hoon, S., Lopez, A. D., Murray, C. J., & Ezzati, M. (2005).
5. Causes of cancer in the world: comparative risk assessment of nine behavioural and environmental risk factors. *Lancet*, 366, 1784-1793. [http://dx.doi.org/10.1016/S0140-6736\(05\)67725-2](http://dx.doi.org/10.1016/S0140-6736(05)67725-2) De Amicis, F., Perri, A., Vizza, D., Russo, A., Panno, M. L., Bonfiglio, D., ... Ando, S. (2013).
6. 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> DellaPenna, D. (1999).
7. Nutritional genomics: manipulating plant micronutrients to improve human health. *Science*, 285, 375-379. <http://dx.doi.org/10.1126/science.285.5426.375> Fernandes, G. (1989).
8. The influence of diet and environment. *Curr Opin Immunol*, 2, 275-281. [http://dx.doi.org/10.1016/0952-7915\(89\)90200-8](http://dx.doi.org/10.1016/0952-7915(89)90200-8) Fugh-Berman, A. (2000). Herb-drug interactions. *Lancet*, 355, 134-138. [http://dx.doi.org/10.1016/S0140-6736\(99\)06457-0](http://dx.doi.org/10.1016/S0140-6736(99)06457-0) Gescher, A., Steward, W. P., & Brown, K. (2013).
9. Resveratrol in the management of human cancer: how strong is the clinical evidence? *Ann N Y Acad Sci*, 1290, 12-20. <http://dx.doi.org/10.1111/nyas.12205> Grimble, R. F. (2003). Nutritional therapy for cancer cachexia. *Gut*, 52, 1391-1392. <http://dx.doi.org/10.1136/gut.52.10.1391> Hertog, M. G., Feskens, E. J., Hollman, P. C., Katan, M. B., & Kromhout, D. (1993).
10. Dietary antioxidant flavonoids and risk of coronary heart disease: the Zutphen Elderly Study. *Lancet*, 342, 1007-1011. [http://dx.doi.org/10.1016/0140-6736\(93\)92876-U](http://dx.doi.org/10.1016/0140-6736(93)92876-U) Issa, A. Y., Volate, S. R., & Wargovich, M. J. (2006).
11. The role of phytochemicals in inhibition of cancer and inflammation: New directions and perspectives. *J Food Compos Anal*, 19, 405-419. <http://dx.doi.org/10.1016/j.jfca.2006.02.009> Jemal, A., Bray, F., Center, M. M., Ferlay, J., Ward, E., & Forman, D. (2011).
12. Global cancer statistics. *CA Cancer J Clin*, 61, 69-90. <http://dx.doi.org/10.3322/caac.20107> Kalra, E. K. (2003). Nutraceutical - Definition and introduction. *Aaps Pharmsci*, 5. <http://dx.doi.org/10.1208/ps050325> www.ccsenet.org/jfr Journal of Food Research Vol. 3, No. 4; 2014 24 Komarova, N. L., & Boland, C. R. (2013).
13. Cancer: calculated treatment. *Nature*, 499, 291-292. <http://dx.doi.org/10.1038/499291a> Lecour, S., & Lamont, K. T. (2011).
14. Natural polyphenols and cardioprotection. *Mini Rev Med Chem*, 11, 1191-1199. <http://dx.doi.org/10.2174/138955711804586766> Levine, M., Rumsey, S. C., Daruwala, R., Park, J. B., & Wang, Y. (1999).
15. Criteria and recommendations for vitamin C intake. *JAMA*, 281, 1415-1423. <http://dx.doi.org/10.1001/jama.281.15.1415> Martinotti, S., Ranzato, E., & Burlando, B. (2011).
16. In vitro screening of synergistic ascorbate-drug combinations for the treatment of malignant mesothelioma. *Toxicol In Vitro*, 25, 1568-1574. <http://dx.doi.org/10.1016/j.tiv.2011.05.023> Martinotti, S., Ranzato, E., Parodi, M., Vitale, M., & Burlando, B. (2014).
17. Combination of ascorbate/epigallocatechin-3-gallate/gemcitabine synergistically induces cell cycle deregulation and apoptosis in mesothelioma cells. *Toxicol Appl Pharmacol*, 274, 35-41. <http://dx.doi.org/10.1016/j.taap.2013.10.025> McCullough, M. L., & Giovannucci, E. L. (2004).
18. 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. Moyers, S. B., & Kumar, N. B. (2004).
19. 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).
20. 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). 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. (2002).
21. 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).
22. Diet and supplements and their impact on colorectal cancer. *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).

23. Cancer chemoprevention by dietary phytochemicals: promises and pitfalls. *Curr Pharm Biotechnol*, 13, 125-136. <http://dx.doi.org/10.2174/138920112798868610> Ranzato, E., Biffo, S., & Burlando, B. (2011).
24. Selective ascorbate toxicity in malignant mesothelioma: a redox Trojan mechanism. *Am J Respir Cell Mol Biol*, 44, 108-117. <http://dx.doi.org/10.1165/rcmb.2009-0340OC> Ranzato, E., Martinotti, S., Magnelli, V., Murer, B., Biffo, S., Mutti, L., & Burlando, B. (2012).
25. Epigallocatechin-3-gallate induces mesothelioma cell death via H₂O₂ -dependent T-type Ca²⁺ channel opening. *J Cell Mol Med*, 16, 2667-2678. <http://dx.doi.org/10.1111/j.1582-4934.2012.01584.x> Roudebush, P., Davenport, D. J., & Novotny, B. J. (2004).
26. The use of nutraceuticals in cancer therapy. *Vet Clin N Am-Small*, 34(1), 249-269. <http://dx.doi.org/10.1016/j.cvs.2003.09.001> Sarkar, F. H., & Li, Y. (2006). Using chemopreventive agents to enhance the efficacy of cancer therapy. *Cancer Res*, 66, 3347-3350. <http://dx.doi.org/10.1158/0008-5472.CAN-05-4526> Scott, E., Steward, W. P., Gescher, A. J., & Brown, K. (2012).
27. Resveratrol in human cancer chemoprevention--choosing the 'right' dose. *Mol Nutr Food Res*, 56, 7-13. <http://dx.doi.org/10.1002/mnfr.201100400> See, D., Mason, S., & Roshan, R. (2002). Increased tumor necrosis factor alpha (TNF-alpha) and natural killer cell (NK) function using an integrative approach in late stage cancers. *Immunol Invest*, 31, 137-153. <http://dx.doi.org/10.1081/IMM-120004804> Singh, C. K., George, J., & Ahmad, N. (2013).
28. Resveratrol-based combinatorial strategies for cancer management. *Ann N Y Acad Sci*, 1290, 113-121. <http://dx.doi.org/10.1111/nyas.12160> www.ccsenet.org/jfr Journal of Food Research Vol. 3, No. 4; 2014 25 Smith-Warner, S. A., Elmer, P. J., Sharp, T. M., Fosdick, L., Randall, B., Gross, M., ... Potter, J. D. (2000).
29. Increasing vegetable and fruit intake: randomized intervention and monitoring in an at-risk population. *Cancer Epidemiol Biomarkers Prev*, 9, 307-317. Surh, Y. J. (2003).
30. Cancer chemoprevention with dietary phytochemicals. *Nat Rev Cancer*, 3, 768-780. <http://dx.doi.org/10.1038/nrc1189> Tuomisto, J. T., Tuomisto, J., Tainio, M., Niittynen, M., Verkasalo, P., Vartiainen, T., ... Pekkanen, J. (2004).
31. Risk-benefit analysis of eating farmed salmon. *Science* 305, 476-477; author reply 476-477. <http://dx.doi.org/10.1126/science.305.5683.476> Volta, V., Ranzato, E., Martinotti, S., Gallo, S., Russo, M. V., Mutti, L., ... Burlando, B. (2013).
32. Preclinical demonstration of synergistic Active Nutrients/Drug (AND) combination as a potential treatment for malignant pleural mesothelioma. *PLoS One*, 8, e58051. <http://dx.doi.org/10.1371/journal.pone.0058051> Weisburger, J. H. (1999). Antimutagens, anticarcinogens, and effective worldwide cancer prevention. *J Environ Pathol Toxicol Oncol*, 18, 85-93. Zhang, D. D. (2010).
33. The Nrf2-Keap1-ARE signaling pathway: The regulation and dual function of Nrf2 in cancer. *Antioxid Redox Signal*, 13, 1623-1626. <http://dx.doi.org/10.1089/ars.2010.3301> Zhang, X., Chen, L. X., Ouyang, L., Cheng, Y., & Liu, B. (2012).
34. Plant natural compounds: targeting pathways of autophagy as anti-cancer therapeutic agents. *Cell Prolif*, 45, 466-476. <http://dx.doi.org/10.1111/j.1365-2184.2012.00833.x>