

## Complementary Alternative Cancer Therapies Cancer Patient Nutrition Therapies

### THE NEED FOR COMPLEMENTARY ALTERNATIVE CANCER THERAPIES

Mainstream medical treatment of cancer revolves around surgery, chemotherapy, and radiation therapy, used either alone or in combination (Isobe T et al 2005; Ostoros G et al 2005). Chemotherapy and radiation therapy cannot discriminate between cancer cells and healthy cells; thus, they damage both types of cells and cause serious and often debilitating side effects, frequently forcing patients to abandon treatment (Ettinger DS 2005; Giraud P et al 2004; Munden RF et al 2005). Therefore, it is not surprising that many cancer patients now opt to complement conventional treatments with alternative therapies that may not only temper the adverse side effects of conventional cancer therapy, but also improve its effectiveness via independent anti-cancer effects.

### WHAT ARE COMPLEMENTARY ALTERNATIVE THERAPIES?

Complementary alternative medical therapies (CAM) is a collective term for an array of remedies that lie outside what is traditionally considered conventional medical treatment for cancer. These include the use of herbal, vitamin, and nutritional supplements, as well as physical and psychological interventions such as exercise, relaxation, massage, prayer, hypnotherapy, and acupuncture (Deng G et al 2005; Hann D et al 2005; Molassiotis A et al 2005). The use of CAM as a component of integrated cancer treatment regimens may help patients reduce the side effects associated with conventional cancer treatments, alleviate symptoms, enhance immune function, and provide greater quality of (and control over) life (Deng G et al 2004, 2005).

The use of CAM is popular among cancer patients undergoing conventional treatment (Hann D et al 2005; Molassiotis A et al 2005). Over 72 million patients used complementary alternative therapies in the past year (Tindle HA et al 2005) to help control their disease. In the United States, 91 percent of cancer patients implemented at least one form of CAM in addition to undergoing conventional cancer treatment (Yates JS et al 2005). The most popular forms of CAM were exercise, relaxation, and prayer (Yates JS et al 2005).

Although most physicians acknowledge the benefits of physical and psychological CAM therapies, the role of nutritional and mineral supplements, particularly when used in conjunction with chemotherapy and radiation therapy, is an issue of considerable controversy.

### CANCER PATIENT NUTRITION: THE USE OF DIETARY SUPPLEMENTS/ANTIOXIDANTS DURING CONVENTIONAL TREATMENT

In the following section, we summarize key findings from published studies demonstrating that dietary supplements influence clinical outcomes and long-term survival, as opposed to showing only a short-term benefit:

1. Encouraging results from a clinical study have shown that the use of antioxidants during chemotherapy treatment does not compromise the treatment. In this study of lung cancer patients, supplementation with vitamin C, vitamin E, and beta-carotene did not interfere with the effectiveness of chemotherapy (Pathak AK et al 2005). In fact, recipients of chemotherapy who took antioxidants had better response rates and overall survival than those who received chemotherapy alone; however, these differences did not reach statistical significance (Drisko JA et al 2003; Pathak AK et al 2005).
2. In a study of non-small cell lung cancer patients over 60 years of age who had undergone surgery to remove their primary tumor(s), doctors compared survival in vitamin users to nonusers and measured blood folate levels as an indicator of folic acid intake. The average survival of nonusers was only 11 months, compared to 41 months for vitamin users; in other words, supplement users survived almost four times longer than did nonusers. Patients with higher blood folate levels also had improved long term survival (Jatoi A et al 1998). The Mayo Clinic researchers who conducted this study have conducted further studies with larger patient samples, and their results consistently show improved survival and quality of life in non-small cell lung cancer patients who use vitamin and mineral supplements (Jatoi A et al 2005a; Jatoi A et al 2005b).
3. Another study examined a group of transitional cell bladder cancer patients. One group was given BCG (a tuberculosis vaccine) immune-augmentation therapy plus the recommended daily allowance (RDA) of vitamins. The second BCG-treated group (the mega-dose group) received the RDA plus 40,000 IU of vitamin A, 2000 mg of vitamin C, 400 IU of vitamin E, 100 mg of vitamin B6, and 90 mg of zinc. After five years, cancer recurrence rates were 91 percent in the group that received the low-potency RDA vitamins, but only 41 percent in the mega-dose group. In this study, large doses of vitamins resulted in a 55 percent reduction in cancer recurrence (Lamm DL et al 1994).
4. Uveal melanoma is a rare form of melanoma that occurs in the iris of the eye (Tallberg T et al 2000). Nine random high-risk patients with uveal melanoma had standard conventional therapy to eradicate their primary tumors. The patients were then

put on a nutritional supplement regimen consisting of folic acid, trace minerals, amino acids, and fatty acids. After 80 months of follow-up, none of the nine patients experienced recurrent disease, compared to a similar group of patients who did not receive these supplements. Given that 100 percent of these high-risk patients were free of disease after almost seven years, the results provide further evidence of the potential value of nutritional supplementation for cancer patients (Tallberg T et al 2000).

5. Studies of breast cancer patients have shown that patients using antioxidants are less likely to suffer a recurrence or die from their cancer (Fleischauer AT et al 2003).
6. The effectiveness of 5-fluorouracil (5-FU), a chemotherapy agent used to treat breast cancer, was improved when it was administered in combination with folic acid (Kreienberg R 1998). 5-FU is also commonly used in colon, liver, and pancreatic cancers, but has not shown a high degree of efficacy (Christopoulou A 2004). A randomized trial of patients with metastatic colorectal carcinoma compared the effects of 5-FU administered alone and in combination with folic acid. Compared to the group receiving 5-FU alone, the patients receiving 5-FU plus folic acid experienced a 76 percent overall tumor reduction. Survival in the group receiving 5-FU plus folic acid was 47 percent greater than in the group receiving 5-FU alone. The addition of folic acid to this chemotherapy drug regimen resulted in an improved therapeutic profile and significantly prolonged survival time (Loffler TM et al 1992). These results are summarized in Table 1 below.

**Table 1:** Effect of folic acid on the effectiveness of 5-FU chemotherapy

	<b>5-FU</b>	<b>Folic Acid and 5-FU</b>	<b>Difference</b>
<b>Complete or partial remission</b>	9%	16%	7%
<b>Arrest of tumor growth</b>	20%	60%	40%
<b>Progression</b>	71%	24%	47%

7. Advanced cancer patients exhibit a range of defects in their immune capacity that likely contribute to an increased susceptibility to infections and disease progression (Campbell MJ et al 2005). A study of 12 advanced colorectal cancer patients sought to determine whether supplementation with vitamin E could enhance immune function. The patients received a daily dose of 750 mg (<1200 IU) of vitamin E beginning two weeks prior to intervention with chemotherapy or radiation treatment. Short-term supplementation with vitamin E led to increased white blood cell (lymphocyte) counts (CD4:CD8 ratios) and enhanced the lymphocytes' ability to produce interleukin-2 and IFN-gamma, which are required for the immune system to destroy cancer cells (Malmberg KJ et al 2002).

While all the studies mentioned above (and many others) showed the benefit of dietary supplements for cancer patients simultaneously undergoing conventional medical treatment, some studies have failed to show any benefit or have shown mixed effects from taking nutritional supplements (Lesperance ML et al 2002). In one study, high levels of folic acid supplementation were associated with greater reductions in neutrophils (a type of white blood cell); however, the same study showed that low neutrophil levels caused by chemotherapy could be improved by vitamin E supplements (Branda RF et al 2004). A preponderance of evidence supports the use of antioxidants with conventional cancer treatments (Moss RW 2006). However, cancer patients are advised to consult physicians who are experienced in both conventional cancer treatments and nutritional oncology.

### ***Prescription Antioxidants vs. Natural Antioxidants***

Proponents of dietary supplementation for cancer patients argue that the use of supplements containing multiple high-dose antioxidants before and during conventional therapy may improve treatment efficacy by increasing tumor response and decreasing normal tissue toxicity. Conventional therapy produces toxicity during treatment that can be severe enough to cause its discontinuation. Therefore, if dietary supplements can reduce the toxicity to normal cells, or increase the response of tumor cells to conventional therapy, this would represent a significant improvement over current strategies for managing cancer (Moss RW 2006).

Critics argue that antioxidant supplements should not be used with conventional free-radical-generating cancer therapies because they would protect cancer cells from death due to free-radical damage (D'Andrea GM 2005; Labriola D et al 1999). However, synthetic antioxidants available as prescription drugs reduce toxicities associated with conventional treatments. For example, amifostine, a synthetic version of the amino acid cysteine (Mehta MP 1998; Schwartz GN et al 1998), is prescribed by oncologists to reduce the toxicity of conventional treatments without compromising their effectiveness (Mehta MP 1998; Spencer A et al 2005). Mesna, another synthetic antioxidant available as a prescription drug, improves the efficacy of the anti-cancer drug ifosfamide, which would otherwise damage the urinary system (Olver I et al 2005). These prescribed, synthetic antioxidants have been investigated in many randomized, controlled clinical trials of cancer patients (Antman K et al 1993; Komaki R et al 2002).

Naturally occurring antioxidants and enzymes are often depleted in cancer patients undergoing aggressive therapies, leaving the healthy cells defenseless against free-radical damage. Therefore, it could be argued that supplementing with antioxidants does not add something foreign to the body (unless they are synthetic), but instead replaces natural substances lost as a result of treatment (Barber MD 2001; Brown TT et al 2003). Replenishing normal antioxidant levels reduces the adverse side effects associated with chemotherapy and radiation therapy (Mehta MP 1998; Olver I et al 2005), and actually improves patient outcomes (Fleischauer AT et al 2003; Malmberg KJ et al 2002; Park CH 1988; Prasad KN et al 1996). For more information on these studies, please refer to the chapters on Cancer Radiation Therapy and Cancer Chemotherapy.

## PHYSICAL AND PSYCHOLOGICAL SUPPORTIVE CAM THERAPIES

**Rehabilitation** programs for cancer patients involve a combination of physical and psychological interventions that improve the patient's physical comfort and ability to function (Pandey M et al 2001; Santiago-Palma J et al 2001). These are thought to alleviate the emotional distress caused by the patient's loss of mobility and need for self-care (Cheville AL 2005; Fialka-Moser V et al 2003).

**Acupuncture** improves cancer symptoms and treatment-related side effects such as nausea, pain, hot flashes, and breathlessness (Samuels N 2002). Indeed, the American Cancer Society recommends the use of acupuncture in cancer patients (Samuels N 2002). In a study of the use of acupuncture in cancer patients, as many as 60 percent of patients showed an improvement in their symptoms (Johnstone PA et al 2002).

**Hypnosis** improves the symptom of hot flashes (Elkins G et al 2004) and overall quality of life by reducing anxiety and insomnia in breast cancer patients (Elkins G et al 2004). Hypnosis is also recommended as an integral part of palliative care (symptom relief) for cancer patients, with a view to reducing pain and shortness of breath (Marcus J et al 2003). In addition, hypnosis improves mental health and overall well-being in cancer patients treated with radiation therapy (Stalpers LJ et al 2005).

**Breathing Exercises.** A study of cancer patients recovering from stem cell transplantation showed that following a breathing exercise program for six weeks reduced levels of fatigue (Kim SD et al 2005).

**Massage and Aromatherapy** improve the general psychological health of cancer patients and, in particular, reduce anxiety levels, pain, and nausea (Fellowes D et al 2004). Breast cancer sufferers receiving massage therapy have improved immune system function and feel less depressed and angry about their circumstances (Hernandez-Reif M et al 2005). A combination of aromatherapy, foot soaking, and reflexology improves the fatigue that is often experienced by cancer patients (Kohara H et al 2004).

**Yoga Meditation.** Kundalini yoga involves a variety of meditation techniques that are effective in alleviating anxiety, fear, anger, and depression (Shannahoff-Khalsa DS 2005). Indeed, this type of yoga helped breast and prostate cancer patients think positively about their cancers (Shannahoff-Khalsa DS 2005).

**Humor.** Laughing has always been recognized as a good relaxation and coping strategy. Scientific studies have now demonstrated that laughter is able to reduce anxiety and physical discomfort in cancer patients (Christie W et al 2005). Laughter has a beneficial effect on the immune system and improves the function of natural killer cells, which play an important role in counteracting cancer (Bennett MP et al 2003; Berk LS et al 2001; Christie W et al 2005; Takahashi K et al 2001). Laughter is also known to improve pain threshold in cancer patients and to reduce levels of stress hormones (Christie W et al 2005).

**Positive Visualization.** Adoption of hope-inspiring interventions by cancer care providers is associated with an improvement in patients' ability to cope with the fear and anxiety associated with a cancer diagnosis (Felder BE 2004; Watts S et al 2004).

**Exercise.** Various forms of exercise, including Tai Chi Chuan, improve the quality of life of cancer patients (Jones LW et al 2004; Mustian KM et al 2004) recovering from surgery or undergoing treatment. Exercise alleviated fatigue and improved heart and lung function and overall physical well-being (Dimeo FC et al 2004; Kendall AR et al 2005; Mock V et al 2005; Stevinson C et al 2004; Thorsen L et al 2005).

**Hydration.** Many cancer patients, particularly those with terminal disease, suffer from low levels of body fluids, or dehydration (Dalal S et al 2004). Artificial hydration in these patients improves dehydration symptoms (Bruera E et al 2005) and is also useful in treating chemotherapy-related diarrhea and kidney disease (Polycarpe E et al 2004; Saltz LB 2003). However, artificial hydration should be approached with caution and used according to each patient's medical condition, as it can also aggravate symptoms associated with water retention, such as edema (Morita T et al 2004; Morita T et al 2005).

### ***What You Have Learned So Far***

- Complementary and alternative therapies (CAM) represent one of the fastest-growing adjunctive cancer treatment modalities in the United States.
- The most commonly used CAM modalities include nutritional supplements, mind-body approaches, and acupuncture.
- When used properly, nutritional supplementation can enhance the effectiveness of conventional cancer treatments, boost the immune system, and improve the patient's quality of (and control over) life.
- Many cancer patients take supplemental nutrition during cancer treatment to alleviate treatment toxicities and to improve well-being.
- Synthetic antioxidants (such as amifostine), available by prescription only, are widely used by both medical and radiation oncologists to control the adverse effects of cancer treatments.

## THE IMPORTANCE OF NUTRITION DURING CANCER TREATMENT

The nutritional status of cancer patients is often compromised as a symptom of the cancer or as a side effect of conventional treatment (Usharani K et al 2004). Indeed, a significant number of patients recovering from cancer are malnourished (Guo Y et al 2005) or have suffered considerable weight loss (Colasanto JM et al 2005). The nutritional status of cancer patients has an impact on a variety of important factors, including:

- Treatment tolerance
- Survival and overall outcome
- Immune function
- Cancer development and progression.

Nutritional intervention as an integral part of cancer treatment can be implemented by eating healthy foods and taking supplements or by administration of enriched formulas through a feeding tube directly into the gastrointestinal tract (enteral) or injection into the veins (parenteral) (Hyltander A et al 2005). Enteral nutrition is always the preferred method of feeding cancer patients when the gastrointestinal tract is functional but the oral route is compromised; parenteral nutrition should be provided only to selected patients, as it is of little benefit to most cancer patients.

However, parenteral nutrition can be administered in the comfort of the patient's home and improves the long-term survival of patients with incurable advanced disease (Hoda D et al 2005). In particular, this type of artificial feeding can be useful in gynecological and colon cancer patients who often suffer from intestinal tract obstruction (McKinlay AW 2004). In a recent study comparing the different types of nutritional intervention during cancer treatment, normal oral nutrition was superior to enteral and parenteral feeding only when it was supported by nutritional counseling from a dietician (Hyltander A et al 2005).

**Treatment Tolerance.** Nutritional intervention during cancer treatment may help patients to better tolerate cancer treatment, with less frequent adverse side effects (Bahl M et al 2004; Capra S et al 2001; Read JA et al 2004). In particular, patients with nasopharyngeal cancer, when artificially fed through a tube before treatment, had less weight loss and superior recovery compared to patients who had the nutritional intervention only after treatment (Bahl M et al 2004).

**Survival and Overall Outcome.** Malnourished cancer patients are more likely to have longer periods of hospitalization, lower survival rates, and a higher frequency of medical complications (Colasanto JM et al 2005; Guo Y et al 2005). A study of stomach cancer patients recently showed that nutritional status affected the patients' quality of life, and the authors recommended increasing the number of high-protein, high-calorie meals consumed each day as a way to improve nutritional status (Tian J et al 2005).

Studies of colorectal and head and neck cancer patients have shown the beneficial effect of nutrition on survival and quality of life (Ravasco P et al 2005b; Ravasco P et al 2005a). These studies have also highlighted the importance of cancer patients having access to counseling and guidance from a dietician. In fact, these studies showed that regular foods supported by dietary counseling were more beneficial than enriched nutritional supplements taken in the absence of qualified guidance (Ravasco P et al 2005b; Ravasco P et al 2005a).

**Immune Function.** Impaired nutritional status in cancer patients is associated with reduced numbers of white blood cells (most often neutropenia) and low red blood cell counts, or anemia (Usharani K et al 2004). Administration of a specialized formula enriched with nutrients (including arginine and omega-3 fatty acids) to cancer patients before surgery reduced the occurrence of infections and time spent in the hospital (Moskovitz DN et al 2004). Because of its immunomodulatory properties, arginine helps to restore immune system balance in cancer patients after surgery (Ates E et al 2004); however, further research is necessary to define its role in the nutritional care of cancer patients

Delays in the healing of surgical wounds—or a complete failure of the wounds to heal—often complicates the rehabilitation of malnourished cancer patients after surgery (Farreras N et al 2005). Artificial nutrition of gastric cancer patients after surgery with a formula designed to boost the immune system improves wound healing and recovery (Farreras N et al 2005).

**Cancer Development and Progression.** A study of patients with high levels of prostate-specific antigen (PSA), a widely accepted indicator of the risk of developing prostate cancer, showed that a diet of low fat and high soybean protein content induced a significant, though temporary, reduction in PSA levels (Tsutsumi M et al 2004).

## NATURAL STRATEGIES FOR BOOSTING RESISTANCE TO CANCER

### *Prevention of Cancer Development and Progression*

Natural strategies known to prevent the development and progression of cancer include:

- Calcium
- Carotenoids
- Curcumin
- Garlic
- Green and black teas
- Folic acid
- Melatonin
- Selenium
- Silymarin
- Vitamin A
- Vitamin C
- Vitamin D
- Vitamin E
- Vitamin K.

**Calcium.** In clinical studies involving more than 1000 colorectal cancer patients, calcium supplements reduced the risk of cancer recurrence (Shaukat A et al 2005). Other studies show that calcium supplements generally reduce the risk of developing colorectal cancer in the first place (Flood A et al 2005; Sandler RS 2005). This beneficial effect of calcium was noted for calcium obtained from both dietary sources and nutritional supplements (Flood A et al 2005).

**Carotenoids.** Clinical studies have found that supplementing with lycopene, a carotenoid that is abundant in tomatoes and tomato-based products, can protect against cancers of the prostate (Campbell JK et al 2004; Jian L et al 2005; Kucuk O et al 2002), colon (Nair S et al 2001), pancreas (Nkondjock A et al 2005), ovaries (Huncharek M et al 2001), breast (Toniolo P et al 2001), and bladder (Schabath MB et al 2004).

According to the American Journal of Clinical Nutrition, individuals seeking broad spectrum colon protection should also include foods rich in lutein (another type of carotenoid) in their diet (Slattery ML et al 2000). These include spinach, broccoli, lettuce, tomatoes, oranges, carrots, celery, and greens.

**Curcumin,** extracted from the spice turmeric, has preventive and therapeutic anti-cancer properties (Aggarwal BB et al 2003; Sharma RA et al 2004).

Curcumin can stop the growth of cancers of the prostate (Dorai T et al 2000; Dorai T et al 2004), colon (Narayan S 2004), and breast (Inano H et al 2000).

In a phase I clinical study of colorectal cancer patients, curcumin in doses of up to 3.6 grams a day improved some clinical markers and was not associated with any toxicities (Sharma RA et al 2004). Clinical studies have shown that curcumin in doses of up to 10 grams a day had no adverse effects in humans (Aggarwal BB et al 2003).

**Garlic** has long been known to have anti-cancer properties (Das S 2002; Khanum F et al 2004) due to its ability to disrupt the function of cancer-causing agents (Das S 2002).

Garlic consumption lowers the risk of developing a range of cancers, including those of the stomach, colon, mammary glands, cervix (Khanum F et al 2004; Sengupta A et al 2004), and prostate (Hsing AW et al 2002). Garlic-derived allitridum, taken in combination with selenium, protects against the development of gastric cancer (Li H et al 2004).

Various other garlic extracts, including aged garlic extract, allicin, and ajoene, have a range of cancer-preventive and therapeutic capabilities (Oommen S et al 2004; Tanaka S et al 2004; Xu B et al 2004).

**Green and Black Teas.** Catechins and theaflavins, compounds found in green and black teas, have anti-cancer properties (Yang CS et al 2005).

Clinical studies have shown that consuming five or more cups a day of green tea reduces the risk of developing breast cancer, and may help reduce the risk of recurrence in breast cancer survivors (Seely D et al 2005).

Consumption of green tea also significantly improves the survival of ovarian cancer patients (Zhang M et al 2004) and reduces the risk of developing cancers of the lung, breast, and prostate (Bonner MR et al 2005; Doss MX et al 2005).

Such is the strength of data demonstrating green tea's potential in preventing cancer that Japanese researchers are trying to develop a strategy, based on green tea consumption, for delaying cancer onset in the Japanese population, as well as reducing the risk of recurrence in cancer survivors (Fujiki H 2005).

**Folic Acid.** The use of folic acid dietary supplements, or the adoption of diets rich in fruits and vegetables containing folate, is associated with a reduced risk of developing cancer, particularly colorectal (Martinez ME et al 2004; Strohle A et al 2005) and lung cancers (Shen H et al 2003). Sufficient intake of folic acid is also thought to protect against breast cancer (Zhang SM 2004) because folic acid guards against DNA damage and promotes gene stability (Strohle A et al 2005).

**Melatonin.** The hormone melatonin, produced by the pineal gland during night-time hours, has anti-cancer properties (Anisimov VN 2003; Sainz RM et al 2005).

The use of melatonin (20 mg a night) during chemotherapy improves survival and quality of life in lung cancer patients (Lissoni P et al 2003). Melatonin also reduces the growth potential of prostate and breast cancer cells (Sainz RM et al 2005; Shiu SY et al 2003).

Further evidence supporting melatonin's role as a cancer-preventive agent comes from studies showing an elevated risk of breast cancer in night-shift workers and others who have lower levels of melatonin due to the disruption of their waking and sleeping cycles (Anisimov VN 2003). Interestingly, blind people, who generally have higher melatonin levels, have lower rates of cancer (Coleman MP et al 1992; Feychting M et al 1998).

**Selenium** supplements have cancer-preventive properties (Combs GF, Jr. 2005), particularly in reducing the occurrence of lung, colorectal, esophageal, and prostate cancers (Mark SD et al 2000). Indeed, low selenium levels are associated with a four- to fivefold increase in the risk of developing prostate cancer (Brooks JD et al 2001). Higher selenium levels are associated with a reduced risk of prostate cancer (Brooks JD et al 2001). Because selenium levels decline with age, selenium supplements may be of particular benefit to elderly men (Brooks JD et al 2001).

However, the benefits of selenium supplements in preventing cancer appear to be cancer-specific, as some clinical studies have shown supplementation to be ineffective in protecting against basal and squamous cell carcinomas of the skin (Clark LC et al 1996). Indeed, selenium supplements may increase the risk of squamous cell carcinoma (Duffield-Lillico AJ et al 2003b).

In addition to their cancer-preventive potential, selenium supplements may enhance the effectiveness of conventional chemotherapy treatment (Vadgama JV et al 2000) and improve quality of life for patients undergoing radiation therapy (Hehr T et al 1997).

**Silymarin**, a milk thistle extract, demonstrates anti-cancer properties against prostate cancer cells and may be useful in preventing and treating prostate cancer (Singh RP et al 2004; vis-Searles PR et al 2005).

**Vitamin A** derivatives, known as retinoids, protect against the development of various cancers, including those of the skin, breast, and lung (Clarke N et al 2004; Khera P et al 2005). Dietary supplementation with synthetic vitamin A for 12 months in liver cancer survivors prevented recurrence of this cancer (Takai K et al 2005). In addition to preventing cancer, vitamin A derivatives have been used to cure acute promyelocytic leukemia (Clarke N et al 2004).

**Vitamin C.** Long-term human studies have shown that vitamin C dietary supplements, when used in conjunction with other antioxidants, can reduce the risk of developing cancer (Herberg S et al 2004). Similar results were found for cancers of the prostate (Meyer F et al 2005) and lung (Mooney LA et al 2005; Wright ME et al 2004).

**Vitamin D.** Moderate sun exposure causes the synthesis of vitamin D in the skin. This micronutrient is known to play a role in cancer prevention (Holick MF 2004; Kimlin MG et al 2004). Indeed, medical literature dating back more than 50 years affirms that regular sun exposure is associated with a substantial decrease in death rates from certain types of cancers (Ainsleigh HG 1993). It is estimated that moderate sun exposure without sunscreen—that is, enough to stimulate vitamin D production but not enough to damage the skin—could prevent 30,000 cancer deaths in the United States each year (Ainsleigh HG 1993). The sun's most damaging rays occur between 10 a.m. and 3 p.m., the hours demanding the greatest watchfulness.

Insufficient vitamin D levels are particularly associated with increased risk of developing breast, colon, and prostate cancers (Chen TC et al 2003; Studzinski GP et al 1995). Increased vitamin D levels, obtained through sun exposure, are associated with a reduced risk of non-Hodgkin's lymphoma (Hughes AM et al 2004). Vitamin D causes bones to release calcium and can thus lead to

excessively high calcium levels (hypercalcemia); however, scientists are developing synthetic versions of natural vitamin D (deltanoids) that lack this adverse side effect (Agoston ES et al 2006; Guyton KZ et al 2003).

**Vitamin E.** Clinical studies have shown that vitamin E can reduce the risk of prostate and lung cancers, particularly when used in combination with selenium supplements (Helzlsouer KJ et al 2000; Woodson K et al 1999). Regular and long-term (over 10 years) use of vitamin E reduces the risk of death from bladder cancer (Jacobs EJ et al 2002). Similarly, the use of vitamin E supplements for longer than three years slightly reduces the risk of recurrence among breast cancer survivors (Fleischauer AT et al 2003).

In addition, animal studies indicate that vitamin E may have activity against colon cancer and melanoma (Barnett KT et al 2002; Malafa MP et al 2002b; Malafa MP et al 2002a).

Larger clinical studies are currently underway to further assess vitamin E's protective role against prostate cancer (Fleshner N et al 2005; Lippman SM et al 2005).

**Vitamin K** has been shown in laboratory and animal studies to have anti-cancer properties (Lamson DW et al 2003). Results from a small clinical study indicate that vitamin K may protect women with viral liver cirrhosis, a known risk factor for liver cancer, from developing the disease (Habu D et al 2004).

## PREVENTING TUMOR SPREAD (ANGIOGENESIS, INVASION, AND METASTASIS)

Natural strategies that arrest the spread of tumors include:

- Alpha tocopherol
- Curcumin
- Green tea
- Pomegranate extracts
- Soy (genistein).

**Alpha-Tocopherol** supplementation, which provides the biological activity of vitamin E, reduces levels of vascular endothelial growth factor (VEGF), a tumor growth factor that plays a critical role in the formation of new blood vessels by cancer cells and subsequent tumor invasion of other organs (Woodson K et al 2002). Indeed, levels of this cancer growth factor decreased by 11 percent in the supplemented group but increased by 10 percent in the non-supplemented group (Woodson K et al 2002).

**Curcumin** is known to arrest the growth of established cancer (Furness MS et al 2005) by interfering with the production of growth factors that cancer cells need to establish new blood vessels and thus invade other organs, a process known as angiogenesis (Arbiser JL et al 1998; Dulak J 2005; Furness MS et al 2005).

**Green Tea.** Epigallocatechin in green tea has long been known to have cancer-preventive properties (Cooper R et al 2005). Epigallocatechin prevents cancer cells from forming new blood vessels and thereby spreading to other organs (Jung YD et al 2001).

**Pomegranate Extract.** A laboratory study has demonstrated that extracts of the pomegranate fruit can prevent human prostate cancer cells from invading new tissues (Albrecht M et al 2004).

**Soy (Genistein).** Present in soy, genistein prevents any cancer cells that persist after surgery from invading new organs and spreading (Vantuyghem SA et al 2005). This potential to arrest the spread of cancer is linked to genistein's ability to reduce production of the growth factor VEGF, a prerequisite for cancer spread and invasion (Ravindranath MH et al 2004).

## ENHANCING THE IMMUNE SYSTEM

A range of CAM therapies have been shown to boost immune function in cancer patients. These include:

- Fermented wheat germ
- Garlic
- Herbal medicines
- Mushroom extracts
- Immunonutrition
- Melatonin
- Probiotic bacteria
- Relaxation techniques

- Vitamin E.

**Fermented Wheat Germ.** Neutropenia, a condition characterized by low numbers of white blood cells known as neutrophils, is a complication of chemotherapy that leaves patients dangerously susceptible to infections (Mego M et al 2005). Supplementing with fermented wheat germ extract during conventional treatment reduces the occurrence of neutropenia (Garami M et al 2004).

**Garlic** supplementation boosts immune function in cancer patients (Patya M et al 2004) by improving the function of natural killer cells and lymphocytes (Hassan ZM et al 2003; Patya M et al 2004; Tang Z et al 1997).

**Herbal Medicines** such as echinacea, ginseng, and astragalus strengthen the immune system and may be beneficial to cancer patients (Block KI et al 2003; Suh SO et al 2002). Indeed, red ginseng boosts the immune system of gastric cancer patients undergoing chemotherapy after surgery (Suh SO et al 2002). Patients taking red ginseng had significantly higher overall survival (76 percent) than non-supplementing subjects (39 percent) at five years (Suh SO et al 2002).

**Mushroom Extracts** increase the activity of natural killer cells in gynecological cancer patients undergoing chemotherapy (Ahn WS et al 2004). A *Ganoderma lucidum* polysaccharide extract known as ganopoly (1800 mg, three times daily before meals for 12 weeks) boosted natural killer cell numbers in advanced-stage cancer patients (Gao Y et al 2003).

In a randomized, double-blind, placebo-controlled study of 68 patients with advanced (stage III or IV) non-small cell lung cancer, polysaccharide peptides (PSP) isolated from the mushroom *Coriolus versicolor* (340 mg, three times daily for four weeks) significantly improved blood leukocyte and neutrophil counts, serum IgG and IgM, and percentage of body fat compared to the control group (Tsang KW et al 2003).

In a case series of eight patients with various cancers (mostly stage II-IV), a combination of maitake mushroom (*Grifola frondosa*) MD-fraction and whole maitake powder resulted in a positive response in 23 of 36 cancer patients. Cancer regression or significant symptom improvement was observed in 69 percent of breast cancer patients, 63 percent of lung cancer patients, and 58 percent of liver cancer patients. The study found a less than 10 percent to 20 percent improvement in leukemia, stomach cancer, and brain cancer patients. In addition, when maitake was taken in addition to chemotherapy, immune-competent cell activities were enhanced 1.2 times to 1.4 times compared to chemotherapy alone (Kodama N et al 2002).

**Immunonutrition.** Patients who undergo surgery to remove a tumor mass often suffer depressed immune systems following surgery, which slows their recovery and leaves them vulnerable to infection (Ates E et al 2004). Different forms of nutrition designed to boost the immune system assist the recovery of cancer patients after surgery (Ates E et al 2004; Braga M et al 2002; Song JX et al 2002). For example, patients administered nutrients containing fatty acids (with the aid of a feeding tube directly into the stomach) have a more rapid recovery of immune cell numbers (Ates E et al 2004). Oral supplements enriched with arginine and omega-3 fatty acids improved immune recovery and reduced infection rates (Braga M et al 2002; Song JX et al 2002).

**Melatonin** is a hormone with immune regulatory activities. Most cancer patients have low levels of melatonin (Bartsch C et al 1999). Melatonin supplements (10 mg a day) improve immune function in patients suffering from a variety of cancers, including gastric, renal, prostate, and bladder cancers, without any apparent adverse effects (Neri B et al 1998). Clinical studies support melatonin's value, demonstrating that supplements of 20 mg a day can improve immune function in cancer patients, predominantly by enhancing the immunity driven by the two chief anti-tumor messengers, interleukin-2 and interleukin-12 (Lissoni P 2000, 2002).

**Probiotic Bacteria.** When cancer patients with neutropenia (low neutrophil counts) exhibit symptoms of infection such as fever, the condition of neutropenia is referred to as febrile neutropenia (Mego M et al 2005). The movement of bacteria through the intestinal lining is partly responsible for febrile neutropenia (Mego M et al 2005). Interestingly, scientists have demonstrated that colonizing the intestine with friendly probiotic bacteria reduced (by virtue of competition) infection from febrile neutropenia-causing bacteria (Mego M et al 2005).

**Relaxation Techniques.** Perhaps not surprisingly, clinical studies have now shown that humor and laughter have a positive effect on the immune system, characterized by increased numbers of natural killer cells (Bennett MP et al 2003; Berk LS et al 2001; Christie W et al 2005; Takahashi K et al 2001).

Other techniques such as massage and meditation that are designed to foster relaxation also improve immune system function in cancer patients (Hernandez-Reif M et al 2004, 2005; Hilderley M et al 2004). In fact, breast cancer patients participating in a massage therapy program had increased numbers of natural killer cells and lymphocytes (Hernandez-Reif M et al 2004, 2005).

**Vitamin E.** Short-term supplementation with high-dose (750 mg) vitamin E increases both the number and activity of lymphocytes in patients with advanced colorectal cancer (Malmberg KJ et al 2002). In addition, supplementation with vitamin E during chemotherapy reduces the loss of white blood cells (neutropenia) that is associated with chemotherapy (Branda RF et al 2004).

## NATURAL STRATEGIES FOR ALLEVIATING CANCER SYMPTOMS

A range of complementary strategies are known to improve symptoms experienced by cancer patients.

**Anxiety, Depression, and Stress.** The use of aromatherapy and massage is effective in alleviating depression, anxiety, and stress in cancer patients and has a positive effect on quality of life (Cassileth BR et al 2004; Soden K et al 2004). Undergoing 30-minute massage sessions three times a week for five weeks reduces hostility and anger in cancer patients (Hernandez-Reif M et al 2004). In addition to massage, progressive muscle relaxation alleviates depression and anxiety in cancer patients (Hernandez-Reif M et al 2005).

The use of acupuncture, hypnosis, and exercise reduces stress and anxiety (Samuels N 2002; Stalpers LJ et al 2005; Thorsen L et al 2005).

Laughter and humor are also known to improve mood and combat depression in cancer patients (Bennett MP et al 2003; Christie W et al 2005; Takahashi K et al 2001). This improvement in mood is accompanied by quantifiable improvements in immune system and hormonal factors that influence overall well-being (Berk LS et al 2001; Christie W et al 2005; Takahashi K et al 2001).

Emotional support from a spouse reduces depression and improves quality of life in cancer patients (Ohara-Hirano Y et al 2004). Dietary supplementation with the amino acid L-carnitine in cancer patients has been effective in treating depression (Cruciani RA et al 2004).

**Nausea and Vomiting.** Acupuncture and finger acupressure are effective in overcoming treatment-induced nausea and vomiting (Collins KB et al 2004; Klein J et al 2004; Shin YH et al 2004). Electro-acupoint stimulation and hypnotherapy also reduce the frequency and intensity of nausea in cancer patients (Gan TJ et al 2004; Deng G et al 2004).

**Poor Appetite/Cachexia.** Advanced cancer is often accompanied by a condition of muscle wasting referred to as cachexia or catabolic wasting (Barber MD 2001; Brown TT et al 2003). Metabolic imbalances caused by the disease, which include the overproduction of inflammatory factors, lead to the loss of appetite and the excessive breakdown of fat and muscle (Barber MD et al 2001). This wasting condition is associated with diminished quality of life and shorter survival (Barber MD 2001; Brown TT et al 2003).

Dietary supplementation with fish oils (omega-3 fatty acids) counteracts the inflammatory factors and reverses the weight loss associated with cachexia (Barber MD 2001; Brown TT et al 2003; Fearon KC et al 2003). Stabilization of this condition with fish oil supplements also leads to enhanced quality of life (Bruera E et al 2003; Burns CP et al 2004; Fearon KC et al 2003). For more information, refer to the chapter on Catabolic Wasting.

**Lymphedema.** Lymphedema, a condition characterized by excessive swelling and retention of water under the skin, often afflicts cancer patients, particularly after radiation therapy and surgery (Ashikaga T et al 2002; McNeely ML et al 2004).

Natural strategies known to be somewhat helpful in alleviating this condition include compression bandaging, which reduces the size of the swollen area, and manual massage of the draining lymph nodes, which may alleviate mild cases of lymphedema (McNeely ML et al 2004; Mortimer PS 1997). The use of selenium may improve the benefits of physical therapies such as massage and compression (Bruns F et al 2003).

**Sexual Dysfunction.** Cancer patients, in particular those with prostate cancer, often experience sexual dysfunction, or impotency, usually as a complication of their treatment (Burnett AL 2005; Jayne DG et al 2005; Turner SL et al 1999). Sexual dysfunction is also associated with surgery for bladder and colorectal cancer, and with chemotherapy agents that damage the ovaries (Jayne DG et al 2005; Molina JR et al 2005).

Sexual dysfunction in prostate cancer patients can be successfully managed by the use of Viagra® (Incrocci L et al 2003a; Incrocci L et al 2003b). However, some alternative therapies are also effective in managing sexual dysfunction.

Clinical studies have shown that oral supplements of L-glutamine and yohimbine, a plant extract, can improve erectile dysfunction (Lebret T et al 2002). Another dietary supplement known as ArginMax™, which contains a combination of ginseng, ginkgo, L-arginine, multivitamins, and minerals, improves erectile dysfunction (Ito T et al 1998, 2001). A nutritional supplement known as Kyo-Green® has also been shown to improve sexual dysfunction (Lau BH et al 2003).

**Hair Loss.** A mushroom extract, originally concocted for use as an immune system booster, improves alopecia (hair loss), a condition associated with the use of conventional cancer treatments (Ahn WS et al 2004). Animal studies have also shown that

supplementing with the antioxidant N-acetylcysteine can also protect against hair loss during conventional cancer treatments (D'Agostini F et al 1998).

**Fatigue.** In addition to relieving stress, dietary supplementation with the amino acid L-carnitine reduces fatigue, which can be a symptom of the cancer or a side effect of conventional treatment (Cruciani RA et al 2004). The use of L-carnitine during chemotherapy with doxorubicin has been proposed as an adjuvant therapy since 1985 (de Leonadis V et al 1985).

Acupuncture has also demonstrated effectiveness in alleviating cancer fatigue (Cohen AJ et al 2005). Cancer-related fatigue responds to a combined regimen of massage, foot soaking, and reflexology (Kohara H et al 2004). In addition, breathing exercises, conducted with the help of a healthcare provider, improves fatigue in patients recovering from stem cell transplantation (Kim SD et al 2005).

## NATURAL STRATEGIES FOR COUNTERACTING ADVERSE EFFECTS FROM CONVENTIONAL CANCER TREATMENT

Nutritional supplements known to counteract some of the negative side effects of conventional treatments are summarized in Table 2. In addition to these nutrients, physical and psychological therapies—including acupuncture, breathing exercises, massage and aromatherapy—can also improve these negative side effects (Fellowes D et al 2004; Kim SD et al 2005; Samuels N 2002). For more information, refer to the chapters on Cancer Surgery, Cancer Chemotherapy, and Cancer Radiation Therapy.

**Table 2:** Nutritional supplements known to alleviate negative side effects of conventional cancer treatment

Cancer Treatment-Related Adverse Effects	Nutritional Supplement	References
Diarrhea, neuropathy, heart complications, mucositis	Glutamine	(Daniele B et al 2001; Savarese DM et al 2003)
Mucositis, fibrosis, cardiovascular complications	Antioxidants	(Borek C 2004; Wattanapitayakul SK et al 2005)
Mucositis, anemia, cardiovascular complications	Melatonin	(Majsterek I et al 2005; Ahmed HH et al 2005; Balli E et al 2004)
Radiation-induced cell damage	Vitamin A	(Levitsky J et al 2003; Vorotnikova E et al 2004).
Neuropathy (nerve damage)	Vitamin E	(Argyriou AA et al 2005; Pace A et al 2003)
Nausea and vomiting	Ginger	(Boon H et al 2004; Sharma SS et al 1998; Manusirivithaya S et al 2004).
Nephrotoxicity (kidney damage)	Silibinin	(Bokemeyer C et al 1996)
Diarrhea	Herbal Remedies	(Mori K et al 2003; Taixiang W et al 2005)
Heart damage	CoQ10	(Portakal O et al 2000; Bandy B et al 1990; Iarussi D et al 1994).

## CLINICAL TRIALS

Numerous ongoing clinical studies are assessing the merits of different CAM therapies for cancer. Cancer patients can opt to participate in these studies or simply monitor their outcomes. The specific details and findings of these studies are subject to constant change and therefore are not provided here. Up-to-date information on ongoing clinical trials can be obtained from the National Center for Complementary and Alternative Medicine (NCCAM) at the following address:

NCCAM  
 National Institutes of Health  
 Bethesda, MD 20892  
 Email: [info@nccam.nih.gov](mailto:info@nccam.nih.gov).  
 Website: <http://nccam.nih.gov/clinicaltrials/>

### **For More Information**

Cancer patients who suffer from the aforementioned manifestations may wish to read the following chapters and design a program that addresses the full range of their cancer concerns:

- Cancer Chemotherapy
- Cancer Radiation Therapy
- Cancer Surgery
- Cancer Vaccines and Immunotherapies

- Catabolic Wasting
- Anemia, Leukopenia, and Thrombocytopenia
- Immune System Enhancement.

## LIFE EXTENSION FOUNDATION RECOMMENDATIONS

Cancer patients should consult their physicians before using any complementary alternative therapies while undergoing conventional medical treatment.

Different doses of the same nutritional supplement may be required for different applications of complementary alternative cancer therapies, such as preventing cancer, inhibiting tumor spread, enhancing/suppressing the immune system, alleviating cancer symptoms, and counteracting the side effects of conventional treatment. Cancer patients who wish to adopt a CAM approach should refer to the appropriate chapter or consult an integrative practitioner for definitive advice on appropriate doses of the nutritional supplements discussed in this chapter.

## PRODUCT AVAILABILITY

All the nutrients and supplements discussed in this section are available through the Life Extension Foundation Buyers Club, Inc. For ordering information, call anytime toll-free 1-800-544-4440, or visit us online at [www.LifeExtension.com](http://www.LifeExtension.com).

The blood tests discussed in this section are available through Life Extension National Diagnostics, Inc. For ordering information, call anytime toll-free 1-800-208-3444, or visit us online at [www.LifeExtension.com](http://www.LifeExtension.com).

## SAFETY CAVEATS

Patients should consult physicians who are qualified integrative practitioners experienced in the field of nutritional oncology.

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