

CHAPTER 26

Nutrition and Cancer Chemoprevention Within an Integrative Health Promotion Model

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INTRODUCTION

Convincing evidence is emerging that diet, exercise, and weight management can significantly influence the risk of first cancers and recurrence of cancer (Jones & Demark-Wahnefried, 2006). Health promotion efforts that address a healthy diet, regular exercise, maintenance of a healthy weight, and reduction in stress are important lifestyle approaches for cancer survivorship (Flynn & Reinert, 2010; Holmes, Chen, Feskanich, Kroenke, & Colditz, 2005; Jones & Demark-Wahnefried, 2006; Smith et al., 2009).

Excess weight and obesity have been implicated in increasing cancer recurrence rates and in the development of second tumors (Calle, Rodriguez, Walker-Thurmond, & Thun, 2003; Demark-Wahnefried, Aziz, Rowland, & Pinto, 2005). A body of evidence has identified the link between stress and immune function (Judd & Sternberg, 2009; Sternberg, 2001), and other studies have identified potential mechanisms of action and tumor biology as they relate to stress (Antoni et al., 2006). Health promotion efforts focused on healthy diet and adequate physical activity have been associated with lower levels of fatigue, increased social support, better physical functioning, and improved health-related quality of life (Alfano et al., 2009; Demark-Wahnefried et al., 2005; Jones & Demark-Wahnefried, 2006; McNeely et al., 2006).

A healthy diet, physical activity, healthy body weight, and stress management compose the requisite domains for a model of integrative health and ideally

should be considered as interrelated and interdependent goals for optimal health. This chapter will focus primarily on nutrition and chemoprevention as specific domains within a broader model of integrative health promotion and will include an application of the model in practice, the LIVESTRONG™ Week at Canyon Ranch.

CANCER PREVENTION AND SURVIVORSHIP

On July 23, 2008, four former U.S. surgeons general stood with two non-profit organizations, the Lance Armstrong Foundation and the Canyon Ranch Institute, as well as numerous other government, private, and nonprofit collaborators, to issue the *National Call to Action on Cancer Prevention and Survivorship*, or the NCTA (Cabe & Springer, 2008). The collaborators of this initiative joined forces because of the human and economic burden of cancer. As a public health crisis, cancer exacts a toll on the U.S. economy in excess of \$305 billion a year (Economist Intelligence Unit, 2009). More than 1.4 million Americans will be diagnosed with cancer each year, and at least half of those new cases can be prevented or detected earlier, when they are most treatable.

Using expertise and access to the best available science, innovations, and best practices in disease prevention and health promotion, the former U.S. surgeons general Richard H. Carmona, David Satcher, Joycelyn Elders, and Antonia Novello collaborated with experts in the cancer prevention and survivorship community to develop the NCTA. The NCTA document has since served as a roadmap for all Americans, including cancer survivors, healthcare professionals, policy makers, employers, educators, insurers, and scientists, to identify the best strategies for cancer prevention and survivorship. Table 26-1 outlines the four primary goals and subsequent strategies for action in the NCTA. This groundbreaking report emphasized empowering survivors to understand and adopt healthy lifestyles to prevent cancer and cancer recurrence. Their recommendations specifically addressed strategies for (a) nutrition for cancer prevention and survivorship, (b) appropriate health education that meets cultural and literacy competencies for consumers to understand healthy eating choices, and (c) improved access to and affordability of healthy food choices (Cabe & Springer, 2008).

The Role of Nutrition in Optimal Health

In the landmark report by Doll and Peto (1981), the authors estimated that 35% of cancers can be attributed to diet and nutrition. More recent studies have indicated that obesity or being overweight contributes to an increased risk of cancer and significantly increase the risk for cancer recurrence (Calle et al., 2003). Increased consumption of refined carbohydrates, such as fast foods and processed foods, contributes to the obesity epidemic and suggests that modern ways of processing grains have dramatically lowered the nutritional quality of

Table 26-1. National Call to Action on Cancer Prevention and Survivorship

Goal	Strategies for Action
Empower healthy lifestyles to prevent cancer.	<ul style="list-style-type: none"> • Provide resources to support innovative public and private partnerships in all settings to develop, implement, and evaluate community-based public health campaigns and media outreach to promote tobacco prevention and cessation, healthy eating, and physical activity. • Ensure that health benefit programs include coverage for evidence-based tobacco prevention and cessation services, nutrition counseling, and physical activity promotion. • Improve access to and affordability of evidence-based tobacco prevention and cessation programs, healthy foods and beverages, and safe areas for physical activity. • Enact and enforce policies to ensure that healthy food choices are provided in all settings and that physical activity options are available in all settings.
Apply what we know about cancer screening and early detection to all people.	<ul style="list-style-type: none"> • Improve health literacy about cancer screening and early detection by providing culturally competent information, health messages, and screening services. • Ensure that all people receive all recommended cancer screenings. • Ensure that cancer survivors are provided screening guidelines and are screened for recurrence of the primary cancer and development of new cancers. • Focus research strategies on advancing existing screening and early detection technologies to improve sensitivity and availability and to reduce costs.
Ensure that all people can navigate through the healthcare system.	<ul style="list-style-type: none"> • Develop and evaluate innovative, culturally competent patient navigation tools and programs that address barriers for cancer survivors, caregivers, families, friends, and people at high risk for cancer.
Provide survivorship care plans and systems of support for all cancer survivors.	<ul style="list-style-type: none"> • Ensure that cancer survivors are given a treatment summary that includes all care received, important disease characteristics, and a survivorship care plan focused on patient-centered, evidence-based standards of follow-up care. • Engage cancer survivors and caregivers as active participants in their survivorship care plans. • Ensure that survivors and their caregivers, families, and friends are empowered to access available resources. • Educate healthcare professionals and cancer survivors about the long-term care needs of cancer survivors, including pain management and palliative care, and the value of survivorship care plans. • Establish policies to balance appropriate regulatory barriers related to palliative care with the needs of cancer survivors and caregivers to ensure pain management.

Note. Based on information from Cabe & Springer, 2008.

these otherwise healthy foods (Hu, 2010). Some studies have indicated that a “Western dietary pattern,” characterized by regular consumption of processed foods, increased intake of refined flours and sugars, and low consumption of fruits, vegetables, and fiber, may be associated with higher risk of recurrence and mortality among patients with colon cancer (Meyerhardt et al., 2007). A plant-based diet is emphasized for cancer survivors including foods such as whole grains, vegetables, fruits, nuts, beans, and seeds. Highly processed foods such as soft drinks, candies, syrups, and presweetened cereals, as well as processed and red meats, especially those that are cooked at high temperatures or charred, are not favored for cancer survivors (Kushi et al., 2006).

The relationship between dietary fat and cancer continues to be a controversial topic. However, evidence is accumulating that the *quality* of dietary fat may be more important than the *quantity* of dietary fat. For example, good quality dietary fat includes sources of omega-3 fatty acids found in salmon, sardines, mackerel, herring, walnuts, and flax seeds. Other healthy sources of dietary fat include monounsaturated oils found in extra virgin olive oil and in a variety of nuts and seeds. However, store-bought, processed foods are abundant in fats such as partially hydrogenated vegetable oils (including partially hydrogenated soybean oil), which have been associated with elevated concentrations of inflammatory biomarkers (i.e., C-reactive protein) and inflammatory cytokines (i.e., interleukin-6 and tumor necrosis factor-alpha) (Esmailzadeh & Azadbakht, 2008; Teng, Voon, Cheng, & Nesaretnam, 2010). Numerous studies have illuminated the relationship between inflammation and cancer, noting that the origin of cancer is often inflammatory in nature (Balkwill & Mantovani, 2001; Coussens & Werb, 2002). In contrast, epidemiologic studies have consistently indicated that a plant-based diet abundant in fruits, vegetables, and whole grains is most effective for cancer prevention (Liu, 2004; Willett, 2000).

Nutrition and Chemoprevention for Cancer Survivorship

Nutrition is one of the cornerstones of cancer survivorship and continues to play an important role in the prevention of primary cancer recurrence and second cancers. Although a plant-based, unprocessed whole-foods diet is the optimal dietary pattern for cancer prevention and survivorship (American Cancer Society, 2010; American Institute for Cancer Research, 2010; Kushi et al., 2006), few survivors consume adequate amounts of many of these recommended foods (Demark-Wahnefried et al., 2005).

Cancer *chemoprevention* is a term that was coined in the late 1970s by Michael Sporn (Mehta, Murillo, Naithani, & Peng, 2010; Sporn, Dunlop, Newton, & Smith, 1976) and is a key concept for prevention of cancer recurrence and primary prevention of second tumors. *Chemo* refers to natural or synthetic chemical agents in foods or pharmaceutical products. When combined with *prevention*, the term *chemoprevention* refers to measures that seek to prevent, inhibit, or reverse carcinogenesis by identifying and intervening with synthetic or naturally occur-

ring entities found in the diet or environment (Theisen, 2001). Tamoxifen is an example of a synthetic/pharmaceutical chemopreventive agent. However, naturally occurring, plant-based chemopreventive agents are ubiquitous in nature and abundant in the human diet. For example, certain foodstuffs such as berries, tomatoes, broccoli, cabbage, citrus fruits, soy, and olives are just some of the chemopreventive agents found in nature that supply the body with bioactive compounds that can prevent, inhibit, or reverse the cancer process. These foods contain bioactive compounds known as *phytochemicals* (*phyto* is derived from the Greek word meaning “plant”). Phytochemicals are defined as “bioactive non-nutritive compounds in fruits, vegetables, grains, and other plant foods that have been linked to reducing chronic diseases” (Liu, 2004, p. 3479S). A product of secondary metabolism in plants, phytochemicals are used to defend plants against predators and microbial infection, and provide color and flavor to the plant (Stoner, Wang, & Casto, 2008).

More than 5,000 phytochemicals have been identified. Two of the most studied classes of phytochemicals include the phenolics and carotenoids (Liu, 2004). A number of bioactive compounds such as lycopene, sulforaphane, monoterpenes, epigallocatechin gallate, and indoles are included within these two categories and are highly concentrated in a number of different “chemopreventive” foodstuffs, including green and black tea, dark chocolate, spices, and fresh herbs. Each of these compounds provides a physiologic function in the human body. For example, cruciferous vegetables are a rich source of isothiocyanates, bioactive compounds known to interfere with the metabolism of nitrosamines. Cruciferous vegetables include broccoli, brussels sprouts, cauliflower, and cabbage.

In addition to their physiologic function, phytochemicals also provide the colorful pigments seen in a variety of fruits, vegetables, and whole grains. Because each pigment produces a specific response in the body, it is important to counsel cancer survivors to eat a “rainbow” of colors found in deep, rich-colored fruits and vegetables. It is the synergy among an array of phytochemicals that produces the chemopreventive effect (Liu, 2004; Mehta et al., 2010) and further emphasizes the importance of recommending a wide variety of foods instead of isolated compounds, nutrients, or single food items that can lead to toxicities at intakes or doses. Berries provide an abundance of nutritive and non-nutritive compounds that can affect tumor initiation and progression (Stoner, 2009). Black raspberries in particular are excellent sources of vitamins A, C, and E, magnesium, zinc, calcium, and fiber. They also contain high concentrations of ellagic acid and anthocyanins. Working together, each of these compounds has a specific role in the cancer process and can affect all stages of the carcinogenesis process, from initiation to promotion to progression (Mehta et al., 2010). Studies indicate that black raspberries modulate a number of biomarkers through various mechanisms of action, including protection against oxidative DNA damage by the scavenging of reactive oxygen species, enhancement of DNA repair, modulation of signaling pathways involved with cellular proliferation, apoptosis, inflammation,

angiogenesis, and cell cycle arrest (Mehta et al., 2010; Stoner et al., 2008). Although specific recommendations for berry consumption do not currently exist, recommending 1–2 servings out of the 5–10 recommended servings of fruits and vegetables per day is a modest recommendation for cancer survivors.

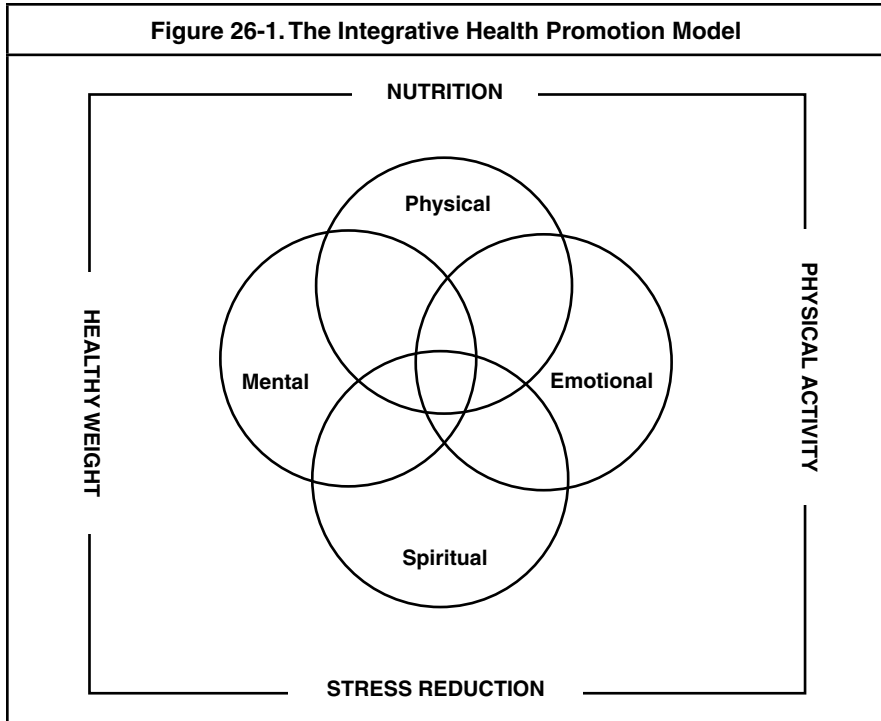
Dietary Supplements

A whole-foods approach is favored over supplement use when possible. A systematic literature review conducted by the World Cancer Research Fund and American Institute for Cancer Research (2007) analyzed 39 randomized controlled clinical trials that investigated dietary supplement use and concluded that micronutrient supplement use (e.g., vitamin C, vitamin B₆, vitamin E, selenium) is not beneficial for cancer survivors. Of warning, high-dose supplements and other isolated plant-based chemicals (beta-carotene, isoflavones) can be harmful, if not toxic, at high levels (American Institute for Cancer Research, 2010). Renewed interest exists in the awareness and importance of whole foods rather than purified compounds (Mehta et al., 2010). Even if it were feasible to identify and measure all of these compounds in a particular food, the information would be difficult to use because antioxidant compounds work in combination, and the synergistic effects are hard to predict. This further emphasizes the benefits of eating whole foods and their essential role in health promotion and disease prevention.

A Person-Centered Approach to Nutrition and Health Promotion

A multidisciplinary approach to health promotion for survivors, the Integrative Health Promotion Model, was developed by the author and Michael J. Miller, MD, of The Ohio State University Medical Center (see Figure 26-1) and represents a multimodal and person-centered approach to cancer survivorship. Through an integrative approach to care, the multidisciplinary healthcare team works together to treat and care for the whole patient. The intersection and interface among physical, mental, spiritual, and emotional health is visually presented in Figure 26-1. The overlap of these four domains creates the optimal approach to survivorship care planning and ongoing care of cancer survivors. This approach considers all of the factors that can potentially influence the risk of cancer recurrence or second tumors and the essential components in the treatment and care of patients.

Although the discussion of this chapter has focused specifically on nutrition and chemoprevention, it is important to remember that health promotion for cancer survivors is dependent on looking at the whole person. One of the basic tenets of integrative health relies on understanding that the relationship between healthcare professionals and patients is a major contributor to health outcomes (Maizes, Rakel, & Niemiec, 2009). By creating a synergy among health disciplines, the Integrative Health Promotion Model supports and empowers cancer survivors in making healthy lifestyle choices.



As depicted in Figure 26-1, alongside the four key domains of optimal health are nutrition, physical activity, healthy weight, and stress reduction. This model emphasizes the need to create synergy among the health messages provided by nurses; physicians; registered dietitians; exercise specialists; counselors; behavioral, occupational, and rehabilitation therapists; and other health professionals. Through the collaborative communication and reinforcement of health messages, the goal is to create an ideal scenario to prevent cancer recurrence and second tumors. The model further emphasizes the important role that healthcare professionals play in cancer survivors' outcomes: helping them to manage the complex balance that exists among all aspects of their physical, mental, emotional, and spiritual health.

CASE STUDY

An example of the application of the Integrative Health Promotion Model in practice is the Canyon Ranch Institute (CRI) LIVESTRONG Week, a collaborative effort between CRI and the Lance Armstrong Foundation. The week consisted of a fellowship program that provided an educational and experiential program for cancer survivors and their friends and families

to learn about and experience an integrative approach to optimizing their health for cancer prevention and survivorship. Activities included hands-on cooking classes, guided physical activity sessions, and relaxation techniques for stress management. Linda, a breast cancer survivor who was one of the CRI LIVESTRONG fellows, described her experience as transformative:

The LIVESTRONG Week at Canyon Ranch helped me in a variety of ways to make positive lifestyle changes. The integrative approach addressed many ways to care for oneself, and hopefully, prevent a recurrence. I had an opportunity to meet with experts in various fields including nutrition, exercise, meditation, and yoga. The nutritional changes I have integrated into my daily schedule include eating more fruits and vegetables, especially berries, taking fish oil and calcium citrate with vitamin D daily, limiting alcohol consumption, and eating primarily olive oil and avocados for fat intake. Exercise was an area that I really struggled with. I learned to find exercise activities that I enjoy and could integrate easily into my schedule. I also learned that even relatively small amounts of exercise make a big difference. In the past, I had felt that I wasn't doing enough so I just gave it up. It was very much an all-or-nothing approach that clearly did not work for me. I now enjoy regular walks, neuromuscular integrative action dance, yoga, and lifting free weights. I was reintroduced to meditation and have incorporated various forms of meditation into my schedule along with journal writing. I have found that meditation, journal writing, and prayer have made a big difference in managing stress and anxiety in my life. I feel grateful to have had the opportunity to learn more about integrative approaches to cancer prevention and recurrence and make them a part of my life.

In addition to the guided activity sessions, each CRI LIVESTRONG fellow received a one-on-one consultation with a multidisciplinary team of healthcare professionals including a physician, nurse, nutritionist, exercise physiologist, and behavioral therapist. It was through this integrative approach to care that the participants experienced a "whole-person" approach to care and integrative health. As outlined in the Integrative Health Promotion Model, the physical, mental, spiritual, and emotional domains of health were addressed through one-on-one and group sessions focused on the interplay among healthy nutrition, regular physical activity, effective stress management, and positive behavior change.

SUMMARY

As the five-year survival rates of cancer continue to climb, health promotion efforts play an increasingly important role in survivorship and quality of life. Although cancer survivors are motivated to make positive changes in diet

and exercise after their cancer diagnosis (Alfano et al., 2009), a number of psychosocial factors and physical conditions may create barriers to making these changes (Jones & Demark-Wahnefried, 2006). Cancer survivors require assistance in addressing these barriers in order to take responsibility for their care. According to the World Cancer Research Fund and American Institute for Cancer Research (2007) report, “the best way to improve quality of life and increase the chances of prolonged life and recovery from cancer is when cancer survivors take responsibility for themselves, supported by associates, friends, and family, while always also consulting their professional advisors and making the best use of available medical care systems and qualified social support” (p. 342).

Adopting an integrative health approach to cancer survivorship provides a multidisciplinary approach to caring for the whole person throughout survivorship. It also opens the door to successful survivorship care planning. Through this patient-centered approach to reducing risk of recurrence and second tumors, the healthcare team aims to reinforce their encouragement of cancer survivors to adopt healthy lifestyle changes in the areas of nutrition, physical activity, weight management, and stress reduction.

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