

Applied Clinical Nutrition as a Preventive and Therapeutic Tool in the Management of Cancer

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ABSTRACT

Cancer is the second leading cause of death in America. 42% of Americans living today are projected to develop cancer in their lifetime. The National Cancer Institute has invested over \$50-billion in the 32-year “War on Cancer” with a resulting increase in the incidence and death rate from cancer among Americans. Cytotoxic therapies of chemotherapy and radiation have not provided the cure for cancer that was once promised. However, nutrition is a low-cost, non-toxic, scientifically validated therapy that can help to prevent or significantly delay the onset of 40-60% of cancers, and substantially improve the quality and quantity of life for medically treated cancer patients.

INTRODUCTION

Cancer is the second leading cause of death in America. 42% of Americans living today are projected to develop cancer in their lifetime. The National Cancer Institute has invested over \$50-billion in the 32-year “War on Cancer” with a resulting increase in the incidence and death rate from cancer among Americans. Cytotoxic therapies of chemotherapy and radiation have not provided the cure for cancer that was once promised. However, nutrition is a low-cost, non-toxic, scientifically validated therapy that can help to prevent or significantly delay the onset of 40-60% of cancers, and substantially improve the quality and quantity of life for medically treated cancer patients.

Nutrition helps to change the underlying causes of cancer, thus paving the way for a long-term favorable outcome in cancer treatment. Reasons for using nutrition as part of comprehensive cancer treatment include:

- 40% or more of cancer patients die from malnutrition.
- Nutrients make chemotherapy and radiation more of a selective toxin against the cancer, thus making them less damaging to the patient.
- Nutrients improve immune function, thus helping the body in its mission to find and destroy any cancer cells that are left after treatment.
- Sugar feeds cancer. Diet and supplements can help to selectively starve cancer cells.
- Nutrients work as “biological response modifiers” in changing angiogenesis, genetic expression, prostaglandins, immune function, and many other factors. Aggressive scientifically based nutrition therapy can make the patient’s body less supportive of neoplastic growth.

A healthy human body is self-regulating and self-repairing. How do we heal from a cut? A fracture? The flu? Bacterial infections? How did we manage to survive up until the 1950s, before the age of modern medicine? The fact is, we each have a miraculous collection of nonspecific host defense mechanisms, and they are partly fueled by good nutrition.

A well-nourished cancer patient can better manage and beat the disease. A number of scientific studies have shown that there is less cachexia, or lean tissue wasting, in well-nourished patients. What exactly does well-nourished mean? A well-nourished person eats minimally processed whole foods and regularly takes dietary supplements. The majority of the food we eat should be plant foods – rich and colorful fruits and vegetables - that have undergone minimal processing and cooking. Sugar should be avoided at all cost. There are many vitamins, minerals, herbs, fatty acids, probiotics, glandulars, and food extracts that can become biological response modifiers, and thus are useful dietary supplements.

GLOBAL CANCER CRISIS

Cancer in a host is like a seed in the soil. Dr Steven Paget wrote in an article published in the Lancet in 1889, "Cancer metastasis involves a complicated biochemical conversation between the seed and the soil." In 1998, Dr Bruce Ames, wrote, "Deficiency of vitamins or minerals appear to mimic radiation in damaging DNA." What we find in the human body is a soup, like an alphabet soup. And if the right collection of nutrients is not present in that soup, what you end up with is biochemical chaos, which is cancer. Therefore, it is essentially possible to induce cancer through malnutrition. More recently we have found that cancer is like a seed, and that there is definitely a conversation going on between the seed and the soil, which is the human. The conversation is the cytokines, the cell-to-cell communication, and the signal cell transduction. This more recent knowledge led Dr Isaiah Fiddler from the MD Anderson Cancer Center to say, "The time has come to put major emphasis on the soil."

Cancer is the second leading cause of death in the US. There are currently 7 million Americans who are in remission, 8 million who are being treated, and another 1 million of those who have poor prognostic malignancies – such as glioblastoma, pancreatic cancer, liver cancer, metastatic melanoma, almost all stage 4 cancers, in which case the patient has less than a 50/50 chance or sometimes a 1% chance that they are going to live. Cancers of the prostate, lung, colon and breast comprise about 80% of all cancers. Lung cancer is the most lethal, while prostate and breast cancers are the most common.

So what is the health state of the union? America is definitely number one in terms of the amount of money we spend on our healthcare system – a staggering \$1.4 trillion each year. Yet, despite spending a colossal amount of money, the World Health Organization ranks our system at number 37. The incidence of heart disease, cancer, diabetes, and Alzheimer's is cause of great concern. The increase in the incidence of cancer we are experiencing is not due to our aging population. Yes, we are getting older, but there is a dramatic increase in cancer beyond what we can explain with the aging population.

COMMON MISCONCEPTIONS ABOUT CANCER AND NUTRITION

A common misconception held by oncologists is the belief that nutrition has nothing to do with cancer. The health of all animals and plants is heavily dependant on nutrition. The veterinarian studies nutrition intensively, and uses that knowledge to help treat a sick animal. Anyone who is a farmer knows that the nutrient content of the soil has a lot to do with the health of the plants that come out of that soil. So how is it that a cancer patient can come to an oncologist with cancer, and the oncologist says that nutrition has nothing to do with their condition? That is not true.

Another myth is that antioxidants are both expensive and will neutralize the benefits of chemotherapy and radiation. If this is the case, why are the antioxidant drugs, Amifostine, Mesna and Dextrazone used as an adjunct to chemotherapy? It is fascinating that oncologists appear to believe that a drug antioxidant is okay, whereas a nutrient antioxidant is unacceptable. In fact, both can be effective in reducing the toxic side effects of chemotherapy.

Yet another myth is that sugar has nothing to do with cancer outcome. If this is so why is a PET scan, which costs approximately \$1.5 million, considered such a valuable tool in diagnosing cancer? With the PET scan, radioactively labeled sugar is injected into the cancer patient's body, and then a Geiger counter is used to track where that radioactive sugar went, because that is where the cancer is. This is because cancer is an obligate glucose metabolizer.

TREATING CANCER IN THE 21ST CENTURY

Comprehensive cancer treatment in the 21st century should include three phases. The first phase is to change the underlying cause of the disease, and nutrition is one of those underlying causes. Number two is restrained tumor debulking. In some cases chemotherapy is appropriate, in others surgery, radiation, and many other therapies can be used to debulk the tumor. The third phase is symptom management.

It is important to understand the etiology of a disease in order to prevent or treat it. Etiology, of course, means underlying cause. Nobody with a headache has a deficiency in aspirin. And nobody with cancer has a deficiency of Adriamycin. That's not their problem. The primary etiology for most diseases is nutrition, infections, exercise, attitude, toxins, energy alignment, and genetic vulnerability.

The Surveillance Theory of Cancer

It is fairly well accepted that all of us are getting cancer all of the time. Despite this, only one-third of Americans will end up in a cancer hospital. This is because we have a number of innate mechanisms to protect us against cancer. This is the Surveillance Theory of Cancer. To support this theory there is an overwhelming amount of data showing that the incidence of a number of different cancers is increased significantly in people who take immunosuppressive drugs. Thus, we are literally sitting in the midst of a biochemical hurricane and the effects of nature are ripping the DNA apart, and it is down to the immune

system to track down and destroy rogue cells and repair damaged DNA. And if our bodies do not repair it properly, cancer is the result. Nutritional status effects this ability of self-repair and self-regulation.

Natural Healing

Many oncologists have been quoted as saying that chemotherapy may not be as effective as we had hoped. One such oncologist is Albert Braverman M.D., who went as far as saying in the *Lancet* that “Many medical oncologists recommend chemotherapy for virtually any, any tumor, with a hopefulness undiscouraged by almost invariable failure.” In spite of the available data, chemotherapy, radiotherapy, and surgery are the only reimbursable therapies in the US. In an article published in the *Journal of Clinical Oncology* Schipper *et al* concluded that they believed that the limits of the cancer-killing model have been reached, and that maybe we should be considering cancer as something that is potentially reversible. Conventional antineoplastic approaches will play a role as debulkers. The strategy will change to one of re-regulation. And that is what nutrition does – it re-regulates the body. Thus, instead of wondering how can we kill more cancer cells, we should be thinking about how our bodies heal themselves. The natural forces within us are the true healers.

The Role of the Diet and Supplementary Nutrients

It is important to consider how our diet has changed through history. Back in the Paleolithic era approximately 33% of our daily calories came from protein, compared with just 12% of modern Western man’s calories. 21% of Paleolithic man’s calories were derived from fat versus modern man’s 42%. Paleolithic man ate in excess of 100 grams of fiber a day; we eat 20 grams a day on average. We consume approximately ten times more sodium each day than Paleolithic man. The Paleolithic diet bares some similarities to The Zone Diet, the Atkins Diet, and the Protein Power Diet – it is what our ancestors ate, it is what our body adapted to eat, and we are way off.

Can nutrients reverse the cancer process? Yes. An on/off switch does not trigger Cancer, it is a continuum from black to white, and health deteriorates from anaplasia into metaplasia through a number of different phases – initiation, promotion, and progression. And if we look at the body, we find that it does its best to prevent this downward slide, or progression, into full-blown malignancy. It is also important to know that there are mechanisms in the body that are driven by nutrients, which can interrupt the process of cancer. For example, Bell *et al* conducted a study to determine whether indole-3-carbonyl (I3C) can reverse cervical intraepithelial neoplasia (CIN), a condition that progresses to neoplasia in 50% of sufferers. Results showed that there was a 50% reduction of cases of progression into cervical neoplasia among women given I3C. Meanwhile Roncucci *et al*, who studied the relationship between vitamins and colon cancer, provides us with another example of how nutrients can interrupt the process of cancer. The researchers gave patients who had had endoscopic polyps removed antioxidant vitamins or a placebo. Results showed that only 6% of the patients who got vitamins went on to develop colon cancer, compared with 36% in the placebo group.

Nutrients essentially follow a window of efficacy like anything else. Oxygen is good for you. Too much oxygen ages you. Water is good for you but a cup of water in your lungs will drown you. And nutrients have a window of efficacy above which is toxic and below which is ineffective.

THE FIVE-FOLD STRATEGY

What we have is a five-fold strategy to use nutrition as part of comprehensive cancer treatment. Number one, and most important, is to prevent or reverse malnutrition, which kills 40% of cancer patients. Number two is immune augmentation. Because the immune system is the army that is supposed to patrol the body and look for invaders like cancer and infections, and kill them and escort them out of the body. Number three is protection from toxic side effects. Adriamycin might kill cancer, but it might kill your heart also. Nutrients like coenzyme Q10 have cardioprotective effects that can reduce any damage done by chemotherapy drugs. Number four in the strategy is to selectively starve the tumor, because cancer is an obligate glucose metabolizer. Finally, we can exploit the antiproliferative effects of certain nutrients.

Immune System Augmentation

Vitamins (A, C, E, and B-6), minerals (zinc chromium, and selenium), quasi vitamins (coenzyme Q10 and fish oils), herbal supplements (Astragalus, Cat’s Claw, Pau D’arco), amino acids (arginine and

glutamine), foods (garlic, green leafy vegetables), and positive emotions can all enhance the immune system. However, the effective of the immune system can also be reduced by a number of things, including toxic metals (cadmium, mercury, lead), volatile organic chemicals, sugar, an unfavorable omega-3 to 6 ratio, negative emotions, and stress.

Protection from Toxic Side Effects

The protection that nutrients can offer from the toxic side effects of chemotherapy is one of the areas in which nutrition can marry with modern oncology and make improvements in outcome. Cancer cells are more anaerobic, glycolytic, and acidotic than normal cells. If a patient is given antioxidants, what we find is that a normal cell will absorb these nutrients much more efficiently than a cancer cell. Thus, if keep giving the patient the correct levels of antioxidants, and then begin treatment with prooxidative chemotherapy and radiotherapy, we kill more cancer cells than normal healthy cells. Nutrients never inhibit the effectiveness of chemotherapy, and often they are able to reduce the toxicity in the patient. The data is very clear on this.

For instance, Pace *et al* recently published results of a study to determine whether vitamin E could reduce the neurotoxicity caused by treatment with cisplatin, which is a highly toxic chemotherapy drug that causes neuropathy, peripheral tingling and numbness in the extremities. Participants were given six cycles of treatment with 300 milligrams of cisplatin, 14 participants were given cisplatin and a placebo, while 13 participants were given cisplatin and 300 milligrams of vitamin E. Results showed that the incidence of neuropathy among those treated with vitamin E was 30.7%, compared with an incidence of 85.7% in the placebo group. All without any reduction in the tumor kill.

Can glutathione reduce cisplatin-induced neurotoxicity in patients with gastric cancer? The answer is yes. The results of a study by Cascinu *et al* led them to conclude that glutathione is a promising and effective new drug for the prevention of cisplatin induced neuropathy, and that it does not reduce the clinical activity of chemotherapy drugs.

Jaakkola *et al* studied eighteen patients with small cell lung cancer who received chemotherapy, radiation and surgery, and nutrition therapy. Their results showed that antioxidant treatment, in combination with chemotherapy and radiation, prolonged the survival time of patients with small cell lung cancer compared to most published combination treatment regimens alone. They also found that patients receiving antioxidants were able to tolerate chemotherapy and radiation treatment well. And what they found is the bottom curve shows normal survival.

Selective Starvation of Tumors

Can we selectively starve the tumor? Maybe. It is hard to control blood sugar in cancer patients because compliance is very poor. Santisteban *et al* conducted a study whereby three groups of mice were injected with an aggressive breast tumor and then placed on three dietary regimens designed to produce three different glycemic levels – hypoglycemic, normoglycemic, and hyperglycemic. Their results showed that 95% of the animals fed a hypoglycemic diet were alive at the end of the study, compared with just 33% of those fed a hyperglycemic diet. In other words, the higher the blood glucose, the shorter the lifespan of the animal with the cancer. It is clear that regulation of blood glucose levels can be effective at slowing cancer growth.

Does fruit cause cancer? The answer is no. An eight-year-long prospective study of 48,000 males, by Giovannucci *et al* led researchers to conclude that there is an inverse relationship between the intake of fresh fruit and prostate cancer. Results showed that men who eat five or more servings of fruit per day were 47% less likely to develop prostate cancer compared with those who ate just one serving per day. It's the phytochemicals. Sugar from a soft drink is not the same as sugar from fresh papaya.

Antiproliferative Factors

Certain nutrients contain antiproliferative factors. This is an example of nutrients acting as biological response modifiers. Many nutrients have been proven to be immune regulators. They have been shown to alter the genetic expression of cancer, to alter cell membrane dynamics, improve cellular communication, regulate prostaglandins, modify energy metabolism, and so on. Antiproliferative agents modify apoptosis, or program cell death, and the body's other tumor protection mechanisms.

Can therapeutic nutrition reduce tumor recurrence? Again, the answer is yes. Lamm *et al* gave 65 patients with bladder cancer either a multivitamin, which contained levels at the recommended daily

allowance (RDA), or RDA multivitamins plus a megadose of 40,000 units vitamin A, 100 mg vitamin B6, 2,000 mg vitamin C, 400 units vitamin E and 90 mg zinc. Results showed that tumor recurrence at five-years was 80% in those given the RDA multivitamin, compared with just 40% in those given the RDA and the megadose of vitamins.

Jatoi *et al* conducted a study in post-surgical lung cancer patients to determine whether taking supplementary vitamins had any effect upon survival. Results showed that vitamin users had a longer median survival than nonusers (41 months versus 11 months). Thus, there was approximately a four-fold improvement in lifespan with nutrients.

Clark *et al* investigated the relationship between selenium supplementation and cancer incidence. For the study a total of 1312 patients with a history of basal cell or squamous cell carcinomas of the skin were treated with either 200 micrograms of selenium per day or a placebo, for approximately 4.5 years. Results showed that selenium treatment was associated with significant reductions in total cancer mortality, total cancer incidence, and incidences of lung, colorectal, and prostate cancers.

THE ROLE OF EICOSANOIDS AND HOW TO CONTROL THEM

There are a number of cellular abnormalities that may generate cancer. These include oncogenic expression, cyclooxygenase (COX) enzyme, cell replication, immune dysfunction, apoptosis, angiogenesis, signal pathway disruption, viral activation, and metastasis. All of these are controlled by a group of hormones called eicosanoids. So the question is how can we control eicosanoids? The answer is really quite simple; eicosanoids can be controlled by diet, or even more simply by the fats that we eat. The ideal ratio of omega-6 to omega-3 fatty acids would be 1:1. The average American ratio is about 15:1. The fats in our diet eventually end up as eicosanoids in the body in prostaglandin E1, E2, or E3 pathways. To say that there are bad prostaglandins may be a misnomer because there's a duality of nature. The bicep pulls the arm towards the body, and the tricep pulls it away. Sleep is a good thing. If you sleep during the day when you're driving, it's called apnea. That's a bad thing. So inflammation is a good thing if you just whacked your thumb with a hammer. A little inflammation is part of the repair and recovery process. But we don't want too much inflammation.

Omega-3 Fatty Acid Supplementation

Does omega-3 fatty acid supplementation as sole therapy improve outcome in patients with solid tumors? The answer is yes. Gogos *et al* investigated the effect of dietary omega-3 fatty acids plus vitamin E on the immune status and survival of well-nourished and malnourished cancer patients. Results showed that omega-3 fatty acids prolonged the survival of all the patients. The researchers also found that the ratio of T-helper cells to T-suppressor cells was significantly lower in malnourished patients, however Omega-3 supplementation had a considerable immunomodulating effect and significantly increased this ratio. Meanwhile, in an *in vitro* study Lai *et al* found that eicosapentaenoic acid (EPA) was able to induce apoptosis, or program cell death in pancreatic cells. Kenny *et al* found that gamma linolenic acid (GLA) improved outcome in breast cancer treatment. Patients who were given tamoxifen plus GLA had a 400% improvement in complete response. Flaxseed oil, which is a rich source of omega-3 fatty acids, has also been shown to be of benefit. Yan *et al* fed mice a basal diet or a basal diet supplemented with 2.5, 5 or 10% flaxseed for 2 weeks before and after the intravenous injection of melanoma cells. Results showed that the median number of tumors in mice fed the 2.5, 5 and 10% flaxseed-supplemented diets was 32, 54 and 63% lower than that of the controls, respectively. The flaxseed also caused a dose-dependent decrease in the cross-sectional area of the tumor and the tumor volume. The researchers concluded that flaxseed might be a useful nutritional adjuvant to prevent metastasis in cancer patients.

CONCLUSION

In conclusion, nutrition should compose an important element in any cancer treatment. The diet should contain fresh, natural foods, high in colorful vegetables, no sugar, some flesh protein, low-fat, and little or no dairy. Herbal medicine should be taken in the form of supplements, as foods, and as seasonings. One-third of the plate should be filled with lean and clean protein, another with cooked wholesome plant food, and the last one-third with fresh, raw, colorful vegetables and fruits. The human body has an extraordinary capacity to recover from some of the most advanced diseases, and nutrition plays a big role in helping the body to do that.

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