



# Your Health Matters

## Nutrition & Prostate Cancer

Natalie Ledesma, MS, RD, CSO  
Ida & Joseph Friend Cancer Resource Center  
UCSF Helen Diller Family Comprehensive Cancer Center  
University of California, San Francisco

Good nutrition may reduce the incidence of prostate cancer and help reduce the risk of prostate cancer progression. There are many studies currently being conducted that will help to further understand how diet and prostate cancer are related. Current research already shows that improved nutrition reduces risk of heart disease, diabetes, and obesity, and usually improves overall quality of life. Additionally, a healthy diet helps to increase energy levels, facilitate recovery, and enhance the immune system. It is estimated that one-third of cancer deaths in the U.S. can be attributed to diet in adulthood, including diet's effect on obesity [1]. Scientific evidence suggests that differences in diet and lifestyle may account in large part for the variability of prostate cancer rates in different countries [2]. Patients with early-stage prostate cancer choosing active surveillance might be able to avoid or delay conventional treatment for at least 2 years by making changes in their diet and lifestyle [3].

### Guidelines for a Healthy Diet

---

- Plant based diet
  - Plenty of fruits and vegetables
  - High fiber – whole grains and beans/legumes
- Low fat diet with emphasis on healthy fats
- Limit processed and refined grains/flours /sugars
- Drink plenty of fluids
- Be physically active to help achieve and/or maintain a healthy weight

### Plant Based Diet

---

A lifelong commitment to a plant based diet may lower a man's risk of developing prostate cancer and may also affect the progression of the disease. Preliminary evidence indicates dietary and lifestyle changes led to a 4% decrease in PSA and significantly decreased prostate cancer cell growth [4]. PSA increased 6% in the control group. A study assessing the recurrence of prostate cancer

\* All words with an asterisk (\*) are defined in the glossary on pages 43-44

found that a plant based diet, in combination with stress reduction may significantly slow disease progression [5]. PSA doubling time, the hallmark of recurrent prostate cancer, increased from 11.9 months (prestudy) to 112.3 months (intervention). Additionally, individuals who made comprehensive lifestyle changes improved their quality of life [6].

## Fruits and Vegetables

---

- Contain vitamins, minerals, fiber, and various cancer-fighting phytonutrients\* (examples: carotenoids, lycopene, indoles, flavonols).
- Vibrant, intense COLOR is one indicator of phytonutrient\* content.
- There is extensive and consistent evidence that high fruit and vegetable intakes are associated with decreased risks of many cancers [4-19], and while results for prostate cancer risk are not yet conclusive, they are promising [4-7, 19-26].
- Men who consumed at least 28 servings of vegetables per week had a reduced risk of prostate cancer compared with those who ate fewer than 14 servings per week [21].
- A Puerto Rican study reported that consuming 1-2 servings of fruit daily was inversely associated with prostate cancer mortality though consuming more than 2 servings of fruit daily was not associated [24].
- The risk for prostate cancer was reduced significantly in men who consumed 70.4 oz-105.6 oz (50% lower risk) and more than 105.6 oz (60% lower risk) of fruits and vegetables per week compared with men who consumed less than 70.4 oz per week [6].
- The rate of PSA rise decreased significantly with the adoption of a plant based diet [19]. Men increased their consumption of vegetables from 2.8 servings/day at baseline to 5.0 and 4.8 servings/day at 3 and 6 months, respectively.
- While vegetable and fruit consumption was not related to prostate cancer risk overall in the Prostate, Lung, Colorectal and Ovarian Cancer (PLCO) Screening Trial, the risk of extraprostatic prostate cancer (stage III or IV tumors) decreased by 59% with increasing vegetable intake [25].
  - This association was mainly explained by intake of cruciferous vegetables.
  - Additionally, there was some evidence that the risk of aggressive prostate cancer decreased with increasing spinach consumption, but the findings were not consistently statistically significant.

## *Allium Vegetables*

- Many studies indicate that in populations that consume high amounts of allium vegetables there is a reduced rate of overall cancer [20, 27-29].
  - These allium vegetables are rich in flavonoids and organosulfur compounds that have anti-cancer properties.
- A Japanese study found that men who consumed 1/3 oz. or more of one of the allium-rich foods mentioned above had approximately 50% reduction in prostate cancer risk compared with men who consumed lesser amounts [28].
- One study reported a reduced risk of prostate cancer when subjects consumed natural garlic at least twice weekly [27].

- According to the prostate cancer literature, garlic supplements do not appear to have the same beneficial effects as fresh garlic, either raw or cooked [30].
- In general, what the studies point to is that eating a whole foods, plant-based diet is better than relying on only supplements for optimum risk reduction.

### *Beta-carotene*

- Beta-carotene is only one of the 600 carotenoids that can be partially converted into vitamin A in the body.
- The benefit of fruits and vegetables in regards to cancer protection may be related to high amounts of carotenoids in certain fruits and vegetables, according to some key population studies [22, 27, 31-37].
- Some research indicates that dietary beta-carotene may reduce prostate cancer if combined with a diet rich in fruits and vegetables, and low in fat [27, 31-33].
  - A study in Japan found beta-carotene in vegetables to be significantly protective, but the effect was not observed in fruits [33].
  - Other studies, including a case-control\* study in Canada and a 30-year follow-up study, observed no association between consumption of beta-carotene and prostate cancer [32, 38].
- Plasma carotenoids were associated with lowering risk of prostate cancer, but no association was observed between carotenoids and disease progression [39].
- Beta-carotene supplements have not been shown to have any beneficial properties in regards to prostate cancer [41-43].
- Furthermore, findings from the ATBC Trial revealed a 23% increased risk of prostate cancer incidence in men who consumed 20 mg beta-carotene supplements [44].

### *Cruciferous Vegetables*

- There is some evidence that cruciferous vegetables have been associated with a reduced risk of prostate cancer [21-22, 25, 31, 45-49].
- Men who ate three or more servings of cruciferous vegetables per week had a 41% decreased risk of prostate cancer compared with men who ate less than one serving per week [21].
- Men who consumed the most cruciferous vegetables in the PLCO trial reduced their risk by 40% compared with men who ate the least cruciferous vegetables [25].
  - Men who ate >1 serving per week of broccoli and cauliflower reduced their risk by 35% and 52% compared with men who ate <1 serving per month.
- In a study with broccoli sprouts, the phytonutrient\*, sulforaphane, blocked cell growth [48].
- An animal study reported that broccoli powder reduced tumor weight by 42%, but the combination of broccoli and tomato decreased tumor weights by 52% [47].
  - Tumor growth reductions were associated with reduced proliferation and increased apoptosis\*.
- The anticancer properties of cruciferous vegetables may be due to one of its compounds, diindolylmethane (DIM). DIM may reduce the risk of prostate cancer recurrence [50].

- A formulated DIM (B-DIM) induced apoptosis\* and inhibited growth, angiogenesis\*, and invasion of prostate cancer cells [51].
- A broccoli-rich diet interacts with a gene variant (glutathione-s-transferase mu 1) to likely lower the risk of prostate cancer [52]. Perhaps this gene mutation explains some of the inconsistencies observed regarding cruciferous vegetables and prostate cancer.

### *Lycopene*

- Antioxidant\* that scavenges free radicals to reduce tissue damage. Evidence suggests that one daily serving of tomatoes or tomato products, the richest source of lycopene, helps protect against DNA damage [53].
- In western countries, tomato-based products comprise 85% of dietary lycopene [54].
- Thirty-two men with prostate cancer consumed 30 mg daily lycopene in the form of tomato sauce for 3 weeks; researchers reported a 28% reduction in oxidative DNA damage and a 17.5% decrease in PSA values [55-56].
- Men who consumed tomato sauce 2-4 times weekly had a 34% lower risk for prostate cancer in a large prospective study [37].
- Similarly, consuming tomato sauce two or more times per week decreased the risk of prostate cancer progression [57].
- Tomato sauce consumption ( $\geq 2$  servings/week vs.  $< 0.25$  servings/week) was associated with a reduced risk of total and advanced prostate cancer, although the findings were not statistically significant for advanced cancer [58].
- The European Prospective Investigation into Cancer and Nutrition (EPIC), however, reported that while lycopene was not associated with the risk of localized prostate cancer, it was inversely associated with the risk of advanced disease [59].
- In a smaller study where men consumed 30 mg dietary lycopene daily for three weeks, men had 18% lower PSA levels whereas the control group had a 14% increase in PSA levels [60].
- Ninety-five percent of the men who took a 15mg lycopene supplement daily achieved PSA stabilization, but no decline in PSA was observed [61].
  - Other studies have also observed lycopene supplementation to have no effect on PSA in men with prostate cancer [62, 63].
- Lycopene from fruits and vegetables significantly reduced the risk of prostate cancer in a recent case-control study [64].
  - Interestingly, the dual effects of dietary lycopene and green tea had a synergistic effect adding greater protection against prostate cancer.
- Similarly, an animal study reported that tomato powder reduced tumor weight by 34%, but the combination of broccoli and tomato decreased tumor weights by 52%; no effect was seen with lycopene supplementation [47].
- Mechanistically, lycopene acts to:
  - Reduce cell proliferation and increase apoptosis\* [47, 60, 65-66].
  - Inhibit IGF-I in normal prostate cells [66].

- Generally, higher blood levels of lycopene have been associated with a reduced risk of prostate cancer [32, 67-70].
- In one study, plasma levels of carotenoids, particularly lycopene, lutein/zeaxanthin, and beta-cryptoxanthin were inversely associated with prostate cancer risk.
  - Subjects in the highest quartile of plasma lycopene had a 55% lower risk of prostate cancer than those in the lowest quartile [70].
- As with most nutrients and non-nutrients, it is best to obtain lycopene from foods. Supplements appear to be capable of interfering with normal nutrition by promoting oxidative damage, which increases cancer risk [71].

Nutrient	Dietary Sources	Recommendation
Allium vegetables	Garlic, leeks, onions, scallions, and shallots	Include these vegetables daily.
Beta-carotene	Carrots, sweet potatoes, winter squash, cantaloupe, and mangos	Include these fruits and vegetables daily.
Cruciferous vegetables	Arugula, broccoli, Brussels sprouts, cabbage, cauliflower, collard greens, horseradish, kale, kohlrabi, mustard greens, radishes, rutabaga, turnips and turnip greens, and watercress	Include these vegetables daily.
Lycopene	Tomato paste (6 ½ tbsp), tomato sauce (¾ cup), tomato juice (12 oz), raw tomatoes (8 med), guava (3 ½ cups), and watermelon (4 ¼ cups)  *Note: Amounts in ( ) = 30 mg lycopene	Include 30mg dietary lycopene daily. Cooked tomato products or juices contain higher amounts of lycopene. Lycopene-rich foods are best absorbed in the presence of fat [72].

*Pomegranate (Punica granatum; Punicaceae)*

- Research suggests that pomegranate exhibits strong anti-inflammatory and antioxidant\* effects [73].
- Pomegranate seed oil and fermented juice block the cancer cells' oxygen supply, slow cell growth, and promote cell death [74].
- Pomegranate extract, rich in ellagitannins, can inhibit tumor-associated angiogenesis as one of several potential mechanisms for slowing the growth of prostate cancer in chemopreventive applications [75].
- Pomegranate extract inhibits both androgen-dependent and androgen-independent prostate cancer cell growth [76].
- Pomegranate extract inhibited nuclear factor-kappaB (NF-kappaB) activation in androgen independent prostate cancer cells [77].
- Animal data suggest that pomegranate fruit extract significantly inhibits tumor growth while also significantly decreasing PSA levels [73].

- Prostate cancer patients significantly increased PSA doubling time (mean of 54 months compared to 15 months) by consuming 8 oz pomegranate juice daily [78].
- Note that pomegranate interacts with some medications; please discuss with your healthcare provider if you use pomegranate products regularly.

### *Organic Produce*

- Organic fruits and vegetables have fewer pesticides, lower levels of total pesticides, and less overall pesticide toxicity than fruits and vegetables grown with chemicals. Although more research is needed, recent evidence indicates a significant increase in antioxidants\* in organic and sustainably grown foods versus conventionally grown foods [79-83].
  - Organic vegetables contained a greater concentration of phytonutrients\* (phenolic acids) when compared to conventionally grown vegetables [80,81].
- Consuming organic foods appears to increase salicylic acid, which may contribute to a lower risk of cancer [80].
- Choosing organic produce will help you reduce your levels of pesticide exposure and will most likely increase your phytonutrient\* consumption.
  - Although washing and peeling your non-organic fruits or vegetables may help to reduce pesticide residues, it will not eliminate them.
- Listed below are produce with the most and least pesticide contamination, both in terms of number of pesticides used and the level of pesticide concentration on an average sampling. Thus, for the fruits and vegetables shown on the most contaminated list, it is wise to buy organic. Alternatively, if organic choices are not available, you may want to consider substituting with produce that tends to contain the least amount of pesticides.

<b>Produce most contaminated by pesticides:</b>	<b>Produce least contaminated by pesticides:</b>
Peaches	Onions
Apple	Avocados
Bell Peppers	Corn
Celery	Pineapple
Nectarines	Mango
Strawberries	Asparagus
Cherries	Peas (sweet)
Kale	Kiwi
Lettuce	Cabbage
Imported Grapes	Eggplant
Carrots	Papaya
Pears	Watermelon

\*\*Adapted from Environmental Working Group – A Shopper’s Guide to Pesticides in Produce

- It is most important, however, to eat fruits and vegetables – organic or conventional. If the availability or cost of organic produce is a barrier, you may wish to avoid those fruits and vegetables that have the highest pesticide residue content.

## Fiber – A plant-based diet is naturally high in fiber

- A diet rich in natural fiber obtained from fruits, vegetables, legumes, and whole-grains (for example: whole-grain cereals and breads) may reduce cancer risk and reduce the risk of prostate cancer progression.
- Fiber binds to toxic compounds and carcinogens, which are then later eliminated from the body [84].
- Various mechanisms have been proposed for the protective effects of dietary fiber against cancer. These include:
  - ▶ Increased fecal bulk and decreased intestinal transit time, which allow less opportunity for fecal mutagens to interact with the intestinal epithelium [85].
  - ▶ Binding to bile acids, which are thought to promote cell proliferation [86].
  - ▶ Fermentation in the gut, producing short-chain fatty acids (SCFA). SCFA improve the gut environment and may provide immune protection beyond the gut [85-86].
  - ▶ Additionally, whole grains are rich in antioxidants\*, including trace minerals and phenolic compounds, which have been linked to disease prevention [86].
- A high fiber diet works to reduce hormone levels that may promote prostate cancer progression [85, 87-88].
- Some research indicates an inverse relationship between prostate cancer and dietary fiber intake [88-89] or fiber-rich foods, such as whole grains, legumes, nuts, and seeds [22, 31, 90-91].
- One study indicated that a high fiber, low-fat diet followed for only 10 days resulted in serum changes that reduced the growth of prostate cancer [88].
- Overall, the EPIC study reported no association between dietary fiber intake and risk of prostate cancer, although calibrated intakes of total fiber and fruit fiber were associated with nonstatistically significant reductions in risk [92].
- Men who ate the most legumes, a high fiber plant protein source, reduced risk by 11% and 26% of total prostate cancer and non-localized or high grade cancer, respectively when compared with men who ate the lowest amount of legumes [91].
- At the same time, a Puerto Rican study found that legume intake was not associated with prostate cancer mortality [24].
- Prostate cancer mortality is inversely associated with consumption of cereals and nuts/seeds, according to a study in the Journal of the National Cancer Institute [93].

### *Fruits*

Food	Serving Size	Fiber Grams/Serving
Apple	1 medium	3.7
Banana	1 medium	2.8
Blackberries	½ cup	3.8
Blueberries	½ cup	1.9
Cantaloupe	1 cup	1.3
Figs (dried)	¼ cup	6.0

Grapefruit	1 medium	3.4
Grapes	1 cup	1.6
Guava	1 medium	4.9
Kiwi	1 medium	2.6
Orange	1 medium	3.1
Pear	1 medium	4.0
Persimmon	1 medium	6.0
Prunes	¼ cup	3.1

*Grains & Other Products:*

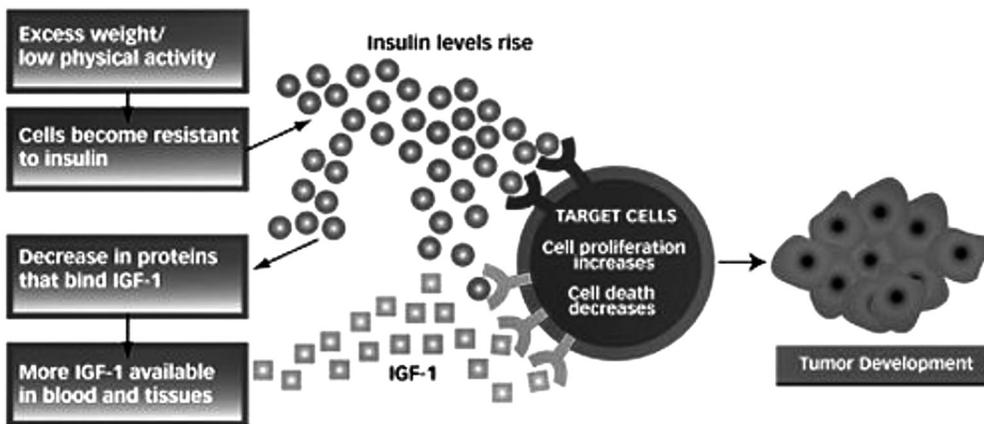
<b>Food</b>	<b>Serving Size</b>	<b>Fiber Grams/Serving</b>
Artichokes	1 medium	6.9
Beets	½ cup cooked	1.7
Broccoli	½ cup cooked	2.3
Brussel sprouts	½ cup cooked	2.0
Carrots	½ cup cooked	2.6
Kale	½ cup cooked	1.3
Lima beans	½ cup cooked	4.5
Peas, green	½ cup cooked	4.4
Spinach	½ cup cooked	2.2
Squash, winter-type	½ cup cooked	3.4
Sweet potatoes (yams)	½ cup cooked	2.7

*Vegetables:*

<b>Food</b>	<b>Serving Size</b>	<b>Fiber Grams/Serving</b>
Artichokes	1 medium	6.9
Beets	½ cup cooked	1.7
Broccoli	½ cup cooked	2.3
Brussels sprouts	½ cup cooked	2.0
Carrots	½ cup cooked	2.6
Kale	½ cup cooked	1.3
Lima beans	½ cup cooked	4.5
Peas, green	½ cup cooked	4.4
Spinach	½ cup cooked	2.2
Squash, winter-type	½ cup cooked	3.4
Sweet potatoes (yams)	½ cup cooked	2.7

## Sugar and other Refined Carbohydrates

- High sugar foods are usually highly processed and refined, low in nutrient value, and low in dietary fiber.
- Animal studies suggest that a diet high in refined carbohydrates is associated with increased prostate tumor growth [96].
- Furthermore, these foods appear to increase serum insulin\* and serum insulin-like growth factor (IGF-I) levels, which lead to both the development and promotion of cancer [97-105].
- Elevated fasting levels of serum insulin within the normal range appear to be associated with a higher risk of prostate cancer [106].
- As serum IGF-I concentration rises, the subsequent risk for prostate cancer increases [107].



INSULIN HIGH TIDE. The observed link between obesity and cancer may be explained by the growth-promoting activities of insulin and IGF-1. One theory posits that excess weight sets off a biochemical cascade that increases insulin and, in turn, IGF-1 levels. Both hormones may activate IGF-1 receptors on cells, which can spur cell growth and inhibit cell death pathways that usually protect against tumor development.

E. Roell/Source: Nature Reviews Cancer, 2004

### *Sugar and other Refined Carbohydrates – Bottom Line*

To help control your insulin level:

- Eat a high fiber diet with limited refined /processed foods
- Follow a low fat diet, rich in omega-3 fatty acids
- Exercise
- Maintain a healthy body weight

## Low Fat Diet

---

- The increased cancer risk observed in developed countries may be, in part, due to the fact that a high fat diet stimulates increased testosterone levels, which is known to be associated with prostate cancer growth [108-109].
- A comprehensive review reported that 20 of 30 studies found positive, although not all statistically significant, associations between dietary fat intake and prostate cancer risk [110].
- While a positive association between prostate cancer and fat intake was not observed in all studies [111], some prospective studies did report significant findings [112-116].
- Prostate cancer mortality has also been associated with dietary fat [117]. Strong correlations were noted for meat, added fats and oils, ice cream, margarine, salad/cooking oil, and vegetable shortening.
- Most researchers agree to aim for 20% or fewer of your total calories from fat, with less than 8% of total calories from saturated fat [118].
- The type of fat is significant and may, in fact, be of greater importance than total fat.

### *Saturated Fatty Acids*

- Several studies indicate a positive association between saturated fat intake from meat and dairy products (animal sources) and prostate cancer [34, 119-122]. Eating red meat [112, 115, 123-124] and dairy products [34, 112, 123-124] also appear to be related to an increased risk of metastatic prostate cancer.

### *Trans Fatty Acids*

- Trans fatty acids, or hydrogenated oils, are known to be atherogenic, increasing one's risk of heart disease [125-128].
- Preliminary research indicates these fats may also be associated with increased cancer risk [18, 129-130].
- A recent prostate cancer trial reported a 30% increased cancer risk in men who used margarine once or more daily [20].

### *Omega-9 Fatty Acids (Monounsaturated Fats)*

- Most research at this time indicates a neutral relationship [20, 111, 131-132], or a slightly protective effect [133-134] between these fats (and foods that are rich in these fats) and risk of prostate cancer.
- Some studies have shown nuts, generally concentrated sources of omega-9 fatty acids, to have a protective effect against prostate cancer [133].

### *Essential Fatty Acids (EFA)*

Essential fatty acids are necessary for the formation of healthy cell membranes, the proper development and functioning of the brain and nervous system, and for the production of hormone-like substances called eicosanoids\* (thromboxanes, leukotrienes, prostaglandins). Among other body functions, these chemicals regulate immune and inflammatory responses.

Eicosanoids\* formed from the omega-6 fatty acids have the potential to increase blood pressure, inflammation, platelet aggregation, allergic reactions and cell proliferation. Those formed from the omega-3 fatty acids have opposing effects. Current research suggests that the levels of essential fatty acids and the balance between them may play a critical role in the prevention and treatment of cancer.

### *Omega-6 Fatty Acids*

- Although not all studies [115, 135-137] have observed an association, a high intake of omega-6 fatty acids (linoleic acid, which can be converted to arachidonic acid) may stimulate the growth of prostate cancer cells [116, 131, 138-143].
- While overall fat intake was not associated with prostate cancer, for men with a family history of prostate cancer, total fat and omega-6 fatty acids increased the risk of prostate cancer by 247% and 261%, respectively, when comparing men in the 4th vs 1st quartile of intake [116].
- Evidence suggests that the balance between omega-6 fatty acids and omega-3 fatty acids can affect prostate tumors [140-142]. Thus, the ratio between omega-6 and omega-3 fatty acids may be of paramount importance and can be modulated by diet. It appears optimal to achieve a 1:1 to 4:1 ratio.

### *Omega-3 Fatty Acids*

- Omega-3 fatty acids [(alpha-linolenic acid (ALA), eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA)] may reduce risk for prostate cancer as well as reduce the risk of cancer progression [20, 132, 141-146].
- Mechanisms proposed for their protective effects include:
  - Induce apoptosis\* (cell death)
  - Suppress cancer cell initiation
  - Compete with arachidonic acid, which limits harm from arachidonic acid
  - Anti-inflammatory effects
  - Strengthen immune function
- In vitro and animal studies have consistently reported reduced cell proliferation and decreased rate of cancer progression with omega-3 fatty acids [142, 147-149].
- An animal study found that omega-3 fatty acids reduced prostate tumor growth, slowed tumor progression, and increased survival, whereas omega-6 fatty acids had opposite effects [143].
- Similarly, tumor growth rates, final tumor volumes, and serum PSA levels were reduced in the omega-3 group relative to the omega-6 group (mice) [149].
- Men who consumed fish, a primary source of omega-3 fatty acids, three or more times per week also had a 44% lower risk of prostate cancer, especially for metastatic prostate cancer where the effect was even greater [145].
- Similarly, consuming fish two or more times a week was also associated with a reduction in prostate cancer progression [57].
- Researchers in New Zealand reported that men with high blood levels of EPA and DHA, the omega-3 fats found in fish, had a 40% lower risk of prostate cancer than those with low blood levels [144].

- While a fish diet was associated with a lower risk of prostate cancer in this study, a meat diet increased the risk of prostate cancer [150].
- Findings of a Canadian cohort study suggested that consumption of preserved fish may reduce the risk of developing prostate cancer [151].
- A 30-year follow-up study found that men who ate no fish had a two to three times higher frequency of prostate cancer than those who ate moderate or high amounts of fish [146].
- A case-control study found that frequent consumption of fatty fish and marine fatty acids (once or more per week) reduced the risk of prostate cancer, and that the association was modified by a genetic variation in the COX-2 gene [152].
- In an ideal environment, ALA is converted to EPA and DHA; however, this process is inefficient [153-154]. On the positive side, the conversion process is enhanced by following a diet that is low in saturated fats and low in omega-6 fatty acids [155].
- Although not all studies agree [135, 156], some research indicates a positive association between ALA and prostate cancer [58, 115, 124, 137-138, 157]. It should be noted, however, that the primary source of ALA in these studies was red meat, milk, butter, mayonnaise, and margarine [115, 124, 157].

***Fat – Bottom Line***

- Less fat is better.
- Limit animal fat.
- Avoid hydrogenated fats.
- Extra-virgin olive oil, canola oil, macadamia nut oil, avocado oil, or almond oil is preferred for salads and cooking.
- Increase omega-3 fatty acids.

<b>Fatty Acid</b>	<b>Dietary Sources</b>	<b>Recommendation</b>
Saturated fatty acids	Meats, poultry skin, baked goods, and whole milk dairy products, including butter, cheese, and ice cream	Reduce or eliminate meat and whole milk dairy products.
Trans fatty acids	Margarine, fried foods, commercial peanut butter, salad dressings and various processed foods including breads, crackers, cereals, and cookies	Avoid trans or hydrogenated fats. Products may be labeled “trans fat free” if they contain less than 0.5 mg per serving.
Omega-9 fatty acids	Extra-virgin olive oil, almond oil, canola oil, macadamia nut oil, almonds, and avocados	Include these healthy fats daily. Limit consumption of nuts to no more than ¼ cup with meal or snack to limit total fat and calories.

Omega-3 fatty acids: EPA and DHA	Cold-water fish (for example: salmon, sardines, black cod, trout, herring), breastmilk, and DHA-enriched eggs	Include these healthy fats daily through diet and/or supplements.  It may be wise to consume coldwater fish or fish oil supplements at least twice weekly to obtain an adequate amount of EPA and DHA.  If you choose to use a supplement, opt for one that is highest in EPA and DHA concentration.  Avoid swordfish, shark, tilefish, and king mackerel due to high mercury levels.
ALA	Flaxseeds, chia seeds, walnuts, hempseeds, and pumpkin seeds	
Omega-6 fatty acids: Arachidonic acid	Meats, butter, egg yolks, whole milk, and whole milk dairy products	Reduce or eliminate meat and dairy products.
Linoleic acid	Common vegetable oils, such as corn oil, safflower oil, sunflower oil, and cottonseed oil, and processed foods made with these oils	Limit consumption of linoleic acid-rich oils.  Substitute an omega-9 fatty acid-rich oil for your current cooking oil or fat.

## Meat

- A meat diet was associated with an increased risk of prostate cancer [150].
  - Men who consumed  $\geq 5$  servings/week of meat had a three-fold higher risk of prostate cancer compared with men who ate 1 meat serving/week.
- Men who consumed  $\geq 5$  servings/week of processed meat had a higher risk of prostate cancer compared with men who ate  $\leq 1$  servings/week [158].
- Similarly, high consumption of red meats, particularly, cooked processed meats (sausages, bacon, hot dogs) increased prostate cancer risk among black men in a U.S. based cohort study; no association was observed among white men [159].
- While no overall association was found between meat and prostate cancer risk, well done and very well done meat consumption increased the risk of prostate cancer by 26% and 97%, respectively, when comparing the highest tertile with the lowest [160].

## Dairy

---

- Multiple studies have linked dairy consumption and prostate cancer risk [111, 158, 161-170]. Possible associations include:
  - Increasing intake of dairy foods and calcium has been positively associated with IGF-I [170-171].
  - Various studies have reported increased prostate cancer incidence with high calcium intakes [167, 169, 172-174].
  - High amounts of calcium (>2000 mg daily) suppress circulating vitamin D blood levels [166, 169, 173-174, 175].
  - Dairy protein: A large prospective trial, EPIC, reported that men who consumed a high intake of dairy protein had a 22% increased risk compared with men with the lowest dairy intake [161].
- It was estimated that an increase of 35 grams/day of dairy protein was associated with a 32% increased risk of prostate cancer.
- Calcium from dairy products was also positively associated with risk, but not calcium from other foods.
  - It used to be thought that the fat in dairy was a culprit, but several studies have linked low-fat/skim milk to prostate cancer risk [111, 164, 166, 169].
- Dairy products, milk, and yogurt significantly increased the risk of prostate cancer when comparing those who consumed the most versus the least; a 63%, 53%, and 52% increased risk, respectively [162].
  - The more dairy that men consumed, the greater the risk of prostate cancer.
- Men who consumed >2.75 servings of dairy/day had a 12% increased risk of nonaggressive prostate cancer compared with men who ate ≤ 0.98 servings of dairy/day [163].
- Milk consumption increased the risk of prostate cancer by 13% when comparing the men who drank the most versus the least amount of milk, a meta-analysis of cohort studies reported [165].
- Men who consumed 21 servings of dairy weekly, compared to men who consumed five or less weekly, more than doubled their risk of prostate cancer [169].
- Dairy and calcium were both strongly associated with risk of prostate cancer [167-168].
- While not all studies agree [176-177], the majority of research suggests an association between dairy foods/calcium and the risk of prostate cancer.

## Calcium

- Several studies suggest an association between high calcium intakes and an increased risk of prostate cancer [58, 111, 163, 166-168, 172-174, 178].
  - One analysis identified a four- to five-fold risk elevation with very high calcium (>2000 mg daily) or very low calcium intakes (<500 mg daily) [173].
  - Calcium intake of >2,000 mg/day was associated with a 34% increased risk of nonaggressive prostate cancer compared with men who consumed <1,000 mg/day of calcium [163].

- ▶ Men who consumed 1329-2250 mg of calcium/day had a 39% greater risk of prostate cancer compared to men who consumed 228-802 mg calcium/day [167].
  - ▶ Men in the ATBC Cancer Prevention Study, a cohort of smokers, who consumed  $\geq 2,000$  mg/day of calcium had a 63% increased risk compared with men who had  $< 1,000$  mg/day of calcium intake [178].
  - ▶ Findings from a prospective cohort of health professionals suggest that calcium intakes exceeding 1,500 mg/day may be associated with a decrease in differentiation in prostate cancer (higher Gleason score) and ultimately with a higher risk of advanced and fatal prostate cancer but not with well-differentiated, organ-confined cancers [174].
  - ▶ Similarly, higher calcium intakes resulted in a modest 7% increased risk of localized prostate cancer, but more than 200% increased risk for advanced prostate cancer compared to men with the lowest calcium intake [172].
  - ▶ Calcium intake increased the risk of fatal prostate cancer [58].
  - ▶ Alternatively, in the NIH-AARP Diet and Health Study, total and supplemental calcium were unrelated to total and nonadvanced prostate cancer, but calcium intake was weakly associated with advanced and fatal prostate cancer [179].
- Skim milk ( $\geq 2$  vs. 0 servings/day), in particular, significantly increased risk of advanced prostate cancer by 23%.
  - In contrast, calcium from nondairy foods was associated with a lower risk of non-advanced prostate cancer.
  - Overall, it is recommended to obtain adequate amounts of calcium in the diet, but to avoid high calcium intakes (more than 1200 mg daily).

Food Category	Summary	Recommendation
Fruits and vegetables	<p>One serving =</p> <ul style="list-style-type: none"> <li>½ cup fruit or vegetable</li> <li>1 cup raw leafy greens</li> <li>¼ cup dried fruit or vegetable</li> <li>6 oz fruit or vegetable juice</li> </ul> <p>Eat 1 cup or more vegetables with lunch and dinner</p>	<p>At least 5, preferably 8-10 total servings daily [180]</p> <p>5 or more vegetable servings</p> <p>3 fruit servings</p>
Fiber	<p>First ingredient on the label should be whole or sprouted grain flour, not white flour, unbleached white flour, or enriched wheat flour</p> <p>Choose breads with 3 or more grams of fiber per slice</p> <p>Whole grains include, among others, oats, barley, brown rice, quinoa, amaranth, bulgur, millet, buckwheat, spelt, wild rice, and teff.</p>	<p>30-45 grams daily [118]</p> <p>This goal can be achieved by meeting your fruit and vegetable goal plus one serving of legumes or at least two servings of whole grains.</p>

Refined carbohydrates and sugars	Dietary sources include products made with refined flours (for example: white bread, white rice, white pasta) or refined grains, alcohol, sodas, drinks containing added sugars, and desserts, such as candy, cookies, cakes, and pastries.	Limit or avoid consumption.
Meat	Dietary sources include beef, pork, and lamb.	Reduce or eliminate meat consumption.  Avoid processed, grilled or fried meats.
Dairy	Dietary sources include milk, cheese, yogurt, ice cream, and butter.	Reduce or eliminate dairy consumption.

## **Genotoxins: Heterocyclic Amines (HCA's) & Polycyclic Aromatic Hydrocarbons (PAH's)**

- Natural components in meat, such as amino acids, creatine\*, and polysaccharide precursors, are converted to HCA's during high-temperature cooking. HCA's are known to cause cancer in laboratory animals [181-184]. While human research is forthcoming [160, 181, 185-190], only one study has observed no association between HCA's and prostate cancer [191].
- It may be that cancer risk is heightened in people who metabolize these compounds more rapidly. Some individuals appear to have genes that encode enzyme production, which readily metabolize HCA's [185, 192].
- The type of protein cooked can also affect the concentration of HCA's. It has been reported, for example, that chicken has more than 100 times the number of HCA's than salmon [192]. London broiled steak had more than 600 times the amount of HCA's when compared to salmon.
- After adjusting for age at prostatectomy and race, grilled meat consumption was significantly associated with higher PhIP levels, a type of HCA, in tumor cells, but this association seemed to be primarily due to consumption of grilled red meats as opposed to grilled white meat consumption [189].
  - Grilled hamburger consumption had the most significant association with PhIP levels in tumor cells.
- These results are consistent with a positive association between PhIP intake and highly elevated PSA, supporting the hypothesis that dietary intervention may help reduce prostate cancer risk [190].
  - However, in this study, PhIP intake was attributable mostly to chicken (61%) and positively associated with saturated fat intake.
- Carcinogenic activity of HCA's is affected by various dietary factors [192]:
  - Factors that enhance carcinogenesis\* when combined with HCA's include:

- High-fat diet
- Caffeine
- Factors that inhibit carcinogenesis\* when combined with HCA's include:
  - DHA
  - Conjugated linoleic acid (CLA)
  - Isoflavones
  - Green tea catechins\*
  - Indole-3 carbinol
  - Probiotics
  - Gamma-tocopherol
- The most important variables contributing to the formation of HCA's are [181, 193]:
  - Cooking temperature (greater than 300°F).
  - Cooking time (greater than 2 minutes).
  - Cooking method (frying, oven grilling/broiling, barbecuing).
- Charring of food (charcoal-broiled or smoked foods) contribute to PAH's [194].
- Meat can potentially be made "safer" to eat by being cooked in a way that does not lead to the formation of these compounds.
  - Choose lean, well-trimmed meats to grill. Lean cuts cause less fat to drip onto the coals (and hence, fewer flame-ups).
  - Using marinades significantly reduces the amount of HCA's.
  - Brief microwave preheating of raw meat, for example, substantially reduces the HCA content.
  - Small portions require less time on the grill.
- Grill vegetables or meat substitutes that do not lead to the formation of HCA's or PAH's.

### *Alcohol*

- While previous studies [195] have reported no association between alcohol and prostate cancer, a recent meta-analysis found evidence that prostate cancer was indeed linked to heavier alcohol use [196].

### **Adequate Fluids**

---

- The functions of water in the body include the following:
  - Carries nutrients and waste products.
  - Participates in chemical reactions.

- ▶ Acts as a lubricant and cushion around joints.
- ▶ Acts as a shock absorber in the eyes and spinal cord.
- ▶ Aids in the body's temperature regulation.
- ▶ Maintains blood volume.
- Increased fluid intake is needed for a high fiber diet.
- Drink plenty of water daily to help meet fluid needs.

## Caloric Intake

---

- Substantial evidence indicates that a high caloric intake increases one's risk of various cancers, including prostate cancer [23, 121, 156, 172, 197-198] and fatal prostate cancer [58, 199].
- A case-control\* study reported a 115% increased risk in local prostate cancer and a 96% increased risk in regional/distant prostate cancer for those consuming higher calorie diets (2,439 or more calories/day) compared with individuals consuming a lower calorie diet (less than 1,322 calories/day) [172].
- In a separate study, researchers reported a nearly four-fold increase in prostate cancer risk in men who consumed the most calories (more than 2,624 calories/day) compared with men who consumed the least calories (1,064 calories/day) [198].
- An earlier study found that caloric intake was positively associated with preclinical prostate cancer risk; as caloric intake increased, cancer risk rose significantly [121]. The greatest risk was for men who consumed more than 3,475 calories/day.
- The mechanism involved may be related to the decrease in IGF-I observed when caloric intake is restricted [121, 200].
- Dietary restriction reduced serum concentrations of IGF-I by 35% in rats, which contributes to reduced VEGF expression and inhibited tumor angiogenesis associated with prostate tumorigenesis [199].

## Body Mass

---

- Higher body mass and physical inactivity may contribute to prostate cancer risk.
  - ▶ A large prospective study observed a significant positive association between body mass index (BMI)<sup>1</sup> and prostate cancer risk [111].
  - ▶ A cohort\* study reported obese men to have a 20% increased risk of dying from prostate cancer and those men who were severely obese had a 34% elevated risk [201].
  - ▶ Higher BMI was associated with a greater percent of the prostate involved with cancer, increased tumor volume, and high-grade disease [202].
    - Men with a BMI  $\geq 35$  had nearly 40% larger mean tumor volumes than normal weight men.

<sup>1</sup> BMI is calculated by weight wt(kg)/ht<sup>2</sup>(m<sup>2</sup>)

- ▶ This research was further supported by recent evidence that obesity is a risk factor for aggressive prostate cancer [202-205].
- ▶ Interestingly, findings from the EPIC study suggest that abdominal adiposity may be associated with an increased risk of advanced prostate cancer, but that this association may be stronger among individuals with a lower BMI [206].
- ▶ The risk of prostate cancer may be reduced with weight loss [205].
- According to a UCSF study with over 2,000 men, men who maintained a healthy body weight were less likely to have a recurrence [207].
  - ▶ Obese men had a 30% increased risk of cancer recurrence, compared with those with lower body weights. Very obese patients (BMI >35) heightened their risk of recurrence by 69%.

## Physical Activity

---

- The HUNT study reported that recreational physical exercise is associated with a reduced risk of advanced prostate cancer and prostate cancer death though not associated with overall prostate cancer [208].
  - ▶ A prospective study suggested that men in the highest category of exercise reduced their risk of advanced prostate cancer by 36% compared to the non-exercisers [208]. The risk of dying from prostate cancer was reduced by 33%.
- While lifetime physical activity was not linked with prostate cancer in a Swedish study [209], strenuous physical activity by men in their early 50s was associated with reduced risk [210].
- Men who exercised most vigorously ( $\geq 3$  hours/week) had a reduced risk of advanced and fatal prostate cancer [58] though a study of Puerto Rican men did not show a significant association between physical activity and prostate cancer mortality [211].
- Vigorous exercise was not associated with total, advanced, or fatal prostate cancer in the NIH-AARP Diet and Health Study [212].
  - ▶ However, the authors did report a small 3% reduction in total prostate cancer in those men who did frequent exercise during adolescence.
- Researchers conducted an 11-day study where men followed the Pritikin program [88]. The Pritikin program focuses on a diet that is high in vegetables, fruits, whole grains, and very low in fat in combination with 60 minutes of daily exercise.
  - ▶ Serum IGF-I decreased by 20% after following the program for 11 days. This reduction in IGF-I may be related to the lower serum insulin\* levels observed via a healthy low fat plant-based diet and regular exercise.
- These findings were further substantiated by researchers who placed blood serums of three groups of men (Pritikin followers of 14 years, regular exercisers of 14 years with no modified diet, and sedentary overweight men who consumed a high-fat, high-sugar diet) in culture dishes containing prostate cancer cells [98].
  - ▶ In a mere three days, researchers reported significant change in the cells. The blood serum of the Pritikin followers destroyed 50% of the prostate cancer cells compared to the exercise-only group where approximately 25% of the cells were destroyed and less than 3% of the cancer cells were destroyed in the overweight, sedentary men eating a more typical high-fat American diet.

- Studies show promising effects of physical activity on muscular fitness, physical functioning, fatigue, and health-related quality of life [213].
- The RENEW study reported that for older long-term prostate cancer survivors, a diet and exercise intervention reduced the rate of self-reported functional decline compared with no intervention [214].
- A 12-week home-based physical activity intervention may provide health and quality of life benefits for prostate cancer patients undergoing hormone therapy [215].
- Healthy weight control is encouraged with an emphasis on exercise to preserve or increase lean muscle mass.

## **Foods and Nutrients of Special Interest to Prostate Cancer Survivors**

---

### *Antioxidants\* – Found in abundance in fruits and vegetables*

- Prevent oxidative damage in body cells.
  - Research indicates a link between oxidant damage and prostate carcinogenesis.
- Examples of antioxidant\* nutrients and non-nutrients include vitamins A, C, and E, selenium, lycopene, and beta-carotene.
- Note that patients may be advised to NOT consume high dose antioxidant\* supplements during chemotherapy or radiation treatments. Antioxidant\* consumption via food sources and a basic multivitamin are very safe.

### *Selenium*

- Antioxidant\*, which scavenges free radicals and suppresses damage due to oxidation in the tissues. Also is essential for the immune system.
- There have been mixed findings regarding the association of selenium and prostate cancer.
- No association was observed between selenium supplementation and prostate cancer risk in the **VITamins And Lifestyle (VITAL)** study [216].
- A recent study suggested that the effect of selenium on the risk of prostate cancer may well be affected by the manganese superoxide dismutase (SOD2) gene [217].
  - Higher selenium levels were associated with a reduced risk of presenting with aggressive disease in men with the AA genotype, whereas higher selenium levels were associated with an increased risk of aggressive disease in men with a V allele.
- Previous research had suggested a possible synergistic effect between selenium and vitamin E in reducing the risk of prostate cancer [218] yet supplementation of 200mcg/day of selenium had no effect on the risk of prostate cancer in relatively healthy men from the Selenium and Vitamin E Chemoprevention Trial (SELECT) [219].
- Other studies, however, have found selenium to have a protective effect against prostate cancer [173, 220-223], inhibit angiogenesis\* [224] and induce apoptosis\* or cell death [225].
- A large cohort study reported that serum selenium was not associated with prostate cancer risk overall, however, higher serum selenium was associated with lower risks in men reporting a high vitamin E (> 28.0 IU/day) intake and in multivitamin users [226].

- ▶ Furthermore, high serum selenium concentrations were related to a reduced risk of prostate cancer among smokers.
- Low plasma selenium has been associated with a 4 to 5-fold increased risk of prostate cancer [227].
- While no overall association between selenium and prostate cancer was observed, African-American men in the highest tertile of selenium levels had a 41% lower risk of prostate cancer when compared with men in the first tertile [228].
- In one trial, the use of selenium supplements reduced the risk of prostate cancer recurrence by 63% [220].
- Although the EPIC trial observed no association between plasma selenium concentrations and the risk of prostate cancer [229], it has been argued that the selenium concentrations did not reach the level needed to maximize plasma glutathione peroxidase activity, which may have precluded an observed effect [230-231].
- Selenium is a precursor to the glutathione\* (GSH) antioxidant\* system. GSH is the principal protective mechanism of the cell and is a crucial factor in the development of the immune response by the immune cells [232].
- Most research studies have used a 200 mcg supplement daily [225, 233].
  - ▶ Selenomethionine is a type of selenium supplement that appears to have greater bioavailability than other forms [234-235].
  - ▶ If you're supplementing with >70 mcg/day, you may wish to consider having your serum selenium level checked to ensure that you're not consuming selenium in excess.

Nutrient	Recommended Dietary Allowance (RDA)	Prostate Cancer Research	Tolerable Upper Intake Level (UL)
Selenium	70 mcg	200 mcg	400 mcg

### *Vitamin C*

- May prevent the formation of free radicals that cause DNA damage and help repair damaged DNA.
- No consistent relationship between vitamin C and prostate cancer. Some studies report slight reductions in risk [23, 124, 236-238] while others have found no effect [38].
  - ▶ Case-control\* studies in Spain [124] and Uruguay [23] that used food frequency questionnaires reported an inverse association of vitamin C and prostate cancer.
  - ▶ An additional case-control\* study reported a 23% reduction in prostate cancer risk from daily vitamin C use [236].
  - ▶ An in-vitro study observed a protective effect of vitamin C against prostate cancer [237].
    - Inhibits proliferation and survival of tumor cells.
  - ▶ A large cohort\* study, however, found no protective effect for vitamin C against prostate cancer [41] and a 30-year follow up study observed no association between consumption of vitamin C and prostate cancer [38].
- Some evidence suggests higher dosages (more than 1000 mg daily) may actually promote oxidative

damage. There are, however, other studies that have not observed adverse effects with vitamin C supplementation.

Nutrient	Recommended Dietary Allowance (RDA)	Prostate Cancer Research	Tolerable Upper Intake Level (UL)
Vitamin C	90 mg (males)	NA	2000 mg

### *Vitamin D*

- Vitamin D is known to inhibit prostate cancer in animals [239-243] and human research is rapidly gaining ground [173, 244-246]. Vitamin D is believed to be important in the protection of human prostate cells [246-249].
- Nonetheless, findings from a meta-analysis of observational studies reported no association between vitamin D intake and prostate cancer risk [177].
- Early-life exposure to sunlight, a primary source of vitamin D, may be related to the risk of prostate cancer [250].
  - Men who were born in a region of high solar radiation had a significantly lower risk of prostate cancer with a slightly greater reduction for fatal than for nonfatal prostate cancer.
  - Frequent recreational sun exposure in adulthood was associated with a significantly reduced risk of fatal prostate cancer.
- Epidemiological\* studies indicate that sunlight exposure is inversely proportional to prostate cancer mortality and that prostate cancer risk is greater in men with lower levels of vitamin D [244-245, 247, 251-252].
- Increasing serum 25(OH) -vitamin D levels is inversely associated with all-cause mortality [253-254].
- A 25 nmol/L increase was associated with a 17% reduction in total cancer incidents and a 29% decrease in total cancer mortality [253].
- No statistically significant trend in overall prostate cancer risk was observed with increasing season-standardized serum 25(OH)D levels [255-257].
  - However, serum 25(OH)D concentrations greater than the lowest quintile were associated with increased risk of aggressive disease [255].
- Serum 25(OH)D at medium (20-32 ng/mL) or high (>32 ng/mL) levels were significantly related to better prognosis compared with the low level [258].
  - This relationship was stronger for patients receiving hormone therapy.
- It is estimated that there is a 30 to 50% reduction in risk for developing prostate cancer by either increasing vitamin D intake to least 1000 IU/d vitamin D or increasing sun exposure to raise blood levels of 25(OH)D >30 ng/ml [259].
- A study on advanced prostate cancer reported that the combination of vitamin D and the chemotherapy agent taxotere was twice as effective as taxotere alone based on PSA responses [260].
- Research has found that a man's genotype and 25(OH)D status affect one's susceptibility to prostate cancer [261-262].

- Vitamin D absorption declines with age, and vitamin D deficiency is not uncommon among older adults [263-267].
- Patients, especially those on hormone therapy, may benefit from a serum vitamin D blood test (25-OH) and a dual energy x-ray absorptiometry (DEXA) bone density scan.
- Optimal serum 25-OH vitamin D levels have not been defined though research indicates 90-100 nmol/L (36-40 ng/mL) may be the minimum [268].
- If supplementing with vitamin D, it is wise to test serum vitamin D. Although unlikely, excessive doses of vitamin D can be toxic and cause high blood levels of calcium.

Nutrient	Adequate Intake (AI)	Prostate Cancer Research	Tolerable Upper Intake Level (UL)
Vitamin D	Under 50 yrs: 5 mcg or 200 IU 50-70 yrs: 10 mcg or 400 IU Over 70 yrs: 15 mcg or 600 IU	AI	50 mcg or 2000 IU
Calcium	19-50 yrs: 1000 mg Over 50 yrs: 1200 mg	AI	2500 mg

### *Vitamin E*

- Vitamin E acts as a cellular antioxidant\* and an anti-proliferating agent. It consists of both tocopherols and tocotrienols.
- While studies are mixed, some suggest that vitamin E may reduce the risk of prostate cancer and inhibit prostate cancer cell growth [23, 44, 269-271].
  - Cancer incidence reduced by 33% and death from prostate cancer reduced 41% in a 6-year follow-up study where men consumed 50-100 IU vitamin E daily [44].
- An Italian case-control study reported a significant inverse association between vitamin E and prostate cancer [238].
- Nonetheless, supplementation of 400IU/day of synthetic vitamin E (dl-alpha tocopherol) was not associated with a reduced risk of prostate cancer in relatively healthy men from the SELECT study [219].
- While supplemental synthetic vitamin E was not associated with a reduced prostate cancer risk overall in the VITAL trial, the risk for advanced prostate cancer decreased significantly with greater intake of supplemental vitamin E ( $\geq 400$  IU/day) [216].
- Results suggest that long-term vitamin E (alpha-tocopherol) supplementation decreases serum androgen concentrations, which is related to a reduced incidence of and mortality from prostate cancer [222].
- Higher alpha-tocopherol concentrations appeared to increase prostate cancer survival in a Finnish study [40].
- Researchers reported lower serum gamma-tocopherol (a form of vitamin E) values in men with prostate cancer in a recent cohort study [270]. Furthermore, large doses of alpha-tocopherol suppress levels of gamma-tocopherol [272-274].

- The most provocative study found that men with the highest plasma gamma-tocopherol concentrations had a significantly fivefold lower risk of prostate cancer compared with men in the lowest quintile [269]. This effect was not significant for plasma alpha-tocopherol concentrations.
- Other researchers have also found gamma-tocopherol to offer a protective effect against prostate cancer [270-272, 275].
- Many studies used a 400 IU vitamin E supplement daily, however, a multi-vitamin may easily provide 50-100 IU vitamin E.
- There has been considerable discussion regarding the different forms of vitamin E.
  - Natural forms of vitamin E (gamma-tocopherol, d-alpha-tocopherol) appear to be better absorbed by the body, but are more expensive [276-277]. A supplement containing mixed tocopherols (d-alpha, gamma, beta) and tocotrienols is preferred. The combination of gamma- and alpha-tocopherol may offer greater protection from DNA damage than alpha-tocopherol alone [278].
  - Many of the studies on vitamin E and prostate cancer have used synthetic forms of vitamin E (dl-alpha-tocopherol) [44, 216, 219, 222, 276, 279]. A recent study, however, reported that the natural form of vitamin E was more effective in the suppression of prostate cancer, and at a lower concentration [276]. More specifically, vitamin E succinate may offer these protective effects [280].

Nutrient	Recommended Dietary Allowance (RDA)	Prostate Cancer Research	Tolerable Upper Intake Level (UL)
Vitamin E	15 mg 33 IU dl-alpha (synthetic) 22 IU d-alpha (natural)	50-200 IU *	1000 mg 2222 IU dl-alpha 1493 IU d-alpha

\* Vitamin E form varies among studies

Nutrient	Summary	Recommendation
Selenium	Dietary sources include Brazil nuts, seafood, enriched brewer's yeast, and grains.  Selenium content depends somewhat on the amount of selenium in the soil in which the products are grown.	70 mcg daily through diet and/or a multivitamin  Two Brazil nuts provide 200 mcg selenium.
Vitamin C	Dietary sources include various fruits and vegetables, including papaya, citrus fruits, kiwi, cantaloupe, mango, strawberries, bell peppers, broccoli, and tomatoes.	>90mg daily  Include these fruits and vegetables daily.  Supplements containing 250-500 mg taken 1-2 times daily appear safe.

Vitamin D	A fat-soluble vitamin that we generate through skin synthesis of sunlight (ultraviolet rays).  Dietary sources include cold-water fish, eggs, and fortified products, such as milk, soy milk, and cereals.	400-2000 IU daily*  Maintain serum 25 (OH)-vitamin D >40 ng/mL.  The bioavailability of vitamin D3 (cholecalciferol) is much greater than vitamin D2 (ergocalciferol).
Vitamin E	Dietary sources include vegetable oils, wheat germ, sweet potatoes, nuts, seeds, and avocados.	Eat vitamin E-rich foods regularly.

\* It may be necessary to use higher dosages of vitamin D; your serum level is used to determine the proper supplemental dosage

### *Multivitamins*

- No association was observed between multivitamin use and risk of localized prostate cancer, but an increased risk of advanced and fatal prostate cancers was observed among men reporting excessive use of multivitamins (more than seven times per week) when compared with never users [281].
  - This association was strongest in men with a family history of prostate cancer or who took individual micronutrient supplements, including selenium, beta-carotene, or zinc.

### *Flaxseed*

- Flax may work to block tumor growth, inhibit angiogenesis\*, and enhance immune function [282].
- Lignans\*, phytoestrogens found in flax, appear to bind with testosterone, which lower circulating levels of testosterone [283-284]. This action may be one of the protective mechanisms of flax.
- Preliminary data suggest reduced tumor growth and spread with the use of flaxseed [283, 285-286].
- Animal data indicates that flaxseed may lead to less aggressive tumors and a lower risk of metastasis [285].
- A pilot trial reported that prostate cancer patients following a 20% fat diet and consuming 30 gm flax daily (2½ tbsp) resulted in reduced cancer growth rates the more days patients followed the above diet [276].
- Flaxseed supplementation (30 gm daily) significantly reduced prostate cancer proliferation rates in men presurgery [287].
  - No effect was observed in men who consumed a low fat diet (20% of total calories) only.

### *Green Tea*

- Green tea contains phytonutrients\* known as polyphenols (flavonoids) that provide antioxidant\*, antidiabetic, anti-inflammatory, antibacterial, and anticancer properties [64, 288].
  - May block the formation of cancer-causing compounds, such as nitrosamines\* [289]
  - Prevents DNA damage [290]
  - May inhibit tumor growth and induce apoptosis\* [291-292]

- ▶ Inhibits COX-2 activity [294]
- ▶ Inhibits IGF-I [295]
- ▶ Increases immune response [292]
- ▶ Many studies indicate a lower risk of cancer with green tea consumption, but more research is needed for conclusive evidence [296-299].
- Green tea catechins\*, a category of polyphenols\*, suppress cell growth and induce cell death in human prostate cancer cells [297, 300-303].
- Animal studies have observed inhibition of prostate cancer development, lower serum testosterone concentrations, and increased survival with green tea [304].
- Epigallocatechin-3-gallate (EGCG), the most abundant green tea catechin, has been shown to suppress prostate tumor growth and angiogenesis while promoting cancer cell death in mice [305].
  - ▶ Additionally, EGCG was correlated with a decreased serum PSA level.
- Researchers found green tea (6 gm daily) to have no significant effect on PSA levels [165, 201]. The median length of the study, however, was only one month.
- The combination of soy and green tea synergistically inhibited tumor weight and metastasis and significantly reduced serum concentrations of both testosterone and DHT [307].
- Similarly, while green tea alone significantly reduced the risk of prostate cancer in a recent case-control study, the dual effects of green tea and dietary lycopene had a synergistic effect adding greater protection against prostate cancer [64].
- In the Japan Public Health Center-based Prospective Study, green tea was not associated with localized prostate cancer, but did appear to significantly reduce the risk of advanced prostate cancer by 48% in men who drank 5 cups/day compared with men who drank less than 1 cup/day [308].
- Nonetheless, the Ohsaki Cohort\* study reported no association between green tea and the risk of prostate cancer [309].
- A case-control study observed heightened protective effects of green tea with increasing frequency, duration, and quantity of green tea consumption [296].
- Supplementation of 800 mg EGCG daily (Polyphenon E) resulted in reduced PSA, hepatocyte growth factor (HGF), and vascular endothelial growth factor (VEGF) in men with prostate cancer [310].

## *Soy*

- Soy is associated with reduced rates of heart disease [311-313], protection against osteoporosis [314-315], and certain types of cancer, including prostate cancer [31, 93, 313, 316-323].
- Soy has been one dietary component thought to play a role in the lower rate of prostate cancer in Asian countries. Two meta-analyses\* found that the consumption of soy foods was associated with a lower risk of prostate cancer [323-324], particularly unfermented soy foods [323].
- Research shows that plant estrogens, such as soy, may also prevent prostate cancer by [317, 325]:
  - ▶ Decreasing blood androgen levels.
  - ▶ Increasing SHBG\* (sex hormone-binding globulin) concentration.
  - ▶ Binding to hormone receptors.

- ▶ Inhibiting 5-alpha reductase.
  - ▶ Restricting other enzymes associated with cell growth.
  - ▶ Causing direct tumor destruction that essentially starves the tumor.
  - ▶ Decreasing IGF-I [312].
- Plasma isoflavones, particularly genistein and equol (a metabolite of daidzein), appeared to reduce the risk of prostate cancer in the Japan Public Health Center-based Prospective Study [326].
  - Recent studies found that soy flour (120 mg isoflavones daily) [327] and tofu [109] decreased serum testosterone levels in healthy men, further substantiating that soy may protect against prostate cancer.
  - A low-fat diet combined with soy has been shown to decrease PSA values significantly in a three-month period [328]. Soy foods and a low fat diet may have a symbiotic relationship [329].
  - A different study, however, found no significant decrease in PSA values in men who consumed 44 gm soy protein for one month [311]. A review study of prostate cancer patients noted that PSA values decreased significantly with soy isoflavones in four of eight trials [330]. Isoflavones in healthy subjects did favorably affect PSA.
  - Eating soy foods 1x/day and at least 2x/week reduced the risk of prostate cancer by 71% and 62%, respectively compared with men who consumed soy less than once weekly [322].
  - Overall, soy products were found to be significantly protective in a study that included data from 42 countries [93].

Source	Amount of Soy Protein (gm)	Amount of Soy Isoflavones (mg)
Miso (1 tbsp)	2	7-10*
Soybeans, edamame (½ cup)	11	35*
Soy milk (8 fl oz)	10	30*
Soy nuts (¼ cup)	19	40-50*
Tempeh (½ cup)	19.5	36*
Tofu (4 oz)	13	38.8*

\* Isoflavone content varies by brand

Food or Beverage	Summary	Recommendation
Flaxseed	<p>Good source of omega-3 fatty acids and fiber, contains protein, calcium, potassium, B vitamins, iron, and boron.</p> <p>Opt for ground flax seeds rather than whole flax seeds, flax seed oil, flax supplements to increase bioavailability.</p> <p>Flax seeds may be ground in a coffee grinder, blender, or food processor.</p>	<p>2 tbsp ground flaxseed daily</p> <p>Flax can have a laxative-like effect, thus, it is wise to gradually increase consumption.</p> <p>Sprinkle into various foods and beverages, including hot cereals, tomato sauces, fruit smoothies, brown rice or other grains.</p> <p>Store flax in the refrigerator or freezer.</p>

Green tea	Green tea contains caffeine though much less than coffee or black tea.  If opting for decaffeinated green tea, opt for those naturally decaffeinated with water as typical caffeine extraction results in a significant loss of phytonutrients.	One cup daily would be a healthful addition to your diet, but evidence suggests that three or more cups may be needed for the cancer protective effects [190].  A squeeze of citrus enhances the bioavailability of the polyphenols.
Soy	Contains various nutrients, including protein, fiber, calcium, and B vitamins.  Rich in antioxidants*, known as isoflavones, namely genistein and daidzein.	Consume 1 or more servings daily.  Soy supplements or isoflavone extracts are not recommended.

### *Food Safety*

- The following recommendations have been adapted from guidelines provided by the American Cancer Society.
  - ▶ Wash foods thoroughly before eating.
  - ▶ Keep all aspects of food preparation meticulously clean.
  - ▶ Use special care in handling raw meats, poultry, and eggs.
    - Thoroughly clean all utensils, counter tops, cutting boards, and sponges that touched raw meat.
    - Thaw meats and fish in the refrigerator.
- Do not eat perishable foods that have been left out of the refrigerator for more than two hours.
- Store foods at low temperatures (less than 40°F) to minimize bacterial growth.
- Individuals undergoing chemotherapy or with a weakened immune system should consider avoiding foods that may have bacterial contamination, including sushi, salad bars, buffets, unpasteurized beverages or food products, and raw or undercooked meat, poultry, fish, and eggs.

## **Herbs**

---

### *Milk Thistle*

- Preliminary research (in vitro and in vivo studies only) suggest that components in milk thistle, silymarin and silibinin, inhibit growth and apoptosis of prostate cancer cells [331-337].
- Silibinin has also been found to show protective efficacy against angiogenesis and late stage metastasis [336-337].
  - ▶ The mechanism of action is still to be determined, but may be related to the inhibition of the IGF-I pathway [332, 335, 338].

## *PC-SPES*

- Combination of seven Chinese herbs and one North American herb, saw palmetto.
- This herbal combination exhibits estrogenic activity and can reduce blood testosterone levels, hence its association with reduced prostate cancer risk [339-340].
- FDA recalled PC-SPES supplements in February 2002 because it was found to contain undeclared prescription drug ingredients [339-340].
- A phase I trial of PC-spes2, a rigorously tested version, reported decreased PSA doubling time for advanced hormone refractory prostate cancer [341].

## *Saw Palmetto*

- A partially dried, ripe fruit of a low scrubby palm associated with prostate benefits.
- This botanical, composed of flavonoids, water-soluble polysaccharides, and free fatty acids, is believed to function as an anti-androgen and anti-inflammatory agent [342].
- Preclinical studies suggest that saw palmetto can induce growth arrest of prostate cancer cells and induce apoptosis [343-344].
- Saw palmetto may reduce the growth of normal or malignant prostate cells by slowing the conversion of testosterone to DHT [343-345].
- However, a human trial reported the use of commercial saw palmetto, which varies widely in dose and constituent ratios, was not associated with prostate cancer risk [346].
- Research also indicates beneficial effects on urinary flow rates in men with enlarged prostates, or benign prostatic hyperplasia (BPH) [342].
  - 320 mg daily seems to be effective.
- Saw palmetto may, like the drug Proscar, lower PSA values. It is not clear, however, if there is any effect on the tumor. In other words, saw palmetto may mask the cancer.
  - The use of saw palmetto may exclude an individual from participating in certain clinical trials.
  - It is suggested to discontinue the use of saw palmetto three weeks prior to PSA testing.

## *Turmeric (Curcumin)*

- Curcumin, the yellow pigment and active component of turmeric, is the most important constituent among natural curcuminoids found in these plants [347].
  - Potent antioxidant\*
  - Anti-inflammatory effects [348]
  - Chemopreventive
  - Anti-prostate cancer effects
- Curcumin exhibits chemopreventive and growth inhibitory activity in several tumor cell lines [349-353].

- Evidence suggests that curcumin may suppress tumor initiation, promotion, and metastasis [349, 352, 354].
- Results indicate that curcumin is a novel and potent inducer of apoptosis\* in both androgen-dependent and androgen-independent prostate cancer cells [349-350, 352-356].
- Additionally, curcumin promotes detoxification in the liver and possesses anti-inflammatory activity, possibly by inhibiting COX-2 activity [357].
- A unique anti-inflammatory herbal preparation (Zyflamend), which contains tumeric, has been found to inhibit both COX-1 and COX-2 activity, suppress cell growth, and induce apoptosis\* in prostate cancer cells [358].
- A phase I trial reported that Zyflamend led to a reduction in C-reactive protein, NF-kappaB, and decreased PSA in 48% of the subjects [359].

## Hormone Deprivation Therapy

---

- Patients who undergo hormone deprivation therapy may experience various side effects, notably hot flashes, night sweats, weight gain, and possibly a decline in bone mineral density.
- While the pathophysiology of hot flashes is complex, it is not yet well understood [360].
- Many studies have found that dietary and supplemental strategies do not appear to significantly affect hot flashes when compared to a placebo in women.
  - It should be noted, however, that the placebo effect has been considerable in various studies.
  - Nonetheless, some studies have found some benefit with soy isoflavones, black cohosh, red clover, and vitamin E [361-363].
  - Studies in men are lacking, but the results would not be expected to vary considerably.
- Similarly to women in menopause, men report significant gains in body mass increased fat mass accompanied with a decrease in lean body mass while on androgen deprivation therapy (ADT) [364-369].
  - This change is concerning considering the evidence regarding increased body mass and prostate cancer risk.
- Multiple prospective studies have examined the relationship between ADT for prostate cancer and bone mineral density (BMD).
- Collectively, these studies suggest that significant bone loss is clearly observed within the first year of ADT [366, 370-375].
- Clinical trials are needed to evaluate the role of vitamin D, calcitonin, and oral bisphosphonates for the prevention and treatment of osteoporosis in patients undergoing ADT [367].
  - Trials are currently in process to evaluate the role of intravenous bisphosphonates.
- Nonetheless, dual-energy x-ray absorptiometry (DEXA) screening for osteoporosis is recommended prior to ADT, again at one year, and then at appropriate intervals thereafter, which may be every two years.
- Additionally, serum vitamin D (25-OH) should be assessed with these patients.

- Patients should be encouraged to maintain adequate yet not excessive amounts of dietary calcium.
- Furthermore, exercise, particularly resistance training may reduce risk osteoporosis and increase muscle mass [367].

## Bone Building Nutrients

Nutrient*	Dietary Sources	Function	Recommendation
Calcium	Dairy products, canned fish with soft bones, beans, leafy greens (especially collard greens, bok choy, and kale), tofu, almonds, fortified products, such as soy milk, cereal, and orange juice	↑ calcium absorption and bioavailability from foods, especially plant sources  Vitamin D is essential for calcium absorption.	800-1200 mg daily
Vitamin K	Dark leafy greens, liver, tomatoes, soybeans, and garbanzo beans  Also produced by intestinal Bacteria	Associated with ↓ bone turnover and ↓ urinary calcium excretion.	120 mcg daily
Phosphorus	Meat, poultry, fish, eggs, milk, products, legumes, and nuts	Combines with calcium to strengthen bones.	700 mg daily
Magnesium	Whole grains, nuts, seeds, spinach, and most fruits & vegetables	Important in calcium and potassium uptake.	420 mg daily
Potassium	Bananas, strawberries, tomatoes, prunes, potatoes, spinach, and beans	Associated with ↓ urinary calcium and phosphorus excretion.	4700 mg daily
Boron	Apples, avocados, beans, milk, peanuts, peanut butter, pecans, raisins, prunes, and potatoes	Improves calcium absorption.  ↓ effects of vitamin D and magnesium deficiency.	2 mg daily
Zinc	Seafood, meats, tofu, whole grains, black-eyed peas, wheat bran and germ	Important in calcium uptake and immune function.	11-15 mg daily

\* Vitamin D is listed in previous table.

## Summary – Healthy Diet for Prostate Cancer

- Eat 8-10 colorful fruit and vegetable servings (4-5 cups) daily
  - 2-3 pieces of fruit
  - 1 cup or more of vegetables with lunch and dinner
  - 12 fl oz tomato-based juice
- Consume 30-45 grams of fiber daily
  - You will likely meet your fiber goal if you eat 8-10 servings of fruits and vegetables plus one serving beans/legumes or at least two servings of whole grains.
- Avoid processed and refined grains/flours/sugars
  - Keep WHITE off your plate - bread, pasta, rice, cereal, cream sauces, cakes, and more.
- Limit or eliminate meats and dairy
- Include healthy fats daily like cold-water fish (i.e. sablefish, salmon, trout, herring, sardines), flaxseed, walnuts, soybeans, avocados, and olive oil
- Consume dietary lycopene (30 mg) regularly
  - ¾ cup tomato sauce, 12 fl oz tomato juice, 6 ½ tbsp tomato paste.
- Vitamin E (50-200 IU)
  - Natural vitamin E supplement that contains gamma-tocopherol
- Maintain serum 25-OH vitamin D above 40 ng/mL
- Drink 1-4 cups green tea daily
- Drink plenty of fluids, water or non-caffeinated beverages, daily to help meet fluid needs
- Engage in daily physical activity to help achieve and/or maintain a healthy body weight

### *Practice Precaution*

- Always discuss changes in diet and supplement use with your physician.

### *Words Of Wisdom*

“Let food be your medicine and medicine be your food.”

- Hippocrates

For additional information or resources, please visit the Ida and Joseph Friend Cancer Resource Center at 1600 Divisadero Street on the first floor, or call (415) 885-3693. The information in this publication is designed for educational purposes only and is not intended to replace the advice of your physician or health care provider, as each patient’s circumstances are individual. We encourage you to discuss with your physician any questions and concerns that you may have.

## Three Day Menu Plan: 3 Meals + Snack

This menu is based on 2,100 calories, calories can be adjusted by altering portion sizes. The menu has been designed to serve as a guide in making healthful food choices. Experiment with substitutions as desired.

Day 1	Day 2	Day 3
Oatmeal (1 cup) Soy milk (1 cup) Flaxseed, ground (2 tbsp) Dried cranberries (¼ cup)	Bagel, whole grain (1 each) Hummus (2 tbsp) Tomato (6 slices) Lemon pepper	Tofu scramble Tofu (4 oz) Onions (¼ cup) Peppers (½ cup) Mushrooms (½ cup) Toast, whole grain (2 slices) Jam (2 tbsp)
Turkey sandwich Whole grain bread (2 slices) Turkey (2 ½ oz) Lettuce (1 cup) Tomato (4 slices) Red peppers (¼ cup) Onions (¼ cup) Mustard (1 tsp) Peach (1 med)	Chunky Tortilla Soup (2 cups) Corn tortillas (2 each) Black beans (½ cup) Green salad (2 cups) Oil/vinegar dressing (2 tbsp)	Salad Spinach (2 cups) Broccoli (⅓ cup) Carrots (⅓ cup) Tomato (⅓ cup) Garbanzo beans (½ cup) Barley (½ cup) Walnuts (2 tbsp) Avocado (4 slices) Oil/vinegar dressing (2 tbsp) Whole-grain roll Orange (1 med) Vegetable juice (12 oz)
Vegetable juice (12 oz) Granola bar (1 each)	Fruit smoothie Banana (1 each) Berries (1 cup) Flaxseed, ground (2 tbsp) Soy milk (1 cup) Brazil nuts (2 each)	Vegetable juice (12 oz) Popcorn (3 cups)
Pasta, whole grain (2 cups) Tomato sauce (1 cup) Mushrooms (¾ cup) Broccoli (1 cup) Green salad (2 cups) Light dressing (2 tbsp)	Chicken & vegetable stir-fry Chicken breast (4 oz) Mixed vegetables (2 cups) Walnuts (2 tbsp) Brown rice (2 cups)	Salmon (4 oz) Quinoa (1 cup) with Brazil nuts (2 tbsp) Asparagus (1 cup) Fruit salad (1 cup)

## Recipes

---

### *Baked Tofu*

#### **Ingredients:**

- 1 pound tofu, firm, drained
- 3-4 tbsp marinade or sauce (personal favorite: Veri Veri Teriyaki by Soy Vay)

Chop drained firm tofu into 1" cubes. Place tofu cubes in glass dish for baking. Pour marinade or sauce over tofu, stir well. Place tofu in oven at 350° F for 1 hour. Stir every 15-20 minutes.

Makes four 4-ounce servings.

#### **Nutrition Information (per 4 oz serving):**

Calories: 96	Dietary fiber: <1 gm
Protein: 8 gm	Sodium: 318 mg
Fat: 5 gm	Calcium: 155 mg (16% Daily Value)
Saturated fat: <1 gm	Iron: 1.4 mg (8% Daily Value)

Recipe developed by Natalie Ledesma, MS, RD, CSO

### *Washington Insider Salad*

#### **Ingredients:**

- 1 can (15 oz) kidney beans, drained
- 1 can (15 oz) black eyed peas, drained
- 1 ½ cups cooked barley
- 6 tbsp cilantro, chopped finely
- 1 can (11 oz) corn
- 1 ½ cups tomatoes, diced
- 3 tbsp balsamic vinegar
- 2 tbsp olive oil

Prepare vegetables. Mix all ingredients together, and serve on a bed of dark green leafy lettuce. Add salt and pepper to taste.

Makes 8 servings (1 cup each).

#### **Nutrition Information (per serving):**

Calories: 215  
Protein: 10 gm  
Fat: 4 gm  
Dietary fiber: 9 gm

Recipe developed by Sous Chef Chris at the Occidental Grill, Washington D.C.

## *Thick 'N Chunky Tortilla Soup*

### **Ingredients:**

- 1 tbsp olive oil
- 1 cup chopped onions
- 2 garlic cloves, minced
- 3 medium sweet potatoes, cut into ½" cubes (4 cups)
- 3 cups chicken (or vegetable broth)
- ½ tsp cumin
- ½ tsp dried oregano leaves
- ½ tsp chili powder
- ¼ tsp ground red pepper (cayenne)
- 3 corn tortillas, cut into ½" strips
- 1 14.5-ounce can diced tomatoes, drained
- 1 cup corn (fresh, frozen, or canned)
- 1 4.5-ounce can chopped green chiles, undrained
- 2 tbsp fresh cilantro

Heat oven to 375° F. Heat oil in Dutch oven or 4-quart saucepan over medium heat until hot. Add onions and garlic; cook and stir 5-7 minutes or until onions are tender. Stir in sweet potatoes, broth, cumin, oregano, chili powder, and cayenne. Bring to a boil. Reduce heat to low; cover and simmer 10-15 minutes or until sweet potatoes are tender. Meanwhile, arrange tortilla strips in single layer on ungreased cookie sheet. Lightly spray strips with nonstick cooking spray. Bake at 375° F for 8-12 minutes or until golden brown and crisp. Cool and set aside. Transfer 2 ½ cups hot sweet potato mixture to food processor or blender; process until smooth. Return mixture to saucepan. Stir in tomatoes, corn, chiles, and cilantro. Cook over medium heat for 5 minutes or until thoroughly heated, stirring occasionally. To serve, spoon soup into individual soup bowls. Top each with crisp tortilla strips.

Makes 5 servings (1 ½ cups each).

### **Nutrition Information (per serving):**

Calories: 280

Protein: 8 gm

Carbohydrate: 50 gm

Dietary fiber: 7 gm

Fat: 6 gm

Adapted from *The Best of Italian, Mexican, & Chinese Cooking*. Pillsbury Classic Cookbooks; January 1999.

## *Barbecued Tempeh with Bell Peppers*

### **Ingredients:**

- 8-ounce package tempeh
- 1 cup sliced onion
- 2 medium red or green bell peppers; sliced in strips
- 1 tsp minced garlic
- ¾ cup water
- ¼ cup tomato paste
- 1-2 tbsp molasses
- 1-2 tbsp brown sugar
- 2 tsp yellow mustard
- 2 tsp apple cider vinegar
- 1 tsp chili powder

### **Marinade**

- ½ cup tamari or soy sauce, low-sodium if desired
- 2 tbsp rice wine vinegar
- 4 tsp lemon juice
- 2 tsp honey

In a small bowl, combine marinade ingredients and mix well. Place tempeh in a shallow bowl and pour marinade over it. Cover and refrigerate several hours, turning occasionally. Drain tempeh and reserve marinade. Cut tempeh into ½" cubes. Coat bottom of large nonstick skillet with cooking spray and heat over medium heat until hot. Add onion and bell peppers and cook, stirring often, until just tender, about 5 minutes. Add marinade and all remaining ingredients. Bring mixture to a boil. Reduce heat and simmer, uncovered, until mixture thickens.

Makes 4 servings.

### **Nutrition Information (per serving):**

Calories: 222

Protein: 18 gm

Fat: 5 gm

Saturated fat: 1 gm

Carbohydrate: 30 gm

Dietary Fiber: 7 gm

Recipe from Vegetarian Times, September 1998.

## *Spinach Spread*

### **Ingredients:**

- 1 package (10-ounces) silken tofu
- 1 tbsp lemon juice
- ¼ tsp garlic powder
- ¾ tsp onion powder
- ½ tsp dried tarragon
- ¼ tsp salt
- 1 box (10 ounce) frozen chopped spinach, thawed
- 1 cup coarsely shredded carrots
- ¼ cup chopped green onion

Puree the tofu and lemon juice in blender until smooth. Whirl in the garlic and onion powders, tarragon, and salt just to blend. Scrape into a mixing bowl. Squeeze the spinach as dry as possible. Stir it into the tofu, along with the carrots and green onion. Mix well. Serve with crackers, pita triangles, or vegetables.

Makes 8 servings (1/4 cup each).

### **Nutrition information (per serving):**

Calories: 39	Sodium: 82 mg
Fat: 1 gm	Calcium: 51 mg
Saturated fat: 0 gm	Carbohydrate: 5 gm
Protein: 4 gm	Dietary Fiber: 2 gm

Recipe from the U.S. Soyfoods Directory, 1998.

## *Creamy Tofu Basil Sauce*

### **Ingredients:**

- 1 package (12.3-ounce) silken tofu
- ½ cup water
- ¾ cup fresh basil, chopped
- 4 tbsp nutritional yeast
- 3 tbsp Bragg's liquid aminos (or tamari or soy sauce)
- 1 tbsp lemon juice
- 1 tsp garlic, minced
- \* ¾ tsp black pepper

\*\* Alternative: Use lime/cilantro rather than lemon/basil

Blend all ingredients together in a blender or food processor. Serve over pasta, vegetables, baked potato, or other.

Makes 6 servings (½ cup each).

**Nutrition Information (per serving):**

Calories: 47                      Carbohydrate: 4 gm  
Protein: 7 gm                      Dietary fiber: 2 gm  
Fat: <1 gm

Recipe developed by Natalie Ledesma, MS, RD, CSO

*Alaska Salmon Bake with Walnut Crunch Coating*

**Ingredients:**

- 1 pound salmon fillets, thawed if necessary
- 2 tbsp Dijon-style mustard
- 1-2 tbsp olive oil
- 4 tsp honey
- ¼ cup bread crumbs
- ¼ cup walnuts, finely chopped
- 2 tsp parsley, chopped
- Salt and pepper to taste
- Lemon wedges

Mix together mustard, olive oil, and honey in a small bowl; set aside. Mix together bread crumbs, walnuts, and parsley in a small bowl; set aside. Season each salmon fillet with salt and pepper. Place on a lightly greased baking sheet or broiling pan. Brush each fillet with mustard-honey mixture. Pat top of each fillet with bread crumb mixture. Bake at 450 F for 10 minutes per inch of thickness or until salmon just flakes when tested with a fork. Serve with lemon wedges.

Makes 4 servings (4 oz each).

**Nutrition Information (per serving):**

Calories: 228  
Protein: 20 gm  
Fat: 12 gm  
Omega-3 fatty acids: 1.7 gm

Adapted from Alaska Seafood Marketing Institute.

## *Vegan French Toast*

### **Ingredients:**

- 2 cups sliced bananas
- ¾ cup vanilla soy milk
- 1 tsp cinnamon, or ¾ tsp cinnamon plus ¼ tsp cardamom
- 8 slices day-old whole grain bread
- 1 tsp canola oil
- 1 mango, peeled and cut

Place bananas, soy milk, cinnamon, and cardamom (if using) in a blender or food processor; blend until smooth. Pour mixture into a pie plate. Dip bread into mixture, turning to coat both sides. Scrape off excess batter. Brush a nonstick skillet or griddle lightly with oil or spray. When hot, add coated bread slices. Brown on one side, 2-3 minutes. Turn; brown other side. Transfer to plates; serve immediately with mango puree.

Makes 4 servings (2 slices each with 2 tbsp puree).

### **Nutrition Information (per serving):**

Calories: 116	Carbohydrate: 23 gm
Protein: 4 gm	Dietary fiber: 3 gm
Fat: 2gm	Sodium: 137 mg

Recipe from Vegetarian Times, December 1995.

## *Banana Bread*

### **Ingredients:**

- ¾ cup ground flax seed
- 1 cup mashed banana
- ¼ cup apple juice concentrate
- ½ cup agave nectar
- ¼ cup applesauce
- Egg replacer for 2 eggs or 2 eggs (Ener-G Egg Replacer is made from potato starch & tapioca flour; works wonderfully in baked goods.)
- 1 ½ cup whole wheat pastry flour
- 1 tsp baking soda
- ½ tsp salt

\*\*Additional optional ingredients may include ½ cup walnuts, raisins, or chocolate chips.

Mix all ingredients together. Pour in a coated 8"x4" pan. Bake at 350 F for about 40-45 minutes.

Makes 10 servings.

**Nutrition Information (per serving):**

Calories: 168                      Carbohydrate: 29 gm  
Protein: 5 gm                      Dietary fiber: 5 gm  
Fat: 4 gm                          Omega-3 fatty acids: 1.4 gm

Recipe developed by Natalie Ledesma, MS, RD

***Dilled Salmon Salad with Peas*****Ingredients:**

- 1 can (15 oz) salmon, drained
- 1 package (16 oz) frozen peas, thawed
- ¼ cup lemon juice
- ¼ cup fresh dill (or 1-2 tbsp dried dill)
- 2 tbsp Dijon-style mustard
- 2 shallots, sliced thinly (about ½ cup)
- 1 bunch radishes (about 11 medium), thinly sliced
- 6 cups red leaf lettuce
- Salt and pepper to taste

Drain salmon, place in a mixing bowl, and break into pieces. Prepare the lemon juice, shallots, radishes, and lettuce. Add to the salmon the peas, lemon juice, dill, mustard, shallots, and radishes. Mix together gently. Add salt and pepper to taste. Serve salmon mixture over lettuce.

Makes 6 servings (2 cups each).

**Nutrition Information (per serving):**

Calories: 160  
Protein: 17 gm  
Fat: 4 gm  
Dietary fiber: 5 gm

Adapted from the Women's Healthy Eating & Living Study (WHEL) at the University of California, San Diego. Developed by Vicky Newman, MS, RD, WHEL nutrition coordinator.

***Neat Loaf*****Ingredients:**

- 2 cups cooked brown rice
- 1 cup walnuts, finely chopped
- 1 onion, finely chopped
- ½ medium bell pepper, finely chopped

- 2 medium carrots, shredded or finely chopped
- 1 cup wheat germ
- 1 cup quick-cooking rolled oats
- ½ tsp each: thyme, marjoram, sage
- 2 tbsp soy sauce
- 2 tbsp stone ground or Dijon mustard
- Barbecue sauce or ketchup

Preheat the oven to 350° F. Combine all the ingredients except the barbecue sauce or ketchup. Mix for 2 minutes with a large spoon. This will help bind it together. Pat into an oil-sprayed 5×9" loaf pan and top with barbecue sauce or ketchup. Bake for 60 minutes. Let stand 10 minutes before serving.

Makes 8-10 servings.

**Nutrition Information (per serving):**

Calories: 204	Sodium: 248 mg
Protein: 9 gm	Cholesterol: 0 mg
Fat: 9 gm	Carbohydrate: 19 gm

Recipe from The Peaceful Palate written by Jennifer Raymond, 1996.

*Nutrition Resources*

**Books**

The ABC's of Nutrition and Supplements for Prostate Cancer – written by Mark Moyad (2000)

Anticancer: A New Way of Life – written by David Servan-Schreiber, MD, PhD (2009)

The Color Code – written by James Joseph, Ph.D., Daniel Nadeau, M.D., and Anne Underwood (2002)

Eating Your Way to Better Health: The Prostate Forum Nutrition Guide – written by Charles E. Myers Jr., M.D., Sara Sgarlat Steck, R.T. and Rose Sgarlat Myers, PT., Ph.D. (2000)

Food for Life: How the New Four Food Groups Can Save Your Life – written by Neal Barnard, M.D. (1994)

Foods to Fight Cancer – written by Richard Beliveau, PhD and Denis Gingras PhD (2007)

How to Prevent and Treat Cancer with Natural Medicine – written by Michael Murray, N.D. (2002)

Integrative Oncology – written by Donald Abrams, MD and Andrew Weil, MD (2009)

Life Over Cancer: The Block Center Program for Integrative Cancer Treatment – written by Keith Block, MD (2009)

The Prostate Cancer Protection Plan – written by Robert Arnot, M.D. (2000)

**Cookbooks**

The Cancer-Fighting Kitchen: Nourishing Big-Flavor Recipes for Cancer Treatment and Recovery – written by Rebecca Katz with Mat Edelson (2009)

Cancer Lifeline Cookbook: Good Nutrition, Recipes, and Resources to Optimize the Lives of People Living with Cancer – written by Kimberly Mathai and Ginny Smith (2004)

Eat to Beat Prostate Cancer Cookbook – written by David Ricketts (2006)

How to Eat Like a Vegetarian Even if you Never Want to Be One – written by Carol Adams and Patti Breitman (2008)

One Bite at a Time: Nourishing Recipes for People with Cancer, Survivors, and Their Caregivers – written by Rebecca Katz, Marsha Tomassi, and Mat Edelson (2004)

The Peaceful Palate – written by Jennifer Raymond (vegetarian cookbook) (1996)

12 Best Foods Cookbook: Over 200 Recipes Featuring the 12 Healthiest Foods - written by Dana Jacobi (2005)

### **Newsletters/Magazines**

Cooking Light – <http://www.cookinglight.com>

Environmental Nutrition – <http://www.environmentalnutrition.com> # (800) 829-5384

Nutrition Action Health Letter – <http://www.cspinet.org/nah/> Fax: (202) 265-4954

### **Websites**

American Cancer Society – <http://www.cancer.org> # (415) 394-7100

American Institute for Cancer Research – <http://www.aicr.org> # (800) 843-8114

Caring 4 Cancer -- Provides up-to-date and comprehensive information on the connection between nutrition and cancer) – <http://www.caring4cancer.com>

Consumer Lab – Evaluates quality of over-the-counter supplements <http://www.consumerlab.com>

Doctor's Guide to Prostate Cancer – <http://www.docguide.com>

EarthSave International – Promotes food choices that are healthful for people and the planet. – <http://www.earthsave.org>

Ida and Joseph Friend Cancer Resource Center – UCSF Mt.Zion – <http://cancer.ucsf.edu/crc> # (415) 885-3693

National Cancer Institute <http://www.nci.nih.gov/> # (800) 4-CANCER # (800-422-6237)

Oncolink – Provides information regarding clinical trials, newsgroups, psychosocial support, and more. – <http://oncolink.upenn.edu>

Prostate Cancer Foundation – <http://www.prostatecancerfoundation.org>

Prostate Pointers - Comprehensive prostate cancer web site with a full range of subjects pertinent to prostate cancer – <http://www.prostatepointers.com>

San Francisco Vegetarian Society – Monthly restaurant outings and pot-luck dinners; call # 415-273-5481. – <http://www.sfvs.org>

US TOO International, Inc. - Nonprofit organization offers descriptions of treatments, online newsletter, glossary of medical terms and information on local support groups – <http://www.ustoo.com>

The Vegetarian Resource Group - Provides vegetarian nutrition information and vegetarian recipes – <http://www.vrg.org>

WebMD – <http://my.webmd.com>

## Glossary

---

**Angiogenesis** – The formation of new blood vessels.

**Antioxidant** – A substance that inhibits oxidation or inhibits reactions promoted by oxygen or peroxides.

**Apoptosis** – Programmed cell death.

**Carcinogenesis** – Beginning of cancer development.

**Case-Control Studies** – An epidemiological study in which a group of, say, cancer patients (cases) is compared to a similar but cancer-free population (controls) to help establish whether the past or recent history of a specific exposure such as smoking, alcohol consumption and dietary intake, etc. are causally related to the risk of disease.

**Catechin** – One of the tannic acids; phytonutrient, specifically, one of the flavonoids found in green tea.

**Creatine** – An amino acid that is formed in the muscle tissue of vertebrates; supplies energy for muscle contraction.

**Cohort Studies** – Follow-up study of a (usually large) group of people, initially disease-free. Differences in disease incidence within the cohort are calculated in relation to different levels of exposure to specific factors, such as smoking, alcohol consumption, diet and exercise, that were measured at the start of the study and, sometimes, at later times during the study.

**Eicosanoids** – Biologically active compounds that regulate blood pressure, blood clotting, and other body functions. They include prostaglandins, thromboxanes, and leukotrienes.

**Endogenous** – Originating from within, as within the body.

**Epidemiological** – Of or relating to epidemiology; the branch of medicine that involved the study of the causes, distribution, and control of disease in populations.

**Glutathione** – A polypeptide produced primarily in the liver; involved in DNA synthesis and repair, protein and prostaglandin synthesis, amino acid transport, metabolism of toxins and carcinogens, immune system function, prevention of oxidative cell damage, and enzyme activation.

**Insulin** – Insulin is a hormone produced by the pancreas in the body that regulates the metabolism of carbohydrates and fats, especially the conversion of glucose to glycogen, which lowers the body's blood sugar level.

**Lignans** – Phytoestrogens that have a similar chemical structure to estradiol and tamoxifen; appear to offer protection against breast cancer.

**Meta-analysis** – The process of using statistical methods to combine the results of different studies.

**Mutation** – Abnormal cell development.

**Nitrosamines** – Derivatives of nitrites that may be formed in the stomach when nitrites combine with amines; carcinogenic in animals.

**Phytonutrients** – Plant compounds that appear to have health-protecting properties.

**Polyphenols** – Phytonutrients that act as an antioxidant; compounds that protect the cells and body chemicals against damage caused by free radicals, reactive atoms that contribute to tissue damage in the body.

**Sex hormone-binding globulin (SHBG)** – A protein in the blood that acts as a carrier for androgens and estradiol; inhibits the estradiol-induced proliferation of breast cancer cells.

---

References are available at [www.cancer.ucsf.edu/crc/nutrition.php](http://www.cancer.ucsf.edu/crc/nutrition.php) or  
[http://urology.ucsf.edu/patientGuides/uroOncPt\\_Doc.html](http://urology.ucsf.edu/patientGuides/uroOncPt_Doc.html).

These materials were developed by:

Natalie Ledesma, MS, RD, CSO  
Ida & Joseph Friend Cancer Resource Center  
UCSF Helen Diller Family Comprehensive Cancer Center  
University of California, San Francisco

Revised December 2009  
SDURO0200