A COMMUNITY GUIDE TO

# CANCER NUTRITION

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A companion to *The Long Table Cookbook: Plant-based Recipes for Optimum Health* by Amy Symington

The following guide provides up to date, detailed and peer-reviewed research relating to the types of food to consume for cancer nutrition. Whether you have just been recently diagnosed with cancer, are in treatment or remission and aiming to prevent recurrence or are looking to take preventative measures this guide provides evidence-based and practical information regarding foods to consume, how to consume them and why.

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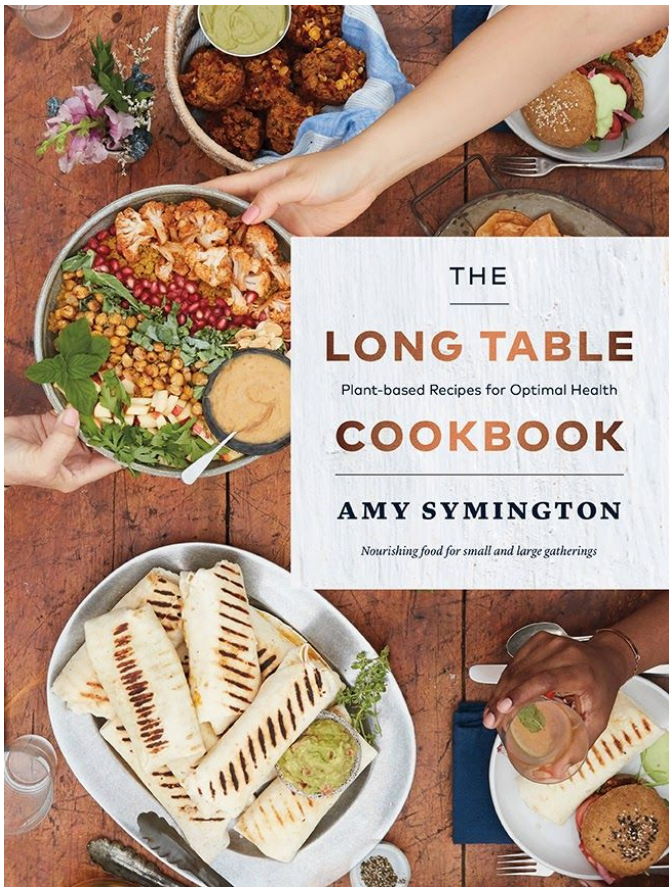
# The Long Table Cookbook: Plant-based Recipes for Optimal Health




*A Community Guide to Cancer Nutrition* was prepared in tandem with the *Long Table Cookbook: Plant-based Recipes for Optimal Health* by Amy Symington (Douglas & McIntyre, 2019).

## About the book

A nutritious diet is key to both the prevention and management of chronic illness, but to make us feel wonderful, it must also taste wonderful—and a meal shared with family and friends is even better. Grounded in this perspective, *The Long Table Cookbook* makes the transition to a health-optimizing plant-based diet simple and satisfying, featuring over seventy-five recipes along with the latest evidence-based nutritional advice, meal planning suggestions and tips for hosting community gatherings.

Chef Amy Symington and *The Long Table Cookbook* team have put a gourmet spin on healthy ingredients with recipes that are made to share. Readers won't be able to resist flavourful dishes like Watermelon, Mint, Tofu Feta & Arugula Salad, Caramelized Fennel, Sweet Potato & Pine Nut Cheese Pizza and Strawberry & Hazelnut Streusel Cake with Maple Vanilla Glaze. And while the recipes are satisfying and simple to prepare, they are also crafted to offer a balanced, nutrient-rich menu of whole foods.

Whether cooking for four or twenty-four people, the vibrant recipes and beautiful photographs in *The Long Table Cookbook* will inspire readers to come together to enjoy their best health.

**All author royalties from the sale of *The Long Table Cookbook* benefit Gilda's Club of Toronto.**

# Table of Contents

# Glossary of terms

**Allium**: the allium family is a pungent smelling species of flowering plants that includes leeks, onions, garlic, and chives. They have been studied for their chemopreventive properties and contain organosulfur compounds which have been shown to provide a number of health benefits (see organosulfur compounds).
**Anthocyanin**: a flavonoid that with a red-purple hue that is often found in a variety of berries, red cabbage, and red onions. It has been associated with lowering risk factors for type 2 diabetes.
**Anti-inflammatory foods**: foods that reduce levels of inflammation in the body, an immune system response that occurs from injury, illness, or foreign substances. Chronic inflammation is a precursor for disease, so it is important to incorporate anti-inflammatory foods like leafy greens, vitamin-E rich nuts, vitamin-C rich fruit, and high-quality oils.
**Angiogenesis**: the formation of new blood vessels. Specific to cancer is tumoral angiogenesis which is when a malignant tumour induces surrounding blood vessels to grow, providing oxygen and nutrients to feed the malignant tumour allowing it to reproduce at an unusually high rate (Kerbel 2000).
**Antioxidants**: also known as free radical scavengers, antioxidants are chemicals that interact with and neutralize free radicals which in turn prevent them from causing damage which could potentially lead to inflammation and chronic disease. Examples of antioxidants include vitamin A, C, and E, selenium, carotenoids, flavonoids, etc.
**Antiangiogenic foods**: food that when eaten daily can block the progression of tumours by attacking new blood vessels from forming and preventing them from reaching maturity (Béliveau & Gingras, 2007) .

**Apoptosis**: the process of programmed cell death.
**Beta-glucan**: a type of soluble fibre that is found in the cell walls of fungi (mushrooms), yeasts, and cereal grains like oats and barley. They have been associated with being a chemopreventive agent and protectant against metabolic syndrome and obesity.
**Carotenoids**: are responsible for the yellow, red, and orange pigments of fruits and vegetables. Beta-carotene, lutein, and lycopene are all subclasses of carotenoids. Carotenoids can be further categorized as being provitamin A and can be converted into vitamin A in the body, or non-provitamin A which cannot be converted. They have been associated with being a chemopreventive agent and are beneficial for eye health.
**Chemopreventive**: natural or synthetic compounds that interfere with the development of cancer cells.
**Cholesterol**: an oily-waxy substance found in fat in the bloodstream. Cholesterol can be produced by the body, or taken in through the diet. It can be further categorized as HDL (high

density lipoprotein) “good” cholesterol, which transports excess cholesterol to the liver and LDL (low density lipoprotein) “bad” cholesterol, which build up in arteries causing heart disease like atherosclerosis. The body needs cholesterol to function properly, but the body can produce all that it needs and consuming excess LDL cholesterol in our diet is a major risk factor for cardiovascular disease.

**Cruciferous vegetables**: vegetables that belong to the brassica family, including cabbage, cauliflower, broccoli, Brussel sprouts and kale. They have been studied as a dietary chemopreventive agent and protectant against cardiovascular disease.

**Danger Zone for foods**: the optimal temperatures harmful pathogens best grow in. Bacteria will grow most rapidly in the range of temperatures between 40 °F and 140 °F and can double in number in as few as 20 minutes.

**Dietary fibre**: indigestible plant material that is found in all varieties of plant-based foods. Dietary fibre includes non-starch polysaccharides, such as cellulose, dextrins, pectins, beta-glucans (like oats and barley) and lignins. Fibre has been shown to provide the following health benefits:

- Improvements in glucose tolerance and insulin response
- Improvements in gastrointestinal health
- Reduction of cardiovascular disease risk factors (i.e. high cholesterol levels, hypertension)
- Reduction in risk of developing certain types of cancers
- Increased satiety and aids in weight management
- Increased beneficial bacteria in the large intestine (with insoluble fibre)

**Flavonoids**: a type of antioxidant from a large group of plant pigments, with over 5000 naturally occurring flavonoids being classified in numerous plants. Flavonol, flavone, isoflavones are sub-classes of flavonoids. An example of flavonoids include anthocyanins, which have a deep blue colour that may appear red, blue or purple. Fruits and vegetables, tea, and cacao and/or cocoa in general are rich natural sources of flavonoids.

**Free radicals**: highly reactive chemicals with the potential to cause damage. They are formed naturally within the body and play an important role in normal cellular processes. However, at high concentrations they can be hazardous, increase oxidative stress within the body and subsequently cause damage to cells, which may play a role in cancer development, cardiovascular disease, diabetes, Alzheimer’s disease, and arthritis. Common sources of free radicals include: cigarette smoke, UV rays, strenuous work or intense exercise, and pollution. Antioxidants have the properties to neutralize unstable free radicals. Thus, it is important that a balance between free radicals and antioxidants is present to encourage proper physiological function in the body.

**Functional foods**: any food or food ingredient that may provide a health benefit beyond the traditional nutrients it contains.
**Lutein**: an antioxidant that aids in maintaining healthy vision. Commonly found in spinach, corn, and citrus.
**Lycopene**: an antioxidant found in red and pink hued vegetables and fruits that is attributed to maintaining good prostate health. Commonly found in tomatoes and its products, watermelon, and red/pink grapefruit.
**Meta-analysis**: a study combining data from multiple studies to identify a common effect.
**Monounsaturated fats**: a type of dietary fat with one carbon double bond. Historically associated with being a "healthy fat" due to its role in promoting cardiovascular health and cholesterol management. Food sources include avocados, almonds, cashews, pecans, and olive oil.
**Nutraceuticals**: any food (fruit, vegetable, beverage or product of fermentation) that contains a large quantity of one-or-more molecules that are health promoting (Das et al., 2011).

**Organosulfur compounds**: organic compounds that contains sulfur, have anti-inflammatory, antibacterial, and antiviral properties and when consumed have been shown to aid in reducing oxidative stress and minimize the risk of cardiovascular diseases, cancer, neurodegenerative disorders, and diabetes. Organosulfur compounds are often found in allium and cruciferous vegetables. For example: allicin, which is present in garlic, is what gives crushed garlic its pungent aroma.

**Phytoestrogen**: a compound that is found in plant foods and has a similar chemical structure to estrogen found in animal and human bodies. Phytoestrogen has been shown to have health benefits relating to heart health and cancer prevention. Often found in flaxseed, soybeans and soy products.
**Phytochemicals/Phytonutrients**: chemical compounds that are often produced by plants that provide potential health benefits. Antioxidants are often found in phytochemical/phytonutrient rich foods.
**Plant-based food**: whole foods that are primarily derived from plant sources and exclude animal products. This includes fruits, vegetables, whole grains, nuts, seeds, beans, legumes, and oils.
**Plant stanols and sterols**: substances that are chemically similar to cholesterol and may help to reduce the risk of cardiovascular disease (CVD) by inhibiting the uptake of LDL cholesterol by the intestinal cells and enhance cholesterol excretion back into the intestinal lumen. Food sources include nuts, seeds, whole grains, corn, and soy.

**Prebiotics**: indigestible food ingredients that promote beneficial bacteria growth in the intestine. When eaten they help to grow the existing beneficial bacteria or probiotics present in the gut. Food sources include: garlic, onions, leeks, asparagus, and whole grains.

**Probiotics**: live beneficial bacteria that have the potential to provide health benefits upon consumption. Probiotics live in the gut and could have been originally obtained through the vaginal canal during birth or via breast milk, but food sources of probiotics include fermented foods like yogurt, miso, kimchi, and sauerkraut. In addition to helping with gut health and improved immunity, they may play a role in protecting DNA from oxidative stress which may aid in cancer prevention.

**Polyphenols**: a type of phytochemical and antioxidant that give plants their colour and flavour. They may provide health benefits relating to heart health, cancer, and chronic inflammation in general. They can be further broken down into groups according to the amount of phenol rings that they contain. Some examples include: anthocyanins, flavonoids, lignans, and phenolic acids.
**Polyunsaturated fat**: a type of dietary fat with two or more carbon double bonds. They are considered to be a "healthy fat" due to their positive association for management of cholesterol as well as their promising chemopreventive properties that may alter cancer cell growth. Types of food with polyunsaturated fat include walnuts, chia seeds, hemp seeds, and flaxseed.
**Triglycerides**: a type of fat found in the blood of humans and animals. High triglyceride levels can lead to high cholesterol, metabolic syndrome, and cardiovascular disease.
**Wholegrain**: a grain or grain product which contains the three components that make up a grain seed, specifically the bran, germ, and endosperm.

# Literature review of cancer nutrition

In 2017, it was calculated that nearly 50% of Canadians will be diagnosed with cancer in their lifetime and about 25% are expected to die from cancer. With those overwhelming statistics stated, significant progress has been made in terms of cancer control via prevention, screening, early detection, and treatment. This includes dietary and lifestyle interventions (Canadian Cancer Statistics Advisory Committee, 2018). When implementing interventions it is important to turn to the evidence related to nutrition, dietary, and lifestyle patterns and their link to disease prevention and management. Authoritative reviews on the subject have estimated that approximately 1/3 of cancer diagnoses could be attributable to lifestyle factors including nutrition, dietary patterns, and physical activity (Wiseman, 2008). Following healthful, evidence-based recommendations relating to cancer prevention and management has been shown to affect cancer risk significantly, may help during and following cancer treatment, can improve rates of cancer survival and reduce the risk of cancer recurrence (Jones and Demark-Wahnefried, 2006, Rock et al., 2012, Schewedhelm et al., 2016, WCRF & AICR, 2018).

Specifically when discussing what to eat, for a society that is very consumed with what to consume, it may seem like a challenge selecting what foods to eat that will satisfy one's palate, and also meet one's nutritional needs. When it comes to choosing foods that will not only meet your nutritional needs but boost your nutrition for disease prevention, research points to eating patterns, particularly when it comes to cancer prevention (Supic et al., 2013). This means that there isn't one specific food or nutrient that you should primarily focus on, rather, include a variety of foods and nutrients that show clinical evidence for cancer prevention and management in your daily eating patterns. Currently the research indicates that focusing on a plant-based diet is the optimal eating pattern for cancer prevention and management (Chikara et al., 2018).

## What to consume for an anti-cancer diet

With that said, this guide focuses on foods from the plant kingdom, as plant food components such as fibre, antioxidants, phytochemicals and its thousands of subcategories, have been shown to lower the incidence of cancer (Supic et al., 2013; Tantamango et al., 2013; Marsh et al., 2012; Gonzales et al., 2014; WCRF & AICR, 2018). Eating a plant based diet has clinically been shown to affect DNA modifications, thereby reducing cancer expression and overall cancer risk (Supic et al., 2013; Tantamango et al., 2013). The lowest incidence of cancers have been found in individuals eating the most fruits and vegetables, which is associated with the content of anticancer compounds in these plant foods (Béliveau & Gingras, 2006).

When choosing ingredients it is important to select from a wide array of whole plant based foods like fruits and vegetables, whole grains, nuts, seeds and plant based protein as each tends to have its own set of unique health benefits and/or phytochemicals. Diversity is key when it comes to healthy eating patterns, as there are a plethora of anti-cancer functional foods waiting to be eaten in the plant kingdom (Béliveau & Gingras, 2006).

Since cancer and nutrition research is such a dynamic and emerging field, it can be overwhelming sifting through all of the food and nutrition advice. Our aim in this guide is to provide you with tips based on evidence that has shown to be promising and substantial, as the "evolution of scientific consensus" (Gonzales et al., 2014) can take some time. Based on research that has been used by cancer organizations to form nutrition guidelines, as well as dietary guidance from reviews and analyses, we have summarized these suggestions for your wellbeing. Taking the approach of Gonzales et al (2014) and applying the precautionary principle to nutrition and cancer, our suggestions are based on the best available evidence, even where some areas are still inconclusive.

One of the largest comprehensive reports on food, nutrition, and physical activity for cancer prevention was a joint report by the World Cancer Research Fund and the American Institute for Cancer Research. The overarching principle of the report was the emphasis on the importance of eating non-starchy vegetables and fruits, pulses (legumes), and unprocessed grains; as they contain ample amounts of dietary fibre and micronutrients (WCRF & AICR, 2007) as the centre of one's cancer preventative diet. "These foods and not foods of animal origin are the recommended centre of everyday meals (WCRF & AICR, 2007)." This report was recently updated and the message remains consistent (WCRF & AICR, 2018).

Physiologically, meat can have several potential nutritional benefits which include providing rich sources of protein, iron, zinc and B-vitamins, as well as vitamin A (Rohrmann et al., 2013). Specifically, iron and folate are more bioavailable from meat products compared to plant based sources (Rohrmann et al., 2013). However, animal based foods also have potential adverse effects including increasing LDL cholesterol and saturated fatty acids. Moreover the nutrients found within these foods that are potentially beneficial are easily obtained from whole, health promoting, plant based foods (Rohrmann et al., 2013). For example current research suggests that a diet higher in plant based protein and lower in red and processed meats reduces risk for chronic diseases, including cancer, and that those with a diet high in red and processed meat are at increased risk of premature death due to cardiovascular disease & cancer (Rohrmann et al., 2013; Thomson, 2014). Since red and processed meat consumption is a modifiable risk factor for chronic disease, advice should be, and now often is, given within health promotion guidelines to reduce or eliminate consumption (Rohrmann et al., 2013).

According to the review by the World Cancer Research Fund (WCRF) and American Institute for Cancer Research (AICR) (2007), which is further discussed by Gonzales et al. (2014), the following dietary recommendations/guidelines for cancer prevention and management are based on evidence that is sufficiently compelling:

1. Limiting or avoiding dairy products to reduce the risk of prostate cancer;

2. Limiting or avoiding alcohol to reduce the risk of cancers of the mouth, pharynx, larynx, esophagus, colon, rectum, and breast;

3. Avoiding red and processed meat to reduce the risk of cancers of the colon and rectum;
4. Avoiding grilled, fried, and broiled meats to reduce the risk of cancers of the colon, rectum, breast, prostate, kidney, and pancreas;

5. Consuming soy products during adolescence to reduce the risk of breast and prostate cancer in adulthood and to reduce the risk of recurrence and mortality for women previously treated for breast cancer; and

6. Emphasizing fruits and vegetables to reduce the risk of several common forms of cancer

(Gonzales et al., 2014).

Most importantly here is the discussion of what to consume for cancer prevention and management, and when focusing on foods from the plant kingdom, foods that are rich in fibre, functional foods, and phytonutrients, the evidence suggests that the overall incidence of cancer is lower (Supic et al., 2013; Tantamango-Bartley et al. 2013;; Marsh et al., 2012; Gonzales et al., 2014; WCRF & AICR, 2007; WCRF & AICR, 2018). Eating a plant based diet has been clinically shown to positively affect DNA modifications, thereby reducing cancer expression and overall cancer risk (Supic et al., 2013; Tantamango et al., 2013). More specifically, when reviewing dietary patterns of those following a plant focused diet, it may seem logical then that in a review by Huang et al. that vegetarians were shown to have an 18% lower cancer mortality risk than non-vegetarians (2012). Or in a meta-analysis of observational studies of vegetarian and vegan diets by Dinu et al. that a vegetarian diet may be protective and reduce cancer risk by 8% and a vegan diet by 15% (2017). Moreover, in some cases with site specific cancers, plant-based diets may be even more protective. For example, a vegan diet seems to confer lower risk for both overall and female-specific cancer in comparison to other dietary patterns, and vegetarians have an overall reduced risk of cancers related to the gastrointestinal tract (Tantamango-Bartley et al., 2012). In the California Teachers Study cohort, including data from

91,779 women, a 15% reduced risk of breast cancer was found when following a plant-based diet (Link et al., 2013). Tanmango-Bartley et al., found 35% less prostate cancer among those following a vegan diet than men in the other dietary groups (2016). Researchers suspect that higher intakes of fibre, soy, and anti-inflammatory antioxidants from fruits and vegetables and lower intakes of saturated fat, animal protein, and serum insulin-like growth factor 1 from dairy products in a vegan diet contribute to this lower cancer risk (Tanmango-Bartley et al., 2016). Overall, including following a plant focused diet, 30-40% of all cancers can be prevented by lifestyle and dietary measures and those that do have cancer can utilize similar recommendations to manage the disease and help to prevent recurrence (Donaldson, 2004; WCRF & AICR, 2018).

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## Lifestyle and dietary measures for cancer prevention and management

- Eat mostly foods of plant origin
- Aim to meet nutritional needs through diet, not supplements
- Store foods that are susceptible to mould, which consequently can increase the risk of aflatoxin growth, in cool dry places (i.e. nuts, seeds, cereals, legumes, grains, dried figs, and dried fruit in general)
- Have a sufficient, but not excessive energy intake, maintain a healthy body weight, and avoid weight gain
- Be physically active a minimum of 30-60 minutes of moderate to vigorous exercise per day
- Eliminate exposure to cigarette smoke
- Reduce consumption of concentrated sugars, like those found in sugar sweetened beverages, and refined flour products that contribute to impaired glucose metabolism (which may also lead to type 2 diabetes)
- Eat high fibre foods at every meal including ample whole grains, legumes, vegetables, and fruit (i.e. all plant based foods contain fibre, all animal based foods do not contain fibre)
- Eliminate or limit the consumption of red and processed meat
- Eliminate or limit alcohol consumption
    - No more than one serving (i.e. 12 oz beer, 1.5 oz spirits, 5 oz wine) per day for women and 2 servings per day for men
- Keep sodium intake to less than 2400 mg (or 6 g of salt) per day and minimize consumption of salt-preserved, salted or salty foods

- Ensure that there is not an imbalanced consumption of omega-3 and omega-6 fatty acids i.e. a lower ratio of omega-6/omega-3 fatty acids is more desirable in reducing the risk of many of the chronic diseases (Simopoulos, 2008)
- Consume healthy fats and minimize the consumption of less healthy fats
    - Focus on mono- and poly-unsaturated fats (i.e. nuts, seeds, and avocado)
    - Eliminate trans-fats from the diet
    - Use cooking oils with a higher smoke point (i.e. avocado, coconut, grapeseed, and sesame oils)
    - Focus on healthier cooking methods with and without oil (i.e. steaming, roasting, poaching, and sautéing)
- Consistently consume functional and phytochemical rich foods, which includes foods containing:
    - Antioxidants i.e. polyphenols, carotenoids, and flavonoids
    - Dietary fibre
    - Monounsaturated and polyunsaturated fatty acids
    - Phytoestrogens
    - Plant stanols and sterols
    - Prebiotics and probiotics
    - Soy proteins
    - Sulphuric compounds
- Consume allium and cruciferous vegetables as they are especially beneficial
- Consume protective elements such as selenium, folic acid, vitamin B12, and vitamin D (Donaldson, 2004; WCRF & AICR, 2007; WCRF & AICR, 2018)

"When a diet is compiled according to the guidelines here it is likely that there would be at least a 60–70 percent decrease in breast, colorectal, and prostate cancers, and even a 40–50 percent decrease in lung cancer, along with similar reductions in cancers at other sites. Such a diet would be conducive to preventing cancer and would favor recovery from cancer as well" (Donaldson, 2004).

When discussing specifically nutrition for those going through cancer treatment or those finished cancer treatment and wishing to focus on recurrence prevention, the research and recommendations remain the same as above (Donaldson, 2004; WCRF & AICR, 2007). Similar to the dietary cancer prevention guidelines, the data overwhelmingly indicate that exercise, a high quality diet focusing on plants and management of stress can improve the likelihood of cancer survival and prevent recurrence (Jones & Demark-Wahnefried, 2006; Rock & Demark-Wahnefried, 2012; Schwedhelm et al, 2016). Moreover, adherence to a healthy dietary pattern has been inversely associated with overall mortality among cancer survivors, whereas a Western dietary pattern (i.e. a diet high in alcohol, animal products and processed foods) is

positively associated with overall mortality among cancer survivors (Schwedhelm et al., 2016). Vegetables in particular are inversely associated with overall mortality amongst cancer survivors, whereas alcohol was positively associated (Schwedhelm et al., 2016). Furthermore, eating a diet rich in healthy foods can help with preventing malnutrition and weight loss both of which can lead to poorer prognosis (Ross et al., 2004; Hager, 2016)

Focusing on the lifestyle and dietary guidelines discussed here will provide, not only a reduced risk of cancer along with a sense of empowerment to those wishing to prevent cancer, manage cancer or prevent recurrence of cancer, but they will also aid in reducing other chronic diseases as well.

As you will see in the next set of pages, we dive deeper into specific cancer preventing foods that can be incorporated into your daily eating patterns. Select foods from this list that appeal to you, so you can simultaneously enjoy what you're eating while boosting your body's defences against cancer development.

**Antioxidants during cancer treatments:**

Eating whole plant based foods high in powerful antioxidants is not a concern during cancer treatment, however, taking antioxidants in supplement form is not recommended during treatments (Lawenda et al., 2008), or generally to prevent cancer (WCRF & AICR, 2018). Research indicates that some supplemental antioxidants can protect non- cancerous tissues from the damaging side effects of treatments (Block et al., 2008; Block et al., 2007; Conklin, 2000), however, other studies indicate that antioxidant supplements may interfere with chemotherapy and radiation therapy. In turn, this can reduce the effectiveness of these treatments (Lawenda et al., 2008; Ladas & Kelly, 2010; Norman et al., 2003; Bairaiti et al., 2006; Greenlee, et al., 2012; Greenlee et al., 2009) . Therefore, more research is needed on antioxidants in supplemental form during treatment and consequently emphasis should be placed on consuming whole plant based foods high in antioxidants over supplements.

# What to Eat: What, Why, and How

## Apples

**Why Eat Apples:** Apples are rich in compounds called polyphenols, which are the largest class of phytochemicals found in nature. The polyphenols in apples can be divided into a couple of subdivisions, all with their unique set of cancer prevention capabilities. Some of these bioactive molecules are flavonoids (further classified into flavonols, procyanidins, quercetin, and catechins) which have been shown to have anti-cancer and antiangiogenic (reducing blood flow to tumour growth) properties (Zessner et al., 2008). In addition, apples can help you reach the recommended five servings a day of fruit and vegetables (WCRF & AIHR, 2018) as it has been found that 80 percent of cancer survivors are not reaching five servings a day of fruit and vegetables (Blanchard et al., 2008).

**How to Eat Apples:** Eat a variety of apples, to reap the benefits of the different nutritional components (Zessner et al., 2008). Make sure to eat the skin to get the strongest dose of anticancer compounds (Wolfe et al., 2003). Eat them whole as an easy portable snack or use them in your morning baked oatmeal or cereal, as a snack with unsweetened nut butter or in a fruit crisp or crumble (minus the refined white sugar and flour of course).

**Nutritional Benefits for Specific Cancers:** Daily apple consumption was shown in one case-control study to significantly lower the odds of breast cancer, ovarian cancer and colorectal cancer by 24% (Gallus et al., 2005). Epidemiological studies have provided evidence that apples have cancer preventive properties, particularly against lung and colorectal cancer (Zessner et al., 2008). In the Nurses' Health Study involving 77,000 women, a significantly lower risk for lung cancer was observed among women who had at least one serving per day of apples and pears (Feskanich et al., 2000). Another observational Finnish cohort involving 10,000 men and women also showed similar results, although these findings were only suggestive, not statistically significant (Arts et al., 2001). Yet another study found a statistically significant decrease in lung cancer risk with increased consumption of apples (Le Marchand et al., 2000). The researchers from the study believed this protective effect of apples was due to their rich source of quercetin (Le Marchand et al., 2000).

Researchers have found a compound in the peels of organic apples that contain a reactive tumour suppressor gene called maspin, which is a compound that our body uses to keep breast cancer at bay. Typically, breast cancer cells find a way to turn off this gene, however, maspin in apple peels help to turn them back on (Regan-Shaw et al., 2010).

## Artichokes

**Why Eat Artichokes**: Artichokes are widely consumed as part of the health-promoting Mediterranean diet and are rich in polyphenols, minerals, inulin fibre, and fibre in general making them a great choice for an anticancer diet (Lattanzio et al., 2009). They are rich in antioxidants (Béliveau & Gingras, 2006), and the polyphenolic action of artichokes have been shown to induce cell apoptosis (or cell death) in human breast cancer cells (Mileo et al., 2012). Additionally, artichoke extract contains apigenin, which may help increase sensitivity to chemotherapy treatments (Mileo et al., 2012; Torquato et al., 2017).

**How to Eat Artichokes:** After thoroughly washing your artichokes and removing the outer leaves, scoop out the fuzzy centre and they are ready to cook. For a healthier cooking method try roasting them with a little grapeseed oil and then serve them with a squirt of lemon juice. Once cooked, they are a great way to increase fibre in your chowders, stews or salads, to eat whole with plant based aioli, or blended into a yummy spinach artichoke dip!

**Nutritional Benefits for Specific Cancers:** Diets that are made up of foods high in fibre and antioxidants like artichokes have shown to help reduce the risk of certain types of cancers (WCRF & AICR, 2007). The World Cancer Research Fund recommends eating foods that contain lots of dietary fibre as there is strong evidence that fibre helps to protect against colorectal cancer (2018).

## Avocado

**Why Eat Avocado**:  Avocados are an example of a fatty food that is also a rich source of phytochemicals which have anti-carcinogenic properties (Dreher & Davenport, 2013). They also provide dietary fibre, antioxidants, have a very low sugar content and are low in saturated fat and high in unsaturated fat (Dreher & Davenport, 2013). These properties provide a multitude of health benefits including supporting cardiovascular health, managing weight, and healthy aging (Dreher & Davenport, 2013).

**How to Eat Avocado:** Eat the avocado once it has gone a little soft. Use fresh or frozen avocado in smoothies, salads, sauces, dressings and on sandwiches. Spread it on toast, add it in a wrap, or even in a key lime dessert. Have avocados as guacamole with your salsa to increase absorption of lycopene and beta-carotene from the tomatoes (Unlu et al., 2005). Due to their fat content, eating avocados with other fruits and vegetables helps to improve the bioavailability of some

healthy micronutrients such as carotenoids, which have also been shown to be a good component of an anti-cancer diet (Unlu et al., 2005).

**Nutritional Benefits for Specific Cancers:** Regular avocado consumption has been associated with improved diet quality and metabolic health markers such as lower body weight and smaller waist circumference (Fulgoni, Dreher & Davenport 2013). Maintaining a healthy body weight is important for protecting against obesity-related cancers such as pancreas, gallbladder, liver, ovary, and postmenopausal breast cancer (WCRF & AICR, 2018). Moreover, avocados are a source of dietary fibre which also helps to protect against colorectal cancer (WCRF & AICR, 2018).

## Blueberries

**Why Eat Blueberries:** Blueberries are a nutrient-packed fruit that contain anthocyanins which are powerful antioxidants. Anthocyanins have been shown in cell culture models to help protect cells from damage caused by free radicals (Davidson et al., 2018). Blueberries are unique as they contain five of the major anthocyanidins (cyanidin, delphinidin, malvidin, peonidin, and petunidin) which are believed to work synergistically to prevent and slow cancer development (Jeyabalan et al., 2014). Although there is compelling in vitro evidence for blueberries (Davidson et al., 2018), few human studies have been undertaken, with observational studies yet to find conclusive evidence to support blueberries' superior anti-cancerous effects.

**How to Eat Blueberries:** Adding blueberries to your diet is a great way to increase the amount of fruit you eat. It is best to buy organic or low spray berries to avoid pesticides that can remain on their thin skin. It is also important to thoroughly rinse all berries before eating them to remove any harmful bacteria that may be present (Smith-Spangler et al., 2012; Baranski et al., 2014). Use them in raw cheesecakes, smoothies, in a compote, and atop all your breakfast foods, including pancakes, waffles, cereal, yogurt, and oatmeal.

**Nutritional Benefits for Specific Cancers:** Research on the anticancer potential of anthocyanins is emerging, and thus far the results are showing that these molecules limit the growth of different cancerous cells (Wang & Stoner, 2008). More recent in vitro research has shown blueberries specifically to prevent the initiation stage of cancer formation, inhibit the growth of abnormal cells, and reduce the risks of recurrence for cancer survivors or those in remission (Davidson et al., 2018).

## Cacao

**Why Eat Cacao:** Cacao beans have one of the highest concentrations of flavonoids, specifically flavanols, of any food. Flavonoids are very strong antioxidants from the polyphenol family associated with a lowered risk of cancer and contain chemopreventive properties. Specifically, catechins and procyanidins, subcategories of flavonols, have been shown to reduce inflammatory markers and angiogenesis (Maskarinec, 2009; Weisburger, 2001).

**How to Eat Cacao:** In an observational study, subjects who had 20 grams of dark chocolate every three days had lower levels of inflammation when compared to those who did not consume dark chocolate or those who consumed more than 6.6 grams (di Giuseppe et al., 2008). Use unsweetened cacao or cocoa in your morning hot beverage, in all the decadent whole food desserts or in a spicy black bean chili.

**Nutritional Benefits for Specific Cancers:** Scientific observations have noted that the flavonoids in cocoa are able to slow the development of certain cancers, particularly colon cancer (Martin, Goya and Ramos, 2016) and flavanoids in general have been shown to reduce the risk of breast (Hui et al., 2013), rectum (Aune et al., 2011), lung (Tang et al., 2009), and ovarian cancers (Cassidy et al., 2014).

## Calcium

**Why Eat Calcium:** Calcium is essential for bone and teeth health and as you age, the absorption of calcium tends to decline, making it crucial to consume sufficient amounts through dietary means (Otten et al., 2006). In relation to cancer nutrition, calcium can also improve signaling within cells which may cause cancer cells to differentiate or die in lieu of multiplying (Milner et al., 2001). There have also been significant findings related to calcium consumption and its potential for reducing the risk of colon cancer (Wu et al, 2002).

**How to Eat Calcium:** Plant based diets are typically high in oxalic and phytic acid, both of which may inhibit calcium absorption. Therefore to reap the benefits of a plant based diet and ensure good calcium levels from dietary means it is important to consume plant based calcium-rich foods with vitamin C rich foods and/or vinegar in addition to consuming calcium from a variety of different sources to reduce the effects of oxalates and phytates (Otten et al., 2006). With that said, foods higher in phytic acid may also inhibit tumour growth and have been shown to reduce incidences of colon, breast, and prostate cancer in addition to potentially reducing the side effects of chemotherapy (Vucenik and Shamsuddin, 2006).

Good sources of plant based calcium include leafy greens like kale, bok choy, mustard greens, Chinese cabbage, broccoli, cauliflower, calcium set tofu, fortified soy and almond milk, and sesame seeds (Otten et al., 2006). These foods should be included in your daily diet to ensure you are consuming adequate amounts of calcium. Try them in coleslaws, salads, soups, stews, and chowders, or in your favourite morning smoothie.

**Nutritional Benefits for Specific Cancers:** Calcium (and vitamin D) are important agents for the primary prevention of new, abnormal colorectal cell growth. It is important to note that the research suggests that the beneficial effect of calcium may be dependent or partially related to the simultaneous intake of vitamin D and that vitamin D has also been shown to reduce colon cancer risk without increased calcium consumption. Additional colorectal cancer studies using food sources of calcium in lieu of supplements as well as plant based sources of calcium are required (Holt, 2008).

A Swedish cohort study looking at dietary calcium intake and overall risk of breast cancer found that women with a high dietary calcium intake had a 34% lower risk of developing ER and PR negative breast cancer compared to women with low dietary calcium intake (Larsson et al., 2009). [ER and PR negative breast cancer refers to estrogen and progesterone receptors. ER/ PR negative means the cells have no estrogen or progesterone receptors, respectively, and ER/PR positive means they do. ER/PR negative tend to grow more rapidly than ER/PR positive (The American Cancer Society, 2017)]. Moreover, the Nurses' Health Study looked at 88,691 women and found that among premenopausal women, a high dietary calcium intake was associated with a 33% lower risk of developing breast cancer (Shin et al., 2002) and the Cancer Prevention Study II Nutrition Cohort of 68,567 postmenopausal women found that women in the highest dietary calcium intake group had a 20% lower risk of developing breast cancer compared to those with low dietary intake (McCullough et al., 2005).

In relation to the source of calcium it may matter significantly. For example, the EPIC (European Prospective Investigation into Cancer and Nutrition) study analyzed the intakes of animal-based sources of calcium and protein in relation to prostate cancer risk in a group of 142,000 men (Allen et al., 2008). They found that a high intake of calcium (and protein) from dairy foods was positively associated with an increase in prostate cancer (Allen et al., 2008). Moreover, calcium (and protein) from non-dairy sources was not associated with an increased risk of prostate cancer (Allen et al., 2008). High levels of calcium may be a risk factor for prostate cancer and therefore excess calcium intake, particularly from dairy (Ahn et al., 2007; Allen et al., 2008), may not be beneficial (Rahmati et al., 2018).

## Citrus Fruit

**Why Eat Citrus:** Citrus fruit are not only a source of vitamin C but they also contain high levels of flavonoids, which have been shown to interfere with tumour spreading and growth (Kunimasa et al., 2010; Michaels et al., 2006; Büchner et al., 2010).

**How to Eat Citrus:** Include all varieties of citrus fruit in your diet for best health results. Eat them raw and solo, drink them freshly pressed, as an addition to your water or include them in salads, stews, chilis, curries and atop vegetables for a flavour and nutrition boost. Include some of the skin (zest) in sauces, dips, smoothies, salad dressings or baked goods whenever you can, as a lot of the cancer preventing and cancer fighting compounds are found in the peel (Miller et al., 2013; Lorenzo et al., 2009; Hakim et al., 2000). Even if you are not using zest in a particular recipe, still thoroughly wash and zest the fruit before juicing and then store the zest in a resealable bag in the freezer for future use.

**Nutritional Benefits for Specific Cancers:** Studies that have observed the dietary habits of large populations have found reduced incidence of lung cancer and colorectal cancer among people who eat citrus fruit on a regular basis (Kunimasa et al., 2010; Michaels et al., 2006; Büchner et al., 2010). When cohort studies were grouped together in a meta-analysis the findings demonstrated an association between citrus consumption and a decreased risk in gastric cancers (Bae & Kim, 2016). To support these findings, a meta-analysis of three studies found that 100 grams of citrus fruit a day (equal to one small orange) lowered the risk of stomach (cardia) cancer by 24 percent (WCRF & AICR, 2018). The benefits of citrus fruits is thought to be due to the phytochemical compounds in citrus (flavonoids included) which are anti-tumorigenic (Steinmetz & Potter, 1991). Additionally, citrus fruit consumption has been associated with lower risk of breast cancer (Song & Bae, 2013).

**Flavonoids Nutritional Benefits for Specific Cancers:**

**Thyroid Cancer:** Significant data suggestions that flavonoids may positively affect several parameters regarding thyroid cancer including cell division, differentiation and iodide uptake which can be important during thyroid cancer therapy. Flavonoids have the potential to limit tumour growth and invasiveness, but more research is needed to determine possible side effects of pharmacological use or concentrated forms of these compounds. With that said, flavonoids found in whole foods are known to be safe for consumption and overall have shown health benefits in relation to cancer (Carlos et al., 2017).

**Ovarian Cancer Risk:** Evidence to date suggests that the intake of dietary flavonoids including subclasses isoflavones and flavonols, have a protective effect against ovarian cancer, helping to reduce the risk of ovarian cancer and recurrence. More research is required on larger populations and while women are undergoing cancer treatment for ovarian cancer, but current research, particularly related to ovarian cancer prevention, is promising (Hua et al., 2016).

## Cruciferous Vegetables

(arugula, broccoli, broccoli sprouts, cauliflower, brussels sprouts, kale, radish, mustard greens, kohlrabi, turnips, cabbage, collard greens, bok choy, watercress)

**Why Eat Cruciferous Vegetables:** Data indicates that cruciferous vegetables contain a large variety of phytochemical compounds with anticancer activity (Chikara et al. 2018). In particular glucosinolates, which release isothiocyanates and indoles. These compounds are known for their anti-cancer properties (Verhoeven et al., 1996; Gingras et al., 2004; Watson et al. 2013). Sulforaphane is a common type of isothiocyanate in cruciferous vegetables. This compound has been found to act as a protective antioxidant as well as play a role in cellular pathways relating to stress, apoptosis and cancer development (Tortorella et al., 2015). Additionally, sulforaphane promotes the enzymes responsible for protecting cells from reactive metabolites (phase II enzymes) and inhibits the enzymes responsible for activating pro-carcinogens (phase I enzymes) (Tortorella et al., 2015). In addition to the mechanistic research, observational studies have found that those who consume cruciferous vegetables regularly are less likely to develop cancer (Aune et al., 2017) especially bladder, colorectal, gastric, kidney, lung, pancreatic, and prostate cancer (Chikara et al. 2018).

**How to Eat Cruciferous Vegetables:** The formation of sulforaphane in cruciferous vegetables requires a precursor enzyme called myrosinase, which becomes inactivated with too much cooking. The amount of sulforaphane available in fresh broccoli is three times more than in steamed broccoli (Conaway et al. 2000). Therefore raw or light cooking techniques (steaming, roasting, and stir-frying) are ideal for preparing cruciferous vegetables (Vermeulen et al., 2008; Ferrarini et al., 2011; Béliveau & Gingras, 2006). One technique that has been suggested to preserve the sulforaphane indicates that chopping the raw vegetable and letting it sit for 30 minutes before lightly cooking. This allows the sulforaphane to develop and become heat resistant (Collins et al., 1988). Another good reason to prepare ingredients ahead of time if possible. With that said, it is best to eat your cruciferous vegetables in a variety of raw and minimally/lightly cooked ways to preserve and absorb all of the cancer preventing and cancer fighting benefits (Verkerk et al., 2009; Higdon et al., 2007). Most importantly, avoid boiling or blanching, and chew your cruciferous vegetables very well to help with absorption of all the beneficial properties (Béliveau & Gingras, 2006).

**Nutritional Benefits for Specific Cancers:** Overall, vegetable consumption has been found to reduce the risk of developing cancer (Chikara et al., 2018). Research suggests that cruciferous vegetables are a great component of the anti-cancer diet, particularly in regards to the prevention and management of certain types of cancers (Higdon et al., 2007). In a large group of observational studies done in Italy and Switzerland, the consumption of cruciferous vegetables just once a week was found to be associated with a lower risk of many cancers (oral cavity/pharynx, esophagus, colorectum, breast, and kidney), when compared to those who only ate cruciferous vegetables occasionally or never (Bosetti et al., 2012). These cancer-protective benefits of cruciferous vegetables have been linked to a sulfur-rich compound, sulforaphane (an isothiocyanate), which is found in cruciferous vegetables and has been shown to act as a histone deacetylases inhibitor preventing growth of human colon, prostate and breast cancer cells (Supic et al., 2013).

A study of 51,928 African American women showed that those who ate two or more servings of vegetables a day (i.e. at least one cup of broccoli) had a significantly lower risk of breast cancer (estrogen and progesterone receptor negative). For premenopausal women, broccoli was shown to be the most protective, whereas collard green consumption was associated with a lower breast cancer risk at all ages (Boggs et al., 2010). Another study of five thousand Swedish women found that eating between 1-2 daily servings of cruciferous vegetables was linked to a 40 percent drop in the risk of developing breast cancer (Terry et al., 2001).

Research has also shown that eating one serving of cruciferous vegetables per day was more effective than tomatoes at preventing the progression of prostate cancer (Richman et al., 2012).

Isothiocyanates are released from cruciferous vegetables when they are broken down by chewing and are believed to act as antibacterial (Fahey et al., 2013) and anti-carcinogenic compounds (Morrison et al., 2019). Some scientists believe that helicobacter pylori, a common pathogenic bacteria in humans, can increase the risk of gastric cancers, when combined with a high sodium diet (Gaddy et al., 2013). Sulforaphane, an isothiocyanate from broccoli sprout extract, has been shown to protect the stomach lining from oxidative damage and therefore other cruciferous vegetables high in sulforaphane may help to prevent stomach cancer caused by helicobacter pylori (Chang et al., 2015). In addition to this evidence, a study in stomach cancer patients where dietary habits were compared to matched controls without cancer, found that cruciferous vegetables may reduce the risk of stomach cancer (Morrison et al., 2019). Specifically, the study found that on average those who ate more than one serving (1cup) of raw cruciferous vegetables per week were almost 50 percent less likely to have stomach cancer when compared to those who reported consuming between 0 to 0.4 servings per week (Morrison et al., 2019).

The Iowa Women's Health Study followed 35,000 women for decades and found that higher cruciferous vegetable intake was associated with lower risk of getting non-Hodgkin's lymphoma (Thompson et al., 2010).

Lastly, a study analyzing 47,909 health professionals over ten years, found that eating 5 or more servings of cruciferous vegetables per week was associated with half the risk of developing bladder cancer compared to individuals consuming less of these vegetables (Michaud et al., 1999).

## Fibre Rich Foods

(legumes, whole grains, fibrous vegetables, and fruits)

**Why Eat Fibre:** Dietary fibre, both soluble and insoluble are invaluable for chronic disease prevention (particularly cancer prevention), weight maintenance and overall health (WCRF & AICR, 2018). Fibre rich foods have been shown to reduce the risk of a variety of cancers and provide benefit while managing cancer during treatment. More specifically, when high fibre foods are broken down in our digestive tract, butyrate (a fatty acid) is generated by the colon, which is known to have cancer preventing activities (Supic et al., 2013).

**How to Eat Fibre:** The World Cancer Research Fund/American Institute for Cancer Research (AICR) recommends eating vegetables, fruits, whole grains, and legumes with every meal, (2018). Aim to get at least 30 grams of fibre per day (WCRF & AICR, 2018). Use a healthy portion of fibre rich foods in everything you make and eat. Use them in salads, soups, stews, curries, burritos, wraps, and all your favourite baked goods.

**Nutritional Benefits for Specific Cancers:** Individuals who eat a healthy plant based diet have been shown to reduce the risk of certain cancers (Chen et al., 2015). One of the major benefits of a plant based diet is the high amount of fibre. Consumption of whole grains and other foods rich in dietary fibre are recommended to help protect against colorectal cancer (WCRF & AICR, 2018).A high fibre diet can impact the overall health of the colon as fibre increases transit rate of the bowels, thereby reducing carcinogens and their surface contact with the bowel wall (Marsh et al., 2012). When comparing colon environments between vegetarians and meat-rich diets, those with vegetarian diets had lower colonic cell proliferation, differing intestinal bacteria, and lower levels of fecal enzymes and mutagens (Marsh et al., 2012).

In addition, diets high in fibre are normally less processed and more nutrient dense helping to regulate energy intake (calories in versus calories spent). These characteristics all help to maintain a healthy body weight, protecting against obesity, and obesity-related cancers (WCRF & AICR, 2018). Furthermore, scientists have found that being overweight reduces the likelihood

of cancer survival compared to those of normal weight (Calle et al., 2003)

A Yale University research study found that premenopausal women who ate more than 6 grams of soluble fibre per day had 62% lower risk of breast cancer compared with women who consumed less than 4 grams per day (Li et al., 2013). Fibre benefits were found to be even stronger for estrogen receptor negative (ER-) breast tumours, finding that in premenopausal women who had more than 6 grams of soluble fibre a day were 85% less likely to develop ER- breast cancer (Li et al., 2013). This type of ER- breast cancer is less likely to respond to hormone therapy and is associated with poorer prognosis.

## Flaxseeds

(lignan rich foods)

**Why Eat Flaxseeds:** Flaxseeds are packed with nutrients providing a great source of vitamins, minerals, and fibre, as well as lignans and omega-3 fatty acids (Rock et al., 2012). More research is needed in human clinical studies, however, many observational studies have shown that flaxseed consumption is associated with a lower risk of breast cancer and overall better prognosis (Calado et al., 2018).

**How to Eat Flaxseeds:** Freshly ground seeds are best, or grinding and storing the flax in a dark area (such as the fridge or freezer) to maintain the freshness of oils for future use is recommended (Malcolmson, Przybylski & Daun, 2000). Ground flaxseeds are more easily digested and absorbed compared to whole seeds (Kuijsten et al., 2005;Calado et al., 2018). Use flax in baking in lieu of eggs. One tablespoon of ground flaxseed plus three tablespoons of water mixed together and allowed to sit for 7-10 minutes is equal to one egg when substituted in cakes, muffins, cookies, pancakes, waffles or french toast recipes. When baking there is no need to worry about damaging the lignans or omega-3 fatty acids either as baking with ground flaxseed does not damage its oils (Hyvarinen et al., 2006; Cunnane et al., 1995). Add them to all your baked goods, smoothies, shakes, dressings, breadings, burgers and atop your favourite salads.

**Nutritional Benefits for Specific Cancers:** The lignans are referred to as phytoestrogens because they have estrogen-like actions within the human body. Dietary lignans and other phytoestrogens have been found in observational studies to be associated with a reduced risk of certain cancers such as prostate, breast, and colorectal (Cotterchio et al., 2006*).*

Dietary flaxseed consumption has the potential to reduce tumour growth in patients with breast cancer and may be a potential adjunct to currently used breast cancer drugs (Thompson, 2005). Flaxseeds are one of the highest sources of lignans, which can minimize the effects of the body's

own estrogen, thereby playing a role in hormone-dependent cancers such as breast (Smeds et al., 2007; Cotterchio et al., 2008). Evidence of this role comes from an observational study which found that women who consumed 5.4 mg of lignans per day had a significantly lower risk of developing breast cancer (Cotterchio et al., 2008). One teaspoon of flaxseed contains 13mg of lignans (Thompson et al., 2006).

However not all evidence has been as clear. A meta-analysis of 21 prospective and case control studies did not find a general association between lignans and breast cancer (Buck et al., 2010). Yet when the researchers looked at a subset of studies which only included postmenopausal women (13 studies) they found alternatively that there was a significant association between high lignan intake and a reduction in breast cancer risk (Buck et al., 2010). This protective effect of dietary lignans in postmenopausal women was also found by another group of researchers (Velentzis et al., 2009). Moreover, in a group of Canadian women, regular consumption of flaxseed (or flax bread) lowered their risk of breast cancer by 20-30% (Lowcock et al., 2013). It has also been found that in women with breast cancer, those who have high levels of lignans in their bloodstream appear to have a longer survival rate when compared to those who do not consume lignans or have lower levels measured in their blood (Buck et al., 2011; Guglielmini et al., 2012; McCann et al., 2010).

There is also evidence that flaxseed supplementation may slow the progression of prostate cancer. In a randomized trial, men with prostate cancer who were given 30g per day of ground flaxseed for 30 days were found to have significantly less cancer cell growth when compared to those not provided with flaxseeds (Demark-Wahnefried et al., 2008).

In addition to prostate cancer, lignans may have a protective effect on digestive cancers. In a meta-analysis that grouped data from two case-control studies, dietary lignan intake was associated with a 40% lower risk of upper aero-digestive tract cancers (larynx, esophagus, and pharynx) (Grosso et al., 2017). Further, in an Ontario-based study, 0.26 mg or more per day of dietary lignans was found to be associated with a 27% reduction in colorectal cancer risk (Cotterchio et al., 2006*)*.

Although current evidence is promising, more human research is still needed to expand on the beneficial effects that flaxseeds and their lignans compounds may have on breast, prostate, and digestive cancer (Grosso et al., 2017).

## Garlic

**Why Eat Garlic:** Garlic is considered to be an essential food for dietary based chemopreventive strategies (Boivin et al., 2009). Garlic is a type of allium vegetable, which have been shown to have beneficial effects at each stage of carcinogenesis and may affect many biologic processes that modify cancer risk (Nicastro, Ross & Milner, 2015). For example, the principal bioactives in garlic are sulfur compounds specifically diallyl sulfide (DAS) and diallyl disulfide (DADS). These compounds inhibit the enzymes responsible for activating carcinogens while at the same time stimulating enzymes responsible for the elimination of carcinogens. As a result, the cells become less exposed to carcinogens and less susceptible to DNA damage that would otherwise lead to cancer development (Demeule et al., 2004).

**How to Eat Garlic:** Eating garlic raw is best in terms of its health benefits as heating lowers the amount of a cancer-protective compound. Specifically heating results in the denaturation of the enzyme alliinase, which leads to decreased allicin, a phytochemical present in garlic known for its numerous health benefits related to cancer and heart disease (Nicastro, Ross & Milner, 2015). For best results, use it raw in salad dressings, dips, hummus, salsa, and pestos. Alternatively, crushing the garlic and allowing it to rest for 10 minutes before cooking will allow the beneficial allicin to develop (Nicastro, Ross & Milner, 2015).

**Nutritional Benefits for Specific Cancers:** Observational research suggests garlic may play an important role in the prevention of digestive system cancers, particularly gastric, colon, stomach, and esophageal cancers (Fleischauer & Arab, 2001; Nicastro, Ross & Milner, 2015). However, recent conclusions from two large US cohorts did not find a protective association between garlic consumption and gastric cancer (Kim et al., 2018).

Few randomized human trials have been done on garlic and cancer (Nicastro, Ross & Milner, 2015). One randomized trial in 37 Japanese men found that there was a protective effect of aged garlic extract for colorectal cancer development (Tanaka et al., 2004). Research has also shown that in vitro, garlic is the choice food to suppress the growth of brain, lung, pancreatic, prostate, and stomach cancer cells (Chu et al., 2002).

## Ginger

**Why Eat Ginger:** The aromatic ingredient in ginger, gingerol, has anti-cancer activity in addition to other medicinal properties. A study showed that gingerol was found to strongly inhibit angiogenesis and tumour growth by blocking two key angiogenesis stimulating proteins (Kim et al., 2005). Ginger may also work as an anti-vomiting agent effective in countering nausea during chemotherapy, radiation and after surgery (Palatty et al., 2013).

**How to Eat Ginger:** Ginger is great in both sweet and savoury recipes. Drink it as a tea (iced or hot), add it to smoothies, soups, salad dressings, marinades, your favourite stir fry, and all of the whole grain baked goods including fruit crisps, crumbles, cookies, muffins, and cakes. To maximize its benefits related to reducing nausea eat it with a plant based protein.

**Nutritional Benefits for Specific Cancers:** Ginger and its active components have anti-inflammatory and anti-mutagenic properties which have been shown to suppress the growth of cancer cells and induce cellular death for a variety of cancers including skin, ovarian, colon, breast, cervical, oral, renal, prostate, gastric, pancreatic, liver, and brain (Prasad & Tyagi, 2015).

In addition to its anti-carcinogenic effects, ginger has been found to possibly improve nausea. A review of seven studies which tested the benefits of ginger for nausea and vomiting caused by chemotherapy found mixed results, with three of the studies demonstrating a beneficial effect of ginger, two studies indicating possible benefit and two finding no effect (Marx et al., 2013). Ginger has also been found to improve the severity of acute chemotherapy-induced nausea in breast cancer patients (Totmaj et al., 2019).

## Grapefruit

**Why Eat Grapefruit:** Grapefruit contains high levels of the flavonoid apigenin, which has been shown to contain anti-oxidative and anti-inflammatory activity and may aid in reducing cancer cell growth without affecting normal cells (Cirmi et al., 2016). Two other flavonoids found in grapefruit, naringin and naringenin, are anti-carcinogenic and may reduce the risk of cancer cell initiation, promotion, and progression (Cirmi et al., 2016).

Additionally, grapefruit is a source of lycopene (also found in tomatoes, papaya and watermelon), which has been noted as a powerful antioxidant known for its potential in reducing prostate cancer risk (Rowles et al., 2017; Seren et al., 2008). Evidence suggests that lycopene may assist in various mechanisms related to mutagenesis, carcinogenesis, cell differentiation, and proliferation, thus potentially preventing cancer (Seren et al., 2008).

**How to Eat Grapefruit:** It is recommended to eat grapefruit in its whole food form more often than juice, as the fibre present in the whole food also contains health benefits. Add slices to your smoothies, fruit salad, parfaits, and baked goods or enjoy it on its own or placed briefly under a broiler to brown and caramelize its natural sugars.

**Nutritional Benefits for Specific Cancers**: Grapefruit falls under the class of citrus fruits which have been shown to be protective against gastric cancer (WCRF & AICR, 2018). Specific to

grapefruit studies have shown that apigenin can induce apoptosis in breast cancer cells and leads to cell cycle arrest in cancers including breast, ovarian, prostate, colon, and thyroid (Cirmi et al., 2016).

An in vivo study found that consumption of grapefruit or its flavonoids may help to control the development of colon cancer (Cirmi et al., 2016).

**Things that affect flavonoids in general:** When selecting and preparing flavonoid rich foods, selecting ripe or near ripe produce, storing them appropriately, and when the time comes applying healthier cooking methods, are all important ways to retain or influence the concentration of the flavonoids present (Holland et al., 1995; Robards and Antolovich 1997; Pascual-Teresa et al., 2000; Modak et al., 2011). Cooking methods such as boiling or frying may decrease the amount of the flavonoids present in the food. However, methods like sautéing do not seem to affect the flavonoid content (Ioku et al, 2001). Other factors to note that may decrease flavonoid content in food include: purchasing fresh, not-local, produce out of season, have been stored for a prolonged period, heating flavonoid rich foods at high temperatures for long periods of time, and discarding the flavonoid rich peels of fruits and vegetables (Harnly et al., 2006).

Note: Some cancer medications cannot be taken with grapefruit as it may interfere with the medication. Please ask your health care team if grapefruit is ok for you to consume.

## Green tea

**Why Drink Green Tea:** Green tea is high in Epigallocatechin gallate (EGCG), a type of catechin from the flavonoid family and has been shown to inhibit tumour growth, angiogenesis, and promote cancer cell death. Studies conducted in laboratories, humans and epidemiologically have reported that drinking green tea may decrease cancer risk in addition to reducing inflammation in the body in general (Ohishi et al., 2016; Suganuma et al., 2016; Supic et al., 2013; Yang et al., 2008).

**How to Drink Green Tea:** How green tea is prepared can significantly affect the amount of catechins present. When drinking green tea, allow the tea leaves to steep in boiling water for 5 minutes to aid in the extraction of the catechins present in the tea leaves and consequently increases the concentration of catechins found in the steeped tea (Shishikura & Khokhar, 2005). Whether or not the tea is decaffeinated may affect its catechin content. In a study analyzing 18 different teas, decaffeinated green tea appeared to contain less catechins than a regular

caffeinated tea. This may have to do with the processing needed to remove the caffeine and not the caffeine itself (Henning et al., 2003). Remember also to drink your tea 1–2 hours prior to or after eating, as the caffeine and tannins present may inhibit nutrient absorption, particularly iron and zinc and to a lesser extent, calcium.

**Nutritional Benefits for Specific Cancers:** EGCG has been shown to induce histone modifications in human melanoma cells (Supic et al., 2013). In animal studies, catechins in green tea have been shown to inhibit the growth of skin, lung, oral, esophagus, stomach, small intestine, colon, bladder, liver, pancreas, prostate and breast cancer (Yang et al., 2008).

A systematic review and meta-analysis by Guo et al. (2017) found that a higher daily intake, 7 cups or more of green tea significantly lowered the risk of prostate cancer. Another systematic review and meta-analysis of observational studies found that drinking 6 cups of green tea per day was associated with a lower risk of gastric cancer, especially for those who drank high amounts long term (Huang et al, 2017). Ensure that the tea is not too hot upon drinking though as high-temperature green tea may be a factor in higher gastric cancer risk (Huang et al, 2017).

There have also been significant associations made in regards to green tea and ovarian cancer prevention and treatment supporting the use of green tea and its components in a clinical environment (Trudel et al., 2012). A study in China researching green tea and ovarian cancer showed that a high intake of green tea after diagnosis is specifically associated with an increased chance of survival (Zhang et al., 2004).

## Healthy Plant-based Oils

(used sparingly)

**Why to Eat Plant-based Oils:** Contrary to popular belief, fats are not the reason for obesity, and dietary fats are an essential and beneficial components of the diet, in appropriate amounts. They can be incorporated into a healthful diet to reduce the risk of cancer and other diseases. Specifically plant based vegetables oil, used in moderation, have been shown to have some health benefits related to cancer. The Mediterranean diet is an example of a diet rich in healthy fats, particularly olive oil, which has been shown to have health benefits including protective effects against cancer (Han et al., 2015). Moreover, plant based fats are good sources of vitamin E, an important nutrient and antioxidant to include in an anti-cancer diet.

**How to Eat Plant-based Oils**: Healthy fats should be used sparingly as part of an anti-cancer diet. Plant based fats can be added to salad dressings, used in cooking, in baked goods, or lightly drizzled over lightly roasted vegetables. Ensure that the oils used for cooking have higher smoke

points to avoid creating free radicals when heating them. Oils like avocado, coconut, grapeseed, and sesame seeds are best for higher temperature cooking. Avocados and nut butters can be used instead of butter or margarine on toast and also add additional flavour, fibre, protein and healthy fats.

**Nutritional Benefits for Specific Cancers:** A meta-analysis looking at observational studies on different types of dietary fat intake and the risk of gastric cancer, found an inverse relationship between polyunsaturated fat, vegetable fat consumption, and risk of gastric cancer, and that saturated fat may increase the risk of gastric cancer (Han et al., 2015).

According to retrospective findings from the Nurses' Health Study at Harvard University, adolescent women who consumed higher amounts of vegetable fat were less likely to develop breast cancer later in life (Frazier et al., 2003). Butter consumption, on the other hand, was found to be associated with an increased risk of breast cancer (Frazier et al., 2003). Furthermore, in a separate cohort of women, the Nurses' Health Study II, higher consumption of vegetable fat was also found to be associated with a lower risk of breast cancer, specifically mentioning a 42% risk reduction in adulthood (Frazier et al., 2004). These findings have also been supported by a prospective observational study, where vegetable fat consumption by pre-adolescent girls was associated with a lower risk of benign breast disease - an established risk factor for breast cancer (Berkey et al., 2013). Moreover, there is research that suggests olive oil or other sources of monounsaturated fatty acids may modestly decrease breast cancer risk and that higher intake of vegetable oils is not associated with the higher risk of breast cancer (Kushi & Giovannucci, 2002; Xin et al., 2015).

The amount of total dietary fat consumed, specifically fats derived from animals, has shown an increased risk of Non-Hodgkin's Lymphoma in a meta-analysis executed (Han et al., 2017).

On the flip side, decreasing the amount of unhealthy fats, like red and processed meats have been shown to also decrease the risk of colon, prostate and potentially breast cancer (Kushi & Giovannucci, 2002; Xin et al., 2015). Saturated and trans fats were also associated with an increased risk of ovarian cancer risk in a meta-analysis of epidemiological studies relating to dietary fat intake and ovarian cancer (Qui et al., 2016) and polyunsaturated fat sources were associated with a reduced risk of ovarian cancer (Merritt et al., 2014).

## Herbs

(fenugreek, oregano, thyme, basil, mint, cilantro, rosemary, and parsley)

**Why Eat Herbs:** Aside from increasing flavour without additional salt, sugar or unhealthy fat, herbs are full of beneficial phytochemicals that are key to include in an anti-cancer diet. They are particularly rich in beta-carotene and flavonoids.

Apigenin, a flavonoid found in parsley has shown to have anti-cancer effects, specifically cell apoptosis and a reduction in cancer cell motility and invasion, for a variety of cancers including colorectal, breast, liver, lung, melanoma, prostate, and osteosarcoma (Xianohui et al., 2017).

Oregano and thyme in particular are shown to contain high levels of an antioxidant called rosmaricin that suppresses the growth of tumour blood vessels (Viuda-Martos, et al., 2010; Kruma, et al., 2008; Huang & Zheng, 2006).

Rosmarinic acid is an antioxidant phenolic compound, which is found in many dietary spices such as mint, sweet basil, oregano, rosemary, sage, and thyme (Huang et al., 2010).

Peppermint was shown to be one of the most common herbs highest in antioxidants (Carlsen et al., 2010).

**How to Eat Herbs:** Raw or cooked, herbs are excellent nutrition and flavour packed additions to all sorts of foods: soups, salads, sandwiches, smoothies (try adding basil, cilantro or mint to your next smoothie), marinades, dressings, etc.

**Nutritional Benefits for Specific Cancers:** Oregano can help to combat the DNA damage that is caused by radiation therapy used for thyroid cancer, thereby acting as a potent radioprotective herb (Arami et al., 2013). Rosemary contains 3 key components which have been associated with cancer prevention including carnosic acid, carnosol and rosmanol (Zheng et al., 2016).

Ginseng is believed to have many anti-inflammatory actions within the human body caused by its bioactives known as ginsenosides (King & Murphy, 2007). Ginseng has been found to improve fatigue in cancer patients (Barton et al., 2013). In a randomized control trial, 2000mg per day of American ginseng was supplemented to cancer patients and was found to significantly improved cancer-related fatigue after 8 weeks of supplementation when compared to placebo (Barton et al., 2013). Other studies in patients with colon cancer also found beneficial effects of ginseng for cancer-related fatigue (Pourmohamadi, Ahmadzadeh & Latifi 2018).

NOTE: Other chinese herbs such as berberine and nigella sativa have shown to contain anti-cancer compounds and the current research appears promising, however, more studies need to be done in humans to conclusively confirm their benefits (Ortiz et al., 2014; Khan et al., 2011).

## Hot Peppers

**Why Eat Hot Peppers:** People who eat red hot chili peppers are more likely to live for longer (Chopan & Littenberg, 2017). The heat producing chemical in hot peppers, capsaicin, has been shown to have pain modulation and cancer preventing properties (Bley et al., 2012). A study showed that capsaicin suppresses tumor blood vessel growth by acting on the cellular pathways involved in the production of nitric oxide by endothelial cells (cells that line blood vessel walls) (Min et al., 2004).

**How to Eat Hot Peppers:** Eat them raw, cooked in your favourite dishes or pickled! Hot peppers are a great addition to curries, stews, chilis, gumbos or on sandwiches, salads, and whole grain pizza!

**Nutritional Benefits for Specific Cancers:** Capsaicin has several anti-cancer properties including cell death, inhibition of angiogenesis and metastasis and cell growth arrest (Clark & Lee, 2016). Studies looking at various cancer cell lines have shown that capsaicin induces cell death in cancerous cells, and leaves normal cells untouched (Clark & Lee, 2016). This has been seen in various cancer cells including those of the pancreas, colon, prostate, liver, esophagus, bladder, skin, leukemia, lung, and endothelial cells (Clark & Lee, 2016).

Epidemiological research has suggested that consumption of fresh chili peppers is associated with lower cancer risk, finding that individuals who consumed fresh chili peppers were more likely to live longer and 11% less likely to die from cancer (Lv et al., 2015)**.** Yet other findings have been less clear (Bley et al., 2012) with much debate over the role of capsaicin and cancer (Bode & Dong 2011). Research based from Mexico found high chili pepper consumption was related to an increased risk for gastric cancer (López-Carrillo, Hernández & Dubrow 1994) and research from Chile found an increased risk for gallbladder cancer (Serra et al., 2002). This difference in findings may be due to cultural differences and possibly the quantity of peppers commonly consumed.

Chilli peppers are not just food but can be used topically (on the skin) as capsaicin cream. Topical application of capsaicin has been shown to help relieve various types of pain, although the effectiveness and safety is still debated (Mason et al., 2004). In a group of 99 cancer survivors with postsurgical neuropathic pain who were treated with capsaicin (0.075%) four times per day, the capsaicin treatment was more effective compared to placebo (Ellison et al., 1997). Specifically the capsaicin-treated site was found to have an average pain reduction of 53%, compared to 17% on the placebo treatment (Ellison et al., 1997). Further, a systematic

review and meta-analysis which looked at six randomized control trials (including the one mentioned previously) found that although topical capsaicin was statistically better than placebo for the treatment of both neuropathic and musculoskeletal pain, the extent of the effectiveness was quite low (Mason et al., 2004). Moreover, the use of topical capsaicin was also found to have side effects with one third of patients experiencing local adverse events. In addition, the safety of long term use of capsaicin for chronic pain has still not been researched well. The reviewers concluded that topical capsaicin should not be generally recommended. However, it may be useful for some who are not responsive to or unable to use other treatments (Mason et al., 2004).

## Low Glycemic Whole Foods

(Green vegetables like broccoli, collard greens, kale, and spinach, other vegetables like cauliflower, celery, zucchini, most fruits, nuts, seeds, legumes, and whole grains)
**Why Low Glycemic Whole Foods:** Low glycemic foods (which are made up of mostly whole, unprocessed plant based foods) help to regulate blood sugar levels keeping us satiated for longer and without dips and spikes in our blood sugar and insulin levels. This is important to our health and risk of cancer as studies have shown an association between high glycemic loads, insulin spikes and the occurrence of cancer (Donaldson, 2004).

**Nutritional Benefits for Specific Cancers:** Various case control studies have indicated a consistent message that those who eat diets with a high glycemic load have an increased risk of developing cancer, specifically gastric (Augustin et al., 2004), upper aero digestive tract (Augustin et al., 2003), endometrial (Augustin et al., 2003), ovarian (Augustin et al., 2003), prostate (Augustin et al., 2004), colon or colorectal cancers (Franceshi, 2001; Slattery, 1998).

## Mixed and Leafy Greens

**Why Eat Greens:** Individual who eat green leafy vegetables and salads are more likely to live longer (Aune et al., 2017). Research shows that salad greens (a variety of lettuce) are important polyphenol sources. In laboratory settings, polyphenols show to inhibit angiogenesis (the growth of tumour blood vessels) (Heimler et al., 2007; Steevens et al., 2011) and provide interceptor molecules that prevent some of the mutations that can cause cancer (Benaron et al., 1997).

**How to Eat Greens:** Chicory has the highest content of polyphenols, however, all lettuce varieties including spinach, red and green leaf lettuce, boston lettuce, frisee, romaine, iceberg and arugula and have been shown to contain quercetin, another antiangiogenic polyphenol.

Therefore, select a variety of lettuce for overall chemopreventive health (Heimler et al., 2007; Steevens et al., 2011).

**Nutritional Benefits for Specific Cancers:** A large epidemiological study showed that daily lettuce intake was associated with a reduced incidence of a type of esophageal cancer (Steevens et al., 2011). A Mayo Clinic study showed that those who ate five or more servings of green leafy vegetables per week had half the odds of getting lymphoma, compared to those who ate less than one serving per week (Holtan et al., 2012).

The Iowa Women's Health Study found that individuals who ate more than six servings of leafy greens such as spinach per week were almost half as likely to develop lung cancer when compared to individuals who ate few leafy greens (Steinmetz et al., 1993).

Another study suggested that a diet rich in fruits and vegetables, particularly leafy greens such as spinach, could lower the risk of a common skin cancer called squamous cell carcinoma by 54% (Ibiebele et al., 2007).

## Mushrooms

**Why Eat Mushrooms:** Mushrooms are used in complementary and alternative medicine as part of treatment for diseases, including certain cancers (Ayeka, 2018). They are rich in dietary fibres and other important anticancer compounds, thereby playing a role in a cancer preventative diets (Akramiene et al., 2007; Manzi et al., 2004). In addition, sun-dried or UV radiation exposed mushrooms are a plant-based source of vitamin D (Cardwell et al., 2018), an important vitamin for overall health and possibly protection against some cancers (Hossein-nezhad & Holick 2013). The cell walls of mushrooms are made up of complex sugars, beta glucans are one of the complex sugars that has been shown in laboratory settings to regulate immune function, suppress angiogenesis and stop tumour growth (Chan et al., 2009). Lectins are another bioactive compound found in mushrooms which exhibit promising anticancer properties by deterring cancer cell growth and angiogenesis as well as promoting apoptosis (Novaes et al., 2011).

**How to Eat Mushrooms:** studies show that the amount of beta glucans in mushrooms vary, and seem to be impacted more so by the life stage of the mushroom rather than the variety or method of preparation (Akramiene et al., 2007; Manzi et al., 2004). Ongoing studies are being conducted to determine life stage of mushrooms and beta glucan content, so eating a variety of edible mushrooms (fresh or dry) is recommended (Akramiene et al., 2007; Manzi et al., 2004). For health and safety purposes, it is best to eat mushrooms cooked (Nguyen, 2012). Try them in a

mushroom stroganoff or bourguignon, in soups, chowders, pastas, veggie meatballs and burgers or simply sauteed with garlic and eaten on whole grain toast.

**Nutritional Benefits for Specific Cancers:** Many studies have been undertaken looking at the role of mushrooms, and their extracts, in cancer prevention and treatment (Li et al., 2014). An in vitro study looking at intake of isolated polysaccharides from white button mushrooms demonstrated the ability of the isolated polysaccharides to inhibit the growth of certain breast cancer cells (Jeong et al., 2012). Research exploring the benefits of Chaga mushrooms, a fungus that grows on the trucks on birch trees, found that the water extract of chaga inhibited the growth and differentiation of melanoma cells in vitro and in vivo (Youn et al., 2009)

In addition, a meta-analysis of 10 observational studies indicated that the consumption of mushrooms (up to 20 grams per day) was associated with a lower risk of developing breast cancer in both pre and postmenopausal women (Li et al., 2014). Within their meta-analysis the researcher included various types of edible mushrooms with no findings relating to a specific type of mushroom.

Further, a meta-analysis looking at 13 randomized controlled trials found that a mushroom and herbal preparation called Yun Zhi taken along with conventional anti-cancer treatments resulted in an increased chance of survival compared to the conventional cancer treatment on its own for breast, colorectal and gastric cancers (Eliza et al., 2012). Studies have shown that the inclusion of the Yun Zhi preparation allows for better control of cancer, especially in chemotherapy (Eliza et al., 2012).

## Nuts

**Why Eat Nuts:** Nuts are full of healthy nutrients including dietary fibre, unsaturated fats, vitamin E, and magnesium. These nutrients all are associated with a lower risk of cardiovascular disease and some cancers (Aune et al., 2016). Vitamin E is a powerful antioxidant and bioactive compound found in nuts which is associated with multiple anti-cancer properties including inhibition of carcinogenesis and tumour growth, as well as apoptosis of cancerous cells (Cui et al., 2018; Nieuwenhuis & Brandt, 2018).

A population-based case control study focusing on adolescents found that nuts (including peanuts, peanut butter and other nuts) intake was associated with a 22-24% reduction in breast cancer risk (Liu et al., 2014). In addition, women who consumed two or more servings (28 grams) of nuts per week were found to be 32% less likely to develop pancreatic cancer (Bao et al., 2013).

Research has shown that some of the most important cancer fighting nutrients are in the skins of nuts (Chen et al., 2005). More specifically, flavanoids, which have been shown to help inhibit angiogenesis, as well as protect cells from damage by environmental toxins (Chen et al., 2005).

Ellagic acid is a type of polyphenol found in nuts that increases the cell's capacity to defend itself against toxic aggression by stimulating its ability to eliminate carcinogens (Labreque et al., 2005).

**Walnuts:** Although all nuts are recommended for a cancer-preventive diet, walnuts are commonly studied for cancer (Toner, 2014). Walnuts have high amounts of α-linolenic acid (ALA), polyphenols, and phytochemicals that have anti-inflammatory and antioxidant properties. On a serving size basis, walnuts are one of the highest sources of polyphenols in the human diet (Vinson & Cai, 2012).

In vitro and in vivo research has found walnuts are chemoprotective (Toner, 2014), preventing cancer cell growth (Carvalho et al., 2010). They also contain a broad range of other potentially protective compounds called elligitannins, which are broken down to ellagic acid. Bacteria in our digestive tract convert ellagic acid into compounds called urolithins. Urolithins have been found to have antioxidant and anti-inflammatory properties (Espin et al., 2013) and walnut urolithins have been found to have direct cancer-inhibiting effects (Sánchez-González et al., 2014).

**Brazil nuts:** Contain extremely high levels of selenium. Selenium has been shown to be associated with many anti-cancer properties and a reduction in cancer risk (Cai et al., 2016).The consumption of 2 brazil nuts a day was found to significantly raise selenium levels in the blood of 59 adults (Thomson et al., 2008).

**How to Eat Nuts:** Buy nuts with their skins on, and roast them to make the flavonoids more potent and concentrated (Monagas et al., 2009). Store nuts in the refrigerator or in the freezer to preserve the good quality healthy oils. If you prefer them at room temperature, store them in a cool, dry and dark place (Lee et al., 2011). Use them to make nut cheeses, healthy baked goods, as a quick and crunchy snack or add them atop your salads, stir-fries, curries, and pancakes.

**Nutritional Benefits for Specific Cancers:**

**Walnuts:** In one of the largest interventional dietary trials called PREDIMED, researchers used baseline data of participants to undertake an observational study to investigate the relationship between nut consumption and mortality. Walnuts were found to have a clear benefit for preventing cancer mortality. People who ate more than three servings of walnuts (84 grams) per

week appeared to cut their risk of dying from cancer in half (Guasch-Ferre et al., 2013).

For specific cancers, walnut extract was found to inhibit the growth of colon cancer cells in vitro (Carvalho et al., 2010). Further, urolithins from walnuts were found to induce apoptosis (cell death) in prostate cancer cells (Sánchez-González et al., 2014).

**Brazil nuts:** in the 1940's selenium was seen as a potential carcinogen, then between the 1960's-2000's research suggested it may have anti-cancer properties, possibly depending on the source of selenium (Vinceti, et al., 2013). A recent meta-analysis looking at 69 studies focused on selenium and cancer risk found that high selenium intake was inversely associated with total cancer risk (Cai et al., 2016). There was a decrease in risk of several cancers including breast, lung, esophageal, gastric, and prostate, although the reduction in risk varied between cancers, there was no gender difference in terms of protective effects (Cai et al., 2016).

Within this meta-analysis, a sub-analysis of 14 studies on selenium exposure and breast cancer risk showed a high selenium intake was associated with a reduced risk of breast cancer (Cai et al., 2016). Moreover, a high selenium intake was associated with a reduction in risk of lung cancer in a sub-analysis of 13 studies (Cai et al., 2016). Similarly, the association between prostate cancer and selenium intake showed a reduction in risk with increased selenium intake in a group of 25 studies (Cai et al., 2016).

## Omega-3 Fatty Acids

(Found in walnuts, flax seeds, chia seeds, hemp seeds, pumpkin seeds, soybeans, and tofu)

**Why Eat Omega-3 Fatty Acids:** Omega-3 fatty acids have many roles within the human body, with potential preventative and therapeutic benefits. Omega-3 fatty acids are used in the synthesis of anti-inflammatory molecules which decrease the production of inflammatory molecules that disrupt the immune system, in turn decreasing cancer development. They are known to improve mental health and related diseases such as depression (Sublette et al., 2011; Bigornia et al., 2016). In addition to these benefits, omega-3 fatty acids also work directly on cancerous cells by modifying their ability to avoid apoptosis (cell death) and preventing the development of new blood vessels for cancer growth (Rose & Connolly, 1999; Larsson et al., 2004).

**How to Omega-3 Fatty Acids:** Sprinkle ground flax seeds, chia seeds, hemp seeds, sunflower seeds, pumpkin seeds, and walnuts onto your favourite baked goods or morning eats including pancakes, oatmeal, granola, avocado toast or add a generous helping into your morning

smoothie. Incorporate edamame and nuts or seeds into your favourite salad and tofu into an easy stir fry.

**Nutritional Benefits for Specific Cancers:** Dietary fat plays an important role in a healthy diet (Simopoulos, 2008). While saturated fatty acids and trans fatty acids are associated with harm, omega-3 fatty acids are indicated to have anticarcinogenic effects in breast, prostate and colorectal cancers (Demark-Wahnefried et al., 2008; Yang et al., 2018; Saadatian‐Elah et a., 2004; Yang et al., 2014).

There are 3 types of omega-3 fatty acids: α-linolenic acid (ALA) which is found in plant foods like nuts and seeds, and eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) which are mostly found in fish, other marine sources and algae. ALA is an essential fatty acid as the human body cannot make it. ALA can be converted into EPA and DHA within the body. Originally the conversion was believed to be very low (Lands, 1992), inferring the importance of EPA and DHA in the diet. This lead to more scientific research being focused on EPA and DHA in supplemental form however recent evidence suggests the conversion of ALA into EPA and DHA within humans may be higher than previously thought (Welch et al., 2010).

An additional factor to consider is the ratio of omega-6 fatty acids to omega-3 fatty acids in the diet (Simopoulos, 2008). The amount of omega-6 fatty acids is increasing in the western diet (i.e. poultry, eggs, some vegetable oils), while the amount of omega-3 fatty acids is less (Simopoulos, 2009). The ratio of these 6 and 3 fatty acids is very important as they both compete for the same enzyme for elongation, thus the excessive consumption of omega-6 fatty acids reduces the already low conversion rate of ALA to long chain EPA and DHA (Simopoulos, 2016). Further, by increasing omega-3 fatty acids in the diet it is possible to decrease the production of omega-6 metabolites which are known to contribute to inflammation and other various carcinogenic processes (Lupulescu, 1996).

In a meta-analysis of three cohort studies, higher amounts of omega-3 fatty acids measured from blood and tissue samples of participants was found to be associated with a lower risk of breast cancer (Saadatian‐Elah et a., 2004). Whereas, a higher composition of saturated fatty acids was associated with an increased breast cancer risk for postmenopausal women (Saadatian‐Elah et a., 2004).

In a group of 161 men with prostate cancer, treatment with 30 grams (~3 tablespoons) per day of ground flaxseed, which contains around 7 grams of ALA (Rodriguez-Leyva et al., 2010), was found to reduce prostate cancer growth over 4 weeks (Demark-Wahnefried et al., 2008). Further, those on the intervention were found to have increased EPA levels and a decreased n-6:n-3 ratio in the prostate tissue (Demark-Wahnefried et al., 2008), suggesting that ALA from flaxseed was

converted into EPA within the body.

So far, fish oil has been the major commercial source of EPA and DHA. However other sources such as from algae are available and may have additional benefits to fish oil, yet more research in humans is needed (Robertson et al., 2015).

## Onions

(including shallots, leeks, scallions, and chives)

**Why to Eat Onions:** Onions are a rich source of fibre, potassium, iron, and vitamin C (Nicastro, Ross & Milner, 2015). Similar to garlic and other *Allium* vegetables, onions contain sulfur-containing compounds which are believed to play a role in cancer prevention (Nicastro, Ross & Milner, 2015). They also contain high levels of flavonoids, specifically quercetin, and anthocyanins, which have been shown to inhibit cancer cell proliferation and angiogenesis (Slimestad et al., 2007; Herman-Antosiewicz & Singh, 2004).

**How to Eat Onions:** Select red and pink onions for the highest levels of flavonoids, followed by yellow (Slimestad et al., 2007). Eat frequently, one meal a day should include a form of onion, as research has shown that frequent consumption (more than 7 times per week) of garlic or onions is associated with a lowered risk of a number of cancers (Galeone et al., 2006). Onions can be eaten raw and/or cooked (Oude Griep, et al., 2010). Add them to soups, stews, chilis, curries, stir-frys, or as a delicious caramelized topping on your salad, sandwich or pizza.

**Nutritional Benefits for Specific Cancers:** Allium vegetables have been found to be protective against many different types of cancers including breast and pancreatic cancer (Challier, Perarnau, & Viel, 1998; Chan, Wang & Holly, 2005). Further, a high intake of onions has been found to be associated with a lower risk of colorectal, ovarian and laryngeal cancers (Galeone et al., 2006). In a case-control study onion consumption was associated with a lower risk of Benign Prostatic Hyperplasia (BPH) (enlarged prostate) when compared to those who do not eat them (Galeone et al., 2007) however there is no link between BPH and prostate cancer.

## Orange Fleshed Vegetables and Fruits

(Carrots, winter squash, sweet potatoes, and papaya)

**Why Eat Orange Fleshed Vegetables and Fruits:** Carrots contain beta-carotene and alpha-carotene, which are converted to Vitamin A and used for immune support and maintaining

healthy cells. These phytonutrients activate carcinogen-metabolizing enzymes. Carrots also contain luteolin, a flavonoid phytochemical that exhibits antioxidants, anti-inflammatory, and anti cancer effects in laboratory settings.

**How to Eat Orange Fleshed Vegetables and Fruits:** Carrots can be eaten/cooked any which way, and still manage to hold onto their exceptional nutritional profile (even boiled!) (Jimenez-Montreal et al., 2009). So, eat them raw as a snack dipped with your favourite bean dip. Use them in soups, shredded into salads or try roasting them.

**Nutritional Benefits for Specific Cancers:** The dietary fibre in carrots lowers the risk of colorectal cancer (WCRF & AICR, 2018). Carrots are considered a non-starchy vegetable, which have been shown to lower the risk of mouth, larynx and pharynx cancers. These specific cancers are also lowered by the carotenoids present in carrots, in addition to lung cancer (AICR, n.d.). Several population studies link higher dietary carotenoids, and especially higher blood levels of carotenoids, with lower risk of some types of breast cancer (AICR, n.d.).

## Winter Squash and Sweet Potato

**Why Eat Winter Squash and Sweet Potato**: Because of their carotenoid (such as beta carotene, a carotenoid that our body can convert into Vitamin A) and dietary fibre content, winter squash and sweet potato can contribute to a diet which lowers cancer risk in many ways (WCRF & AICR, 2018). Lab research has shown that both alpha-carotene and beta-carotene act as antioxidants that promote cell-to-cell communication, thereby controlling cell growth (Fiedor & Burda, 2014).

**How to Eat Winter Squash and Sweet Potato:** Steamed, roasted, spiralized, tossed into salads or blended into soups. Winter squash and sweet potatoes are a very versatile food that you can incorporate into your diet in many ways.

**Nutritional Benefits for Specific Cancers:** Similar to carrots, winter squash and sweet potatoes are a good source of fibre, and research convincingly shows that eating high fibre foods lowers the risk for colorectal cancer (WCRF & AICR, 2018). In addition, there is a lower risk of mouth, pharynx, larynx, and lung cancer when eating a diet high in carotenoids (Ziegler, 1991), such as those found in winter squash and sweet potato. In a meta-analysis of seven studies, dietary intake of carotenoids was found to reduce the risk of lung cancer, although the evidence was characterized as limited (WCRF & AICR, 2018). Lutein and zeaxanthin are two major types of carotenoids found in winter squash that may have any  decrease the development of skin cancer related to sun exposure (Evans & Johnson, 2010).

## Papaya

**Why Eat Papaya:** Is a very high source of carotenoids, which have antiangiogenic properties, thereby lowering the risk of certain cancers (Irwig et al., 2002; Li et al., 2011; Yuan et al., 2003; Zhang et al., 2009; Tamimi et al., 2009; Pandey & Shukla, 2002)

**How to Eat Papaya:** Eat the fruit as is for a quick snack or get creative with papaya salads, papaya chutneys or toss a few frozen papaya pieces into your smoothie for a creamy treat.

**Nutritional Benefits for Specific Cancers:** One study found that the intake of high levels of carotenoids from papaya was associated with a 50 % risk reduction of breast cancer (Zhang et al., 2009; Tamimi et al., 2009; Pandey & Shukla, 2002). Two studies examining HPV infection and women's diets showed that consumption of foods high in beta-cryptoxanthin (a specific carotenoid) found in high levels in papaya is associated with lower HPV infection rates and lower risks of cervical lesions. Research also shows that papaya intake can decrease the risk of breast, lung, and gallbladder cancer (Giuliano et al., 2003; Siegel et al., 2010). A large epidemiological study in China found that a high level of beta-cryptoxanthin in the body is associated with a significantly lower risk of lung cancer. A Costa Rican study confirmed that beta-cryptoxanthin is well absorbed by the body, therefore the high levels in papaya make it an excellent fruit to consume for its cancer fighting and prevention potential (Irwig et al., 2002;. Li et al., 2011; Yuan et al., 2003).

## Plant-based Protein

(includes legumes and beans such as lentils, chickpeas, white beans, black beans, kidney beans, split peas, soybeans, tofu, tempeh etc. as well as nuts, seeds, seed butters, whole grains such as quinoa, and even some vegetables)

**Why Eat Plant-based Protein:** Research has convincingly shown that eating a diet rich in foods of plant origin is the best for overall health and cancer prevention (WCRF & AICR, 2018). Those undergoing cancer treatments require extra calories and protein to support organ function, muscle repair, and daily activities (Arends et al., 2017) as well as to prevent malnutrition (Edington, Kon & Martyn, 1996). Extra calories and protein helps to heal tissues and fight infections, making it crucial to include protein on a daily basis for those with cancer (Cleveland Clinic, nd). Sufficient protein can be obtained from nuts, seeds, legumes, and whole cereal-grain products (Doyle et al., 2006).

As we have already discussed nuts and whole grain cereals in previous sections, we will focus on legumes here.

Legumes are an affordable source of plant protein and there are several ways in which legumes may act to prevent cancer. Legumes have a great nutritional profile as they are a rich source of folate and dietary fibre, just one serving (half a cup) provides at least 20% of the recommended amounts of both (Rebello, Greenway & Finley, 2014). Dietary fibre is key in reducing risk of cancer as it helps to manage weight and prevent obesity-related cancers (WCRF & AICR, 2018). In addition, folate plays a key role in DNA stability (Duthie, 1999) and therefore cancer prevention (Pieroth et al., 2018).

Dry beans, split peas and other legumes also contain a variety of phytochemicals that scientists are studying for their antioxidant, anti-inflammatory, and antimicrobial effects (Kalogeropoulos et al., 2010). Lentils, chickpeas and white lupin legumes have some of the highest amount of flavonoids among common legumes (Rebello, Greenway & Finley, 2014).

**How to Eat Plant-based Protein:** There are so many kinds of plant based proteins, you don't have to stick to just one. Aim to eat low processed plant protein that are high in dietary fibre and low in saturated fat. Switch it up so that you don't get bored, and buy your beans and whole grains in larger quantities to save money. Add them in whole or pureed form to your dips, dressings, sauces, smoothies, soups, stews, chilis, salads, and baked goods!

**Beans:** Cook from scratch or save time by purchasing canned beans (look for low sodium or no salt added, and BPA free cans). If you have leftovers, ensure to always remove them from the can once opened and store them in an airtight container in the fridge. There are many different types of beans, so try them all!

**Lentils:** Half a cup of cooked lentils gives you about 18 percent of your iron (3.3mg), 32 percent (8 grams) of your daily fibre, and 9 grams of plant protein. Start by adding them to soups or salads, or let your creativity run wild by using them in Shepherd's pie, cabbage rolls, burgers, or stuffed peppers.

**Soy:** Fermented is best, like miso or tempeh or in its whole form like edamame, which can be found fresh or frozen. Try making tofu or tempeh fries, tofu feta, and add edamame to salads, wraps or sandwiches for a pop of colour.

**Nuts and seeds:** Raw or roasted, store in the fridge or freezer to keep them fresh and prevent moulding. Nuts and seeds are great for baking in muffins, energy bars, and cookies, and also delicious on their own as a snack.

**Nutritional Benefits for Specific Cancers:** Human studies include case-control studies, which compare groups of people with and without cancer checking for a difference in plant protein consumption. It also includes cohort studies that follow people without cancer for several years and then look at how much beans, peas, and lentils participants generally consumed. In a prospective study in Spain looking at 7216 participants, researchers found that high legume consumption including dry beans, chickpeas, lentils and fresh peas (average of 28.1 grams per day) was associated with a 50 percent lower risk of cancer mortality when compared to the lowest intake of legumes (Papandreou et al., 2018).

Several studies link higher consumption of legumes with lower risk of colon cancer or the benign adenomas (polyps) that are the beginning of most colon cancer (Zhu et al., 2015; Wang et al., 2013). But overall, human studies focusing on legumes and cancer risk have resulted in inconsistent findings. One reason may be that the common Western diet does not contain beans regularly, making comparison between groups that eat high and low amounts of beans difficult. Research links regular plant protein and legume consumption with a possible reduced risk of breast (Berkey et al., 2014), prostate cancer (Park et al., 2008), and cancer mortality (Papandreou et al., 2018) but more research is needed in western countries.

According to findings from an extension of the Nurses' Health Study II, where dietary information from the daughters of the NHSII participants was assessed yearly from 1996 to 2001, adolescent women who consume 10 grams per day of vegetable based proteins (nuts, beans, lentils, soybeans and corn) had a significantly lower risk for benign breast disease than those who did not (Berkey et al., 2014). Having benign breast disease is a risk factor for breast cancer later in life (Berkey et al., 2014).

The Ontario Women's Diet and Health Study found that intake of dietary fibre, plant based protein, and nuts were all associated with a reduction in breast cancer risk (Liu et al., 2014). Comparing the women in the highest group to the lowest, in terms of intake for each of these foods, was associated with 34%, 20%, and 24% reduction in risk, respectively (Liu et al., 2014).

A meta-analysis of 14 prospective cohort studies looking at legume consumption and colorectal cancer risk found that higher legume consumption led to decreased risk of colorectal cancer (Zhu et al., 2015). However, when they looked at the subgroups they found that only in the Asian population the association was statistically significant, unlike the US and Europe populations where no association was found, which is likely due to Asia's higher consumption of legumes (Zhu et al., 2015).

Among all legumes, soybeans are unique in that they have a concentrated source of phytoestrogens, which are structurally similar to the estrogen hormone found in humans. This similarity to estrogen allows phytoestrogens to bind estrogen receptors in humans and therefore

may have a role at reducing hormone-dependent cancers (Patisaul & Jefferson, 2011). Legumes are also a good source of dietary fibre, protein, vitamin E, B selenium and lignans, all of which are associated with anti-cancer effects (Messina, 1999).

## Pomegranate

**Why Eat Pomegranate:** Fruit is an important part of a healthy cancer preventative diet (WCRF & AICR, 2018). Pomegranate boasts high levels of polyphenols, specifically ellagitannins, ellagic acid and other flavonoids, which are known to have anti-cancer activities (Seeram et al., 2005). Pomegranate has been shown to inhibit cell cycle progression, angiogenesis, and metastasis of cancer cells (Turrini, Ferruzzi & Fimognari, 2015). The majority of the polyphenols are found in the skin of the pomegranate, which is released when juice is made from pressing the whole pomegranate (Gil et al., 2000). In one study, commercial pomegranate juices obtained from the whole fruit were shown to exhibit antioxidant activity three times higher compared to that of red wine and green tea (Gil et al., 2000).

**How to Eat Pomegranate:** Pomegranate juice is great, however, be mindful of portion sizes as juice consumption can equal a lot of sugar consumption. Make sure to look for sugar free versions of pomegranate juice. Eating the juicy pomegranate seeds are a much better option, as you can get the benefits of the antioxidant-rich juice, as well as the added bonus of fibre from the seeds (called pomegranate arils). Snack on them as is, or toss them onto oatmeal, into smoothies, or into a savoury salad for a bright and beautiful garnish.

**Nutritional Benefits for Specific Cancers:** Pomegranate has been shown in cell culture studies to exhibit beneficial effects for cancer prevention. Few studies in humans have been undertaken looking at pomegranate consumption and cancer however one area of great interest is pomegranate for both the prevention and treatment of prostate cancer (Turrini, Ferruzzi & Fimognari, 2015).

One of the first clinical studies provided men, who had a history of recurrent prostate cancer, with one cup of pomegranate juice per day (Pantuck et al., 2006). They found that these men had a longer PSA (prostate specific antigen) doubling time and therefore a lower risk of cancer recurrence than those who did not receive pomegranate juice (Pantuck et al., 2006). However this study design did not include a control and therefore the findings may be caused by a placebo effect. Since then, a total of five additional studies testing pomegranate juice and extracts in men with prostate cancer have been undertaken. While the studies did consistently find that pomegranate juice and extract are safe for those with prostate cancer, the anti-cancers effects were not consistent and overall when the six studies were looked at collectively they did not find

strong evidence to support pomegranate's therapeutic effects for prostate cancer (Paller, Pantuck, & Carducci, 2017).

Currently no human clinical trials have been done to assess the protective effects of pomegranate on colon cancer (Jaganathan et al., 2014). Yet, many cell culture studies have found promising results demonstrating that pomegranate may help modulate cancer cell death and proliferation in colon cancer (Turrini, Ferruzzi & Fimognari, 2015). Polyphenols found in pomegranate including ellagitannins and urolithins were shown to induce apoptosis in human colon cancer cells (Kasimsetty et al., 2010).

## Raspberries

**Why Eat Raspberries:** Berries are rich in cancer-fighting anthocyanins and raspberries are specifically rich in cyanidin (Kristo, Klimis-Zacas & Sikalidis, 2016)**.** The World Cancer Research Fund recommends that fruit is consumed everyday to reduce the risk of cancer (2018). Raspberries can be incorporated as part of an anti-cancer diet. Similar to strawberries, raspberries contain ellagic acid, an anti-cancer phytochemical compound, and are a rich source of antioxidants (Stoner, 2009). More specifically, research on freeze-dried black raspberry extract have shown anti-cancer effects (Stoner et al., 2007).

**How to Eat Raspberries:** When raspberries are in season they are bursting with flavour and appealing to the eye with their rich red appearance. They are great enjoyed on their own, after being thoroughly rinsed or can be thrown into baked goods, smoothies, made into a jam, or added to sparkling water. Raspberries are also great frozen, when picked at the peak of their season, so that they are accessible year round.

**Nutritional Benefits for Specific Cancers:** Both red raspberries and black raspberries are rich in anthocyanins. In vitro studies have shown that anthocyanins have many anticancer activities acting as strong antioxidants, and reducing cancer cell growth, inflammation and angiogenesis (Wang & Stoner, 2008). While research indicates fruit consumption is linked to reductions in cancers of the esophagus, lung, stomach, colorectum, and bladder (WCRF & AICR, 2018), there are few studies on raspberries alone (Stoner, 2009) with only small trials being undertaken. In one such study, black raspberries were found in 10 patients, who were at risk of esophageal cancer, to improve markers of cancer development (Kresty et al., 2006) however it is important to note that further research in larger groups of 20 patients did not find conclusive evidence for blackraspberries and esophageal cancer (Kresty et al., 2018). In another study of 25 colon cancer patients, those provided with black raspberry powder for 2-4 weeks prior to receiving biopsies were found to have reduced cancer proliferation and reduced angiogenesis (Wang et al., 2007).

## Sea Vegetables

**Why Eat Sea Vegetables:** Sea vegetables contain many key nutrients including fibre, protein and unsaturated fat as well as lignans and sulfated polysaccharides (Teas et al., 2013; Kim & Li, 2011). Sea vegetables also contain vitamins and minerals including vitamin C, vitamin B, calcium, iron, iodine and magnesium (Kumar et al., 2008), all of which are important for overall health. The lower incidence of certain cancers in Asia, where sea vegetables are a diet staple, compared to North America suggests that sea vegetables, among other differences in dietary trends, may have protective effects against cancer (Brown et al., 2014). However observational research is limited and not all investigations have found sea vegetables to have protective effects (Shigihara et al., 2014). Further, in North America because sea vegetables are not consumed in significant quantities it is challenging to determine the applicability of the limited evidence found in Asian countries (Shigihara et al., 2014).

**How to Eat Sea Vegetables:** Sea vegetables are great in soups and stews to add depth of flavour. Try making homemade sushi with nori topped with a whole grain rice and your favourite fruits and vegetables! Roasted seaweed is a great snack for on the go and can be purchased in single serving packs.

**Nutritional Benefits for Specific Cancers:** Seaweed may have a role to play in breast cancer prevention. An in vitro study comparing the use of a common chemotherapeutic agent with a solution made using mekabu seaweed (the flowering part of wakame) found that the mekabu solution had stronger effects on human breast cancer cells (Funahashi et al., 2001). Moreover, a study looking at mammalian lignan production in a variety of foods found that dried seaweeds ranked second on the list (Thompson et al., 1991). Lignans are known for their anticancer properties so including some dried seaweeds may be protective against certain cancers such as breast (Cotterchio et al., 2008).

A small study of 15 American post-mentopausal women found that supplementation of 5 grams per day of brown seaweed for 7 weeks lowered serum estrogens and increased favourable estrogen metabolism (Teas et al., 2009). When researchers retrospectively looked at the diets of 362 Korean women who had a history of breast cancer with aged-matched controls, daily consumption of seaweed, specifically *gim,* was associated with a reduction in breast cancer risk (Yang et al., 2010).

In a small placebo-controlled trial, American women were provided 5 grams of Undaria seaweed over four weeks (Teas et al., 2013). The researchers found that when the women were provided

with the seaweed supplement they had significantly lower urine concentrations of urokinase-type plasminogen activator receptor (uPAR) (Teas et al., 2013). High levels of uPAR are associated with increased cancer progression.

## Soy

(Emphasis on whole food and fermented sources)

**Why Eat Soy**: Soy foods are a source of high quality plant protein and are believed to have a variety of health benefits related to chronic disease prevention. Much research has been undertaken to investigate the health benefits of soy foods (Messina, 2016). The main phytochemicals in soy foods are isoflavones with a specific focus on genistein, which has been shown to have chemopreventive characteristics (Supic et al., 2013; Béliveau & Gingras, 2006). Researchers believe that genistein is the primary molecule responsible for anti-cancer properties due to its ability to block enzymes involved in the uncontrolled growth of tumour cells (Sarkar & Li, 2002).

**How to Eat Soy:** The highest concentrations of isoflavones are found in soy flour, soybeans (such as soy nuts and edamame) and in fermented soy products (e.g. miso, tempeh, and natto) (Rizzo & Baroni, 2018). For example frequent consumption of miso soup (3 cups per day) in Japanese women was associated with a 30% lower risk of breast cancer (Yamamoto et al., 2003). As with all foods, soy foods are best eaten as whole foods rather than in their overly processed or supplemental forms (Messina & Messina, 2010).

**Nutritional Benefits for Specific Cancers:** Isoflavones can bind to estrogen receptors and cause either weak estrogenic or anti-estrogenic activity. The ability of genistein and other isoflavones to act on hormone receptors infers that soybean consumption may be useful in the prevention of hormone-dependent cancers (breast and prostate cancer) (Béliveau & Gingras, 2006; Shu et al., 2009).

**Soy and Women's Health**

Low incidence rates of breast cancer in Japan and other East Asian countries fuelled interest in the role of soy in breast cancer.

*Epidemiology*

Many epidemiological studies in the scientific literature have examined the relationship between soy foods in women's diets and their risk of developing breast cancer (Lee et al., 2009; Chen et al., 2014) although the results are inconclusive (Trock, Hilakivi-Clarke & Clarke, 2006). In a

meta-analysis of 35 observational studies, higher consumption of soy isoflavones was found to be associated with a lower risk of breast cancer in both pre and post menopausal women in Asian countries but this protective effect was not found in Western countries (Chen et al., 2014). It is thought that this inconsistency in findings is because soy consumption is much lower in Western countries compared to Asian (Zhang et al., 2017). Per capita isoflavone intake in the US and in Europe is typically less than 3mg per day, and this usually comes from foods that contain small amounts of soy protein that have been added to the food. Contrastly, intake in Japan and China is approximately 25mg-50mg of soy isoflavones per day (Messina & Wu, 2009).

*Exposure time (early intake)*

For prevention of breast cancer, timing may mean more than intake amounts with early exposure providing maximum protection (Messina & Wu, 2009). Results from studies show that women consuming moderate amounts of soy throughout their life have lower breast cancer risk than women who do not consume soy. This protective effect likely originates from soy intake early in life (Hilakivi-Clarke et al., 2010).

A recent study in 70,000 women found that high intake of soy during both adolescence and adulthood was almost as protective for breast cancer as only having a high intake during adolescence (but a low intake during adulthood) (Baglia et al., 2016). This finding is consistent with other large observational research (Wu et al., 2009) and with the current scientific evidence which links what children and adolescents are exposed to (such as soy) to cancer risk as adults.

*Post-Diagnosis/Cancer Survival*

As for women who have been diagnosed with breast cancer, studies have shown that breast cancer survivors can safely incorporate soy products (such as edamame or tofu) in their diets and that soy may have a protective effect (Nechuta et al., 2012). It is important to note that although the WCRF believes that current research indicates a relationship between consuming soy foods and better survival the evidence is not substantial enough for them to make specific guidelines for breast cancer survivors to consume soy (WCRF & AICR, 2018). This conclusion by WCRF may be due to their being too few studies in this area as they were only able to consider the evidence from three trials.

When looking at the literature, one significant study in China (Shu et al., 2009) and two from the US (Guha et al., 2009; Caan et al., 2011) provide evidence linking soy consumption and improved breast cancer survival. In the China-based study, exposure to isoflavones in breast cancer survivors was associated with lower cancer mortality and cancer recurrence in women with both ER(-) and ER(+) breast cancer (Shu et al., 2009). Alternatively, soy consumption in a cohort of breast cancer survivors in California was only found to have significant protective effects in postmenopausal women who were treated with tamoxifen (Guha et al., 2009). Further,

the After Breast Cancer Pooling Project that grouped results from three prospective cohort studies (Pierce et al., 2002; Shu et al., 2009; Caan et al., 2011) showed that in 9,514 breast cancer survivors, those who ate soy products were 25 percent less likely to have cancer recurrence compared to those who avoided soy products (Nechuta et al., 2012).

**Soy and Men's Health**

The relationship between diet and prostate cancer is of great interest and conclusions from a large prospective observational study in North American men found that those who consume a vegan diet have a 35% lower risk of developing prostate cancer (Tantamango-Bartley et al., 2016). Higher soy consumption along with fibre were considered major components of the vegan diet that caused this protective effect. Further research has looked at soy individually as a protective food.

A meta-analysis looking at 14 observational studies on men and soy showed that consumption of soy foods was associated with a 30% lower risk of prostate cancer (Yan & Spitznagel, 2009), however the protective findings of this meta-analysis was mostly driven by research in Asian populations compared to Western populations (Yan & Spitznagel, 2009). Again this lack of effect in Western populations may be due to the very low consumption of soy when compared to Asian populations (Yan & Spitznagel, 2009). Another meta-analysis in Asian populations showed that increased amounts of total and non-fermented soy foods was also associated with a lower risk of prostate cancer (Hwang et al., 2009). Intake of non-fermented soy foods including tofu and soy milk was associated with a lower risk of prostate cancer, whereas fermented soy foods was not (Hwang et al., 2009; Yan & Spitznagel, 2009). Further analyses looking at various soy food products suggested that the lower risk of prostate cancer was associated with consumption of tofu specifically (Hwang et al., 2009).

## Spices

**Why Eat Spices:** Using spices in cooking allows you to add layers of flavour in a healthy way, compared to adding ingredients high in salt, refined sugar, or saturated fats. Due to their antioxidant, anti inflammatory, and immunomodulatory properties, many spices may be associated with cancer treatment and prevention (Zheng et al., 2016), as well as being used as chemopreventive agents (Butt, 2013). Including a variety of spices in your diet is a great way to reap the varying health benefits of different spices. Many spices have phytochemicals and other bioactive components which has lead to much interest in researching their cancer protective effects (Kaefer & Milner, 2008). Yet research on spices is quite limited as the type, quantity, and

forms they are consumed differently across cultures (Kaefer & Milner, 2008). Most of the research available on spices and cancer is from in vitro studies.

**How to Eat Spices:** Toasting spices in a dry pan is a great way to bring out the deeper flavours. Get creative and don't be afraid to experiment with different spices in familiar dishes to take an old recipe to a new level! Try adding a couple new-to-you spices into your daily repertoire. A little can go a long way depending on the spice, so add little by little and be sure to taste as you go. Store your spices in sealed jars, in a dry, cool place and replace every two years to ensure freshness. Buying small amounts at the bulk store is a good way to ensure that they stay fresh and full of flavour.

**Nutritional Benefits for Specific Cancers:** Spices are known to have antioxidant properties (Kaefer & Milner, 2008) which can protect against cancer development (Devasagayam et al., 2004). Spices with the highest amount of antioxidants are ground cloves, dried oregano, ground ginger, ground cinnamon, turmeric powder (Halvorsen et al., 2006). Consuming a diet that is high in antioxidants has been found to reduce the risk of gastric cancer (Serafini et al., 2002), breast cancer (Pantavos et al., 2014), and possibly others (Zheng et al., 2016) however research in humans specifically focused on the relationship between spices and cancer is lacking. Saffron contains compounds called crocin and crocetin, both of which have shown anticancer effects in cell culture models (Zheng et al., 2016) including inducing cell death in lung cancer cells (Samarghandian et al., 2013) and inhibiting leukemic cells through various mechanisms (Moradzadeh, Kalani and Avan, 2019). In addition saffron is unique as there is evidence that it may have antidepressant effects for those with mild-to-moderate depression (Lopresti and Drummond, 2014). In a meta-analysis of six clinical studies saffron extract (30mg per day) was found to be efficacious for the treatment of adults diagnosed with depression (Lopresti and Drummond, 2014).

Piperine, found in black pepper has shown antitumor effects in various cancer cells including breast cancer, prostate cancer, colorectal cancer as well as in melanoma cells and in the treatment of osteosarcoma (Zheng et al., 2016).

Other spices such as chili, ginger, and turmeric have been found to have anticancer effects and have been covered in their own sections here.

## Strawberries

**Why Eat Strawberries:** The World Cancer Research Fund recommends that fruit is consumed everyday to reduce the risk of cancer (2018). Strawberries are a great option as they contain one

of the most anticancer phytochemical compounds, ellagic acid, which prevents the activation of carcinogenic substances into cellular toxins thereby inhibiting DNA mutations which can trigger cancer (Ceci et al., 2018). Anthocyanidins (polyphenols that contribute to the vivid hues of berries) and proanthocyanidins (a complex chain of polyphenols) are another reason one should consume strawberries (and other berries) in their cancer preventative diet (Hannum, 2004).

**How to Eat Strawberries:** Nothing is more delicious than a freshly picked strawberry while they are in season. That is often hard to come by, so if you can't get your hands on fresh strawberries, frozen strawberries are great too. Toss them into smoothies or warm them up into a strawberry sauce/compote to put on top of a bowl of oatmeal. Jam is not the best way to get all the benefits from strawberries as much of the cancer productive components such as ellagic acid and flavonols are lost during standard processing (Flores & Ruiz Del Castillo, 2016).

Lastly, while not as readily available, freeze dried strawberries exhibit the most antioxidant and anticancer properties (Chen et al., 2012). You can look for freeze dried strawberries at health food stores or online, if you are curious to try them out. They have a delicious concentrated strawberry flavour and are perfect to toss into a trail mix with nuts and seeds.

**Nutritional Benefits for Specific Cancers:** While research indicates fruit consumption is linked to reductions in cancers of the esophagus, lung, stomach, colorectum, and bladder (WCRF & AICR, 2018), research on berries alone is lacking (Stoner, 2009) with only small trials being undertaken. In a randomized clinical trial of freeze dried strawberries and 75 participants with precancerous esophageal cancer lesions, the progression of the disease was reduced in almost 80% of the patients in the high dose (2 oz freeze dried strawberries, daily for 6 months) group (Chen et al., 2012).

## Tomatoes

**Why Eat Tomatoes:** Tomatoes are a great vegetable to include in a healthy cancer protective diet. Tomatoes contain high amounts of vitamin C and A, which are both important vitamins, but are also free radical fighting antioxidants. They are an easy way to increase dietary carotenoids a class of phytochemicals. Lycopene in particular is a red carotenoid abundant in tomatoes that has been shown to have significant potential for cancer prevention (Giovannucci, 2002).

**How to Eat Tomatoes:** Consume them in every form possible - fresh, cooked, roasted, on whole grain toast with fresh herbs and olive oil, in soups, stews, spicy chilis, eggplant moussaka, and in all tomato based products like tomato sauce and tomato paste. Cooked tomatoes have a significantly higher lycopene content than raw tomatoes, up to 164 percent higher when cooked

for 30 minutes, although vitamin C amounts decreases slightly (Dewanto et al., 2002). During cooking the tomato's cell walls are ruptured allowing the lycopene to be released from its matrices and be more easily absorbed (Dewanto et al., 2002). To boost absorption even more, eat tomato based products with a healthy fat, such as olive oil, as lycopene is lipophilic (likes lipids) and thus is more easily absorbed in the intestine (Fielding et al., 2005).

**Nutritional Benefits for Specific Cancers:** The consumption of tomatoes and tomato products has been found to be associated with a reduced risk for cancers of the prostate, lung and stomach (Giovannucci et a., 1999). When compared to other carotenoids, lycopene is an extremely potent antioxidant and is thought to not only decrease the risk of developing cancer, but also reduce the growth rate of tumors (Gajowik & Dobrzyńska, 2014).

The mechanisms of how lycopene reduces the development of cancer are still being studied (Gajowik & Dobrzyńska, 2014). Because lycopene can act as an antioxidant it can scavenge and neutralize free radicals which in turn prevent them from causing damage and inflammation within our body (Gajowik & Dobrzyńska, 2014). Findings have shown that lycopene may slow down the development of prostate cancer by acting directly on certain enzymes responsible for cell tissue growth in the prostate area, as lycopene is preferentially absorbed in the prostate as well as in the adrenal glands, testicles and liver (Wertz, Siler & Goralczyk, 2004; Wertz, 2009;Gajowik & Dobrzyńska, 2014).

Observational research has shown that men whose diets are high in lycopene have a lower risk of developing prostate cancer (Story et al., 2010). Just one meal per week containing tomato sauce may have protective effects in men for prostate cancer (Giovannucci et al., 2002). Further, in a small study of men with early stage prostate cancer, consuming tomato sauce once every day as part of a meal for 3 weeks was found to reduce markers of cancer progression and increase the amount of lycopene in the prostate (Chen et al., 2001). Evidence from the Health Professionals Follow-up Study with 47,365 men, one of the largest prospective epidemiological studies, showed that high lycopene intake lowered the risk of prostate cancer by 16%. Moreover, eating a serving of tomato sauce (1/2 cup) twice per week lowered the risk of prostate cancer by 23% when compared to those who only consumed tomato sauce once a month or less (Giovannucci et al., 2002). Adding to the evidence, a meta-analysis of 42 observational studies found that consuming a diet high in lycopene was associated with a lower risk of prostate cancer (Rowles et al., 2017).

In addition to prostate cancer, tomatoes may also help to decrease the risk of skin cancer **(**Rizwan et al., 2011). In a study examining the effects of lycopene rich foods on skin cancer showed that women who consumed 55g tomato paste with olive oil (to help with lycopene absorption) daily, had a significant reduction in indicators of sun damaged skin, including a

decrease in angiogenesis. These results suggest that regular intake of high lycopene foods can prevent sun damage, a precursor to skin cancer **(**Rizwan et al., 2011).

## Turmeric

**Why Eat Turmeric:** Turmeric contains more than 300 different bioactives (Gupta et al., 2013), including both turmerones and curcumin, these compounds in turmeric have been shown to have anticancer and antiinflammatory activities (Greger, 2015; Supic et al., 2013). Curcumin has been researched highly and its safety at high doses has been well researched in clinical studies of cancer patients (Dhillon et al., 2008; Gupta et al., 2013). Further cucumin shows promise among the polyphenols to be protective against cancer (Torquato et al., 2017).

**How to Eat Tumeric:** In its raw form (turmeric root, looks similar to ginger root) or cooked (dried/powdered) form are both excellent choices. Raw turmeric has been shown to have greater anti-inflammatory effects while dried/powdered has better DNA protection (Percival et al., 2012).

To enhance the absorption of curcumin in turmeric, it is best to consume it in food form (fresh or dried) rather than as a supplement. This is due to the fact that turmeric root contains natural oils that can enhance the bioavailability of curcumin by 8 times! Cooking with oil adds even more of a boost, helping your body absorb the beneficial properties of turmeric into the bloodstream through the lymphatic system (bypassing the liver which would try to remove it through urine) (Greger, 2015).

Another way to enhance the absorption of curcumin is to add black pepper to the dish you are making with turmeric, as a molecule called piperine in black pepper can boost the absorption of curcumin (Shoba et al., 1998).

**Nutritional Benefits for Specific Cancers**: Working through multiple cellular pathways, curcumin has been found to be a promising therapeutic agent against many types of cancer, including colorectal, breast, prostate and pancreatic cancers (Devassy, Nwachukwu, & Jones, 2015).

Specifically, curcumin has shown much promise in colorectal cancer as it is able to come in direct contact with the gastrointestinal lining, compared to other cancers where it needs to be absorbed into the blood and transported throughout the body becoming diluted and quickly metabolized and thus weakening the effect (Carroll et al. 2011). Curcumin was found in a clinical trial to have anticarcinogenic effects by decreasing the progression of abnormal cells in

the rectum (Carroll et al. 2011). Over 30 days, curcumin supplementation (4 grams per day) in a small sample of smokers was able to significantly reduce the number of abnormal cells located in the rectum (aberrant crypt foci) by 40 percent (Carroll et al. 2011). No effect was found for those who where only supplemented 2 grams per day of curcumin, however a longer duration may have allowed for benefits to have been measured (Carroll et al. 2011).

Research in other cancers has been more difficult as the bioavailability of curcumin is low (Anand et al., 2007). This characteristic of cucumin  makes it challenging for researchers to provide a large enough dose to cause a measurable effect in a clinical trial. In order to get significant effects some researchers have grouped curcumin with other bioactives hoping the two compounds will work synergistically causing a stronger, more measurable effect. A treatment combining isoflavones (from soy) and curcumin was found over six months to significantly decrease prostate specific antigen (PSA) levels in men who had elevated levels of PSA (Ide et al., 2010).  Elevated levels of PSA is a risk factor for developing prostate cancer (Gaudreau et al., 2016). Also when looking at cell culture studies, curcumin combined with piperine was found to have cancer preventative actions in breast cancer cells (Kakarala et al., 2010).

Turmeric has been found to be a cholecystokinetic agent, which means that it facilitates the gallbladder to keep bile moving out, thereby reducing the risk of gallbladder cancer (Rasyid et al., 1999; Goel et al., 2008).

## Watermelon

**Why Eat Watermelon:** Fruit is an important part of a health and cancer preventative diet (WCRF & AICR, 2018). Although 92% is water, watermelon is a source of natural antioxidants specifically lycopene, ascorbic acid and citruline (Naz et al., 2014). Red fleshed watermelon contains a significant amount of lycopene and when compared to tomato juice, both were found to significantly increase lycopene concentrations in the blood of human volunteers compared to the control (Edwards et al., 2003).

**How to Eat Watermelon:** Watermelon is best enjoyed in season and freshly sliced! It is also great blended with a bit of mint, lime and ice cubes for a refreshing beverage, grill on the BBQ or cut into chunks and enjoyed with mint, lime and other seasonal vegetables in a cold salad.

**Nutritional Benefits for Specific Cancers**: Research has found that a diet high in lycopene is associated with a lower risk of prostate cancer in men (Rowles et al., 2017). Watermelon juice (360ml) has been shown to increase circulating lycopene levels by three times (Ellis, Dudenbostel & Crowe-White, 2019).

When two cups per day of fresh watermelon was provided to 33 overweight and obese subjects over four weeks, it reduced markers oxidative stress and improved total antioxidant capacitity (Lum et al., 2019). Watermelon is also known to have possible metabolic health benefits (Figueroa et al., 2011; Figueroa et al., 2012; Figueroa et al., 2017). Over four weeks, daily consumption of two cups of fresh watermelon was found to reduce hunger and improve body weight management (Lum et al., 2019). Maintaining a healthy body weight is important for protecting against obesity-related cancers such as pancreas, gallbladder, liver, ovary, and postmenopausal breast cancer (WCRF & AICR, 2018).

## Whole Grains

**Why Eat Whole Grains:** Whole grains provide many nutrients including dietary fibre, vitamins, minerals, and phytochemicals, all of which have anticancer effects (Aune et al., 2011; WCRF & AICR, 2018). Other anti-cancer compounds found in whole grains include vitamin E, selenium, copper, zinc, phytoestrogens, and lignans (WCRF & AICR, 2018). Lignans are a group of polyphenols found in whole grains and other plants. They are shown to have chemopreventive benefits and whole grains are an easy way to incorporate lignans into the diet (Slavin, 2000). Whole grains also have a lower glycemic index, compared to more processed grains, which has been shown to be protective for cancer (Donaldson, 2004)

**How to Eat Whole Grains:** Look for whole grains and whole grain products made from the entire grain as most of the anti-carcinogenic compounds are found in the bran and germ of the grain (WCRF & AICR, 2018). When selecting grain products, use colour as a guide. For example, red quinoa is more nutrient dense than white quinoa. Brown and black rice are more nutrient dense than white rice (Goufo & Trindade, 2014). Blue corn flour is more nutrient dense than yellow corn flour.

**Nutritional Benefits for Specific Cancers:** The World Cancer Research Fund believes there is strong evidence that eating whole grains lowers the risk of colorectal cancer (2018). When looking at the scientific evidence through a dose-response meta-analysis of 6 studies, they found that consuming 90 grams of whole grains per day lowered the risk of colorectal cancer by 17 percent (WCRF & AICR, 2018). Further, an inverse relationship between intake of dietary fibre, cereal fibre, whole grains, and risk of colorectal cancer was found in a meta-analysis looking at 25 prospective studies (Aune et al., 2011).

For breast cancer, a meta-analysis was conducted on 16 studies following women and their fibre intake. The results showed that women who consumed the most fibre had a lower risk of breast

cancer, regardless of other risk factors and importantly, it was fibre from whole grains that provided the greatest risk reduction (Aune et al., 2012). In addition, coloured rice (red, purple, and black rice) was shown to have anticancer effects against breast cancer and leukemia cells (Pintha et al., 2015; Suttiarporn et al., 2015).

Oats, either eaten or used topically, have been found to contain anti-inflammatory compounds called avenanthramides, which are soothing for certain chemotherapy induced skin rashes (Alexandrescu et al., 2007) as well as being anti-inflammatory for the gastrointestinal tract (Guo et al., 2010).

## Vitamin D Supplements

**Why Take Vitamin D Supplements:** In addition to playing a role in bone metabolism and mineralization, recently some studies have shown that vitamin D may exhibit anti-cancer activities (Scaranti et al., 2016). Although it is recommended to obtain nutrients directly from food whenever possible instead of taking supplements, vitamin D is unique in that not many foods provide a sufficient amount, and the majority of vitamin D that we get is actually from being outdoors in the sun (Scaranti et al., 2016). In the winter months, however, vitamin D levels can drop significantly, and supplementation can help counteract the lack of sunshine exposure. In addition to supplements, in Canada there are nut milks (soy, cashew, almond etc.) which are fortified with calcium and vitamin D, and these can also be included in the diet on a daily basis to ensure adequate vitamin D levels are being achieved (Otten et al, 2006; Davis & Milner, 2011).

**How to Take Vitamin D Supplements:** Vitamin D supplements are recommended to be taken on a daily basis, especially in the winter months. The recommended dietary allowance for healthy adults is 600 IU per day, and the tolerable upper limit is 4000 IU (Health Canada, 2010). Some plant based foods in Canada, such as soy and almond milk, and orange juice are fortified with vitamin D, which can also help to reach the daily recommended amount (Otten et al., 2006; Davis & Milner, 2011). Fortified milk alternatives and mushrooms exposed to UV rays are also great sources of vitamin D and should be consumed regularly as a result. Although vitamin D toxicity is rare, individuals who consume lots of fortified foods, fish and take supplements in tandem, may be at risk (Otten et al., 2006).

**Nutritional Benefits for Specific Cancers:** Much research on vitamin D has been undertaken however a clear signal within the literature for cancer prevention is lacking. In observational research vitamin D exposure can be measured in two ways either through circulating levels in the

blood (serum vitamin D) or through assessing dietary/supplement intake.

When looking at specific cancers some observational evidence has shown protective effects of serum vitamin D (colorectal and bladder cancer), however, some research has found mixed results (prostate) or no effect (breast and ovary cancer) (Mondul et al., 2017). One of the more consistent signals for serum vitamin D is a reduction in colorectal cancer risk. In the Physicians' Health Study, those with the highest levels of circulating serum vitamin D were found to have a 35% reduced risk for colorectal cancer when compared to those with the lowest levels (Lee et al., 2011). Moreover, a meta-analysis looking at five studies found that there was an inverse relationship between circulating vitamin D and risk for colorectal cancer (Gorham et al., 2007).

When looking at trials where vitamin D was supplemented no clear benefits for cancer prevention has been identified. For example, in a large meta-analysis of 18 studies, researchers found no beneficial effect for general cancer prevention or specific cancers in those supplemented with vitamin D (Bjelakovic et al., 2014). However most of the participants in these 18 trials were elderly women because most of the current clinical evidence for vitamin D supplementation comes from osteoporosis prevention research. When looking at research in men, a meta-analysis of three randomized trials in patients with advanced prostate cancer where vitamin D was supplemented no significant benefit (or harm) was found (Buttigliero et al., 2011).

It is important to note that the World Cancer Research Fund does not recommend using supplements for cancer prevention, especially at high doses, rather they recommend eating a healthy diet to best protect against cancer (2018). Furthermore, no official institution currently recommends using vitamin D supplements for cancer prevention (Mondul et al., 2017) and while vitamin D is important for overall health the evidence does not provide reason to supplement vitamin D above the recommended 600 IU per day.

# Chart of foods to frequently consume and supporting research

| What | Why | References |
|---|---|---|
| **Apples** (including their peels) | • Rich in *polyphenols* which have anticancer and antiangiogenic properties<br>• Rich in *flavonoids* which have anti-cancer and antiangiogenic properties | Zessner et al., 2008 |
| **Artichokes** | • Part of the health-promoting Mediterranean diet<br>• Rich in *polyphenols, inulin, fibre, minerals, antioxidants*<br>• Polyphenolic action shown to induce cell death in human breast cancer cells | Lattanzio et al., 2009<br><br>Mileo et al., 2012 |
| **Avocado** | • Rich in phytochemicals, dietary fibre, antioxidants and healthy fats<br>• Multitude of health benefits i.e. supporting cardiovascular health, managing weight and healthy aging | Dreher & Davenport, 2013 |
| **Blueberries** | • Contain *anthocyanidins* which are powerful antioxidants protecting cells from free radicals<br>• Unique as they contain 5 of the major *anthocyanidins* which may work synergistically to prevent and slow cancer development | Davidson et al., 2018<br><br>Jeyabalan et al., 2014 |
| **Cacao** | • Very rich in *flavanols*<br>• Specifically, the flavanols *catechins* and *procyanidins* have shown to reduce inflammatory markers and angiogenesis | Weisburger, 2001<br><br>Maskarinec, 2009 |

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| **Calcium** - (from plant based sources) | • Calcium is essential for bone health<br>• Vegetarian diets are high in oxalic and phytic acid, both of which may inhibit calcium absorption, so calcium from a variety of different foods is essential<br>• Inverse relationship between dietary calcium intake and breast, colorectal and prostate cancer | Otten et al., 2006<br><br>Larsson et al., 2008 |
| **Citrus fruit** (including zest) | • Contain high levels of *flavonoids*, shown to interfere with tumour spreading and growth<br>• 100g/day reduces the risk of stomach cancer<br>• Associated with decreased breast cancer risk | Kunimasa et al., 2010<br>Michaels et al., 2006<br>Büchner et al., 2010<br><br>WCRF & AICR, 2018<br><br>Song & Bae, 2013 |
| **Cruciferous vegetables** (e.g. broccoli, broccoli sprouts, cauliflower, Brussel sprouts, kale, radish, mustard greens, kohlrabi, turnips, cabbage, collard greens, bok choy) | • Contain a large variety of *phytochemical* compounds with anticancer activity<br>• In particular, *glucosinolates* are known for their strong anti-cancer properties<br>• *Sulforaphane* has shown to inhibit activity in human stomach, colon, bladder, prostate and breast cancer cells<br>• Regular consumption is associated with a lower cancer risk | Verhoeven et al., 1996<br>Gingras et al., 2004<br>Watson et al. 2013<br><br>Supic et al., 2013<br><br>Aune et al., 2017 |
| **Fibre rich foods** | • Invaluable for chronic disease prevention (particularly cancer | WCRF & AICR, 2018 |

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| (e.g. legumes, whole grains, fibrous vegetables and fruits) | prevention), weight maintenance and overall health<br>• Associated with lower colon and breast cancer risk | Marsh et al., 2012<br>Li et al., 2013 |
| **Flaxseeds** (freshly ground) | • One of the highest sources of *lignans*, which are protective against prostate, breast and colorectal cancers<br>• Great source of fibre and omega-3 fatty acids | Smeds et al., 2007<br>Cotterchio et al., 2006<br><br>Rock et al., 2012 |
| **Garlic** | • The principal compounds in garlic *diallyl sulfide* (DAS) and *diallyl disulfide* (DADS) inhibit the enzymes responsible for activating carcinogens and stimulating enzymes responsible for elimination of carcinogens<br>• May play a role in the prevention of digestive system cancers | Demeule et al., 2004<br>Fleischauer & Arab, 2001 |
| **Ginger** | • The aromatic ingredient in ginger, called *gingerol*, has anti-cancer activity in addition to other medicinal properties<br>• Improves nausea severity caused by chemotherapy | Kim et al., 2005<br><br>Palatty et al., 2013<br><br>Totmaj et al., 2019 |
| **Grapefruit** | • Contains high levels of *flavonoids*<br>• High in *Apigenin*, which has antioxidative and anti-inflammatory activities<br>• Source of *lycopene*, a powerful antioxidant known to decrease prostate cancer risk | Cirmi et al., 2016<br><br>Rowles et al., 2017<br>Seren et al., 2008 |
| **Green tea** | • High in EGCG, a *catechin polyphenol* compound in green tea, has been shown to inhibit tumour growth, | Yang et al., 2008<br>Supic et al., 2013<br>Ohishi et al., 2016 |

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| | angiogenesis, and promote cancer cell death<br>• Linked to lower risk for cancer<br>• Anti-inflammatory | Suganuma et al., 2016 |
| **Healthy plant-based oils** | • Essential component of a healthy diet<br>• Can be incorporated into a healthful diet to reduce the risk of cancer and other diseases | Han et al., 2015<br>Dreher & Davenport, 2013 |
| **Herbs** | • Rich in *beta-carotene* and *flavonoids*<br>• Apigenin, a flavonoid found in parsley has shown to have anti-cancer effects<br>• Ginseng's bioactives, *ginsenosides*, have anti-inflammatory properties<br>• Oregano and thyme were shown to contain high levels of an antioxidant (*rosmarinic*) that suppress the growth of tumour blood vessels<br>• Peppermint was shown to be one of the most common herbs highest in antioxidants | Xianohui et al., 2017<br>King & Murphy, 2007<br>Viuda-Martos et al., 2010<br>Kruma Z, et al., 2008<br>Huang et al., 2006<br>Greger, 2015 |
| **Hot peppers** | • The heat producing chemical in hot peppers, *capsaicin*, has been shown to have cancer preventing properties<br>• Topically applied *capsaicin* may also have pain modulation effects | Bley et al., 2012<br><br>Mason et al., 2004 |
| **Low Glycemic Whole Foods** | • Help to regulate blood sugar levels which can help to reduce cancer risk | Donaldson, 2004 |
| **Mixed greens** | • Associated with living longer<br>• Important *polyphenol* sources for cancer risk reduction | Aune et al., 2017<br>Steevens et al., 2011<br>Heimler et al., 2007 |
| **Mushrooms** | • They are rich in dietary fibres and other important anticancer | Akramiene et al., 2007 |

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| | compounds, thereby playing a role in a cancer preventative diet<br>• If UV exposed are a great source of plant-based vitamin D | Manzi et al., 2004<br><br>Cardwell et al., 2018 |
| **Nuts** | • Great source of dietary fibre, unsaturated fats, vitamin E, and magnesium<br>• Reduce the risk of breast and pancreatic cancer | Aune et al., 2016<br><br>Liu et al., 2014<br>Bao et al., 2013 |
| **Walnuts** | • Great source of α-linolenic acid (ALA), polyphenols, and phytochemicals that have anti-inflammatory and antioxidant properties<br>• On a serving size basis, walnuts are one of the highest sources of polyphenols in the human diet | Vinson & Cai, 2012 |
| **Brazil Nuts** | • Contain extremely high levels of *selenium* which has shown many anti-cancer properties and a reduction in cancer risk | Cai et al., 2016 |
| **Omega-3 fatty acids** (e.g. plant based sources found in walnuts, flax seeds, chia seeds, hemp seeds, soybeans, tofu) | • Used in the synthesis of anti-inflammatory molecules that in turn decrease cancer development<br>• Improve mental health<br>• Work directly on cancerous cells by modifying their ability to avoid apoptosis (cell death)<br>• Prevent the development of new blood vessels for cancer growth | Rose & Connolly, 1999; Sublette et al., 2011; Bigornia et al., 2016 Larsson et al., 2004 |
| **Onions** (including shallots, | • Similar to garlic and other *Allium* vegetables, onions contain sulfur-containing compounds which | Nicastro, Ross & Milner, 2015 |

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| leeks, scallions, and chives) | are believed to play a role in cancer prevention<br>• Also contain high levels of *flavonoids*, specifically *quercetin* and *anthocyanins* which have been shown to inhibit cancer cell proliferation and angiogenesis | Slimestad et al., 2007<br>Herman-Antosiewicz & Singh, 2004 |
| **Orange vegetables & fruit (**e.g**.** carrots, squash, sweet potato, orange peppers, papaya, mango) | • Very high sources of *carotenoids*, which have antiangiogenic properties<br>• High source of Vitamin A, an important vitamin for immune health<br>• High in fibre which helps to lower the risk of colorectal cancer | Irwig et al., 2002<br>Li et al., 2011<br>Yuan et al.,, 2003<br>Zhang et al., 2009<br>Tamimi et al., 2009<br>Pandey & Shukla, 2002<br>WCRF & AICR, 2018 |
| **Plant based protein** (e.g. legumes and beans such as lentils, chickpeas, white beans, black beans, kidney beans, split peas, soybeans, etc. as well as nuts and seeds/nut and seed butters, whole grains such as quinoa) | • High in fibre, folate, protein and phytochemicals<br>• Protein helps to heal tissues and fight infections<br>• Lentils, chickpeas and white lupin legumes have some of the highest amount of flavonoids among common legumes | Rebello, Greenway & Cleveland Clinic, nd<br>Finley, 2014 |

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| **Pomegranates** | • High levels of *polyphenols* such as *ellagitannins, ellagic acid* and other *flavonoids*<br>• Inhibit cell cycle arrest and induction of apoptosis, angiogenesis and metastasis | Seeram et al., 2005<br>Turrini, Ferruzzi & Fimognari, 2015 |
| **Raspberries** | • Contain *ellagic acid*, an anti-cancer phytochemical compound<br>• Rich in cancer-fighting *anthocyanins* | Stoner, 2009<br>Kristo, Klimis-Zacas & Sikalidis, 2016 |
| **Sea Vegetables** | • Contain key nutrients including fibre, protein, unsaturated fat, *lignans* and sulfated polysaccharides<br>• Source of vitamins and minerals including vitamin C, vitamin B, calcium, iron, iodine and magnesium | Teas et al., 2013<br>Kim & Li, 2011<br>Kumar et al., 2008 |
| **Soy** (non-processed soy, such as soybeans, miso paste, tofu, tempeh. NOT soy protein isolates) | • Source of high quality plant protein<br>• Main *phytochemical* in soy foods is a *polyphenol* called *isoflavone* (more specifically *genistein*) which has chemopreventive actions<br>• Associated with reductions in breast and prostate cancer | Messina, 2016<br><br>Supic et al., 2013<br><br>Baglia et al., 2016<br>Yan & Spitznagel, 2009 |
| **Spices** | • Antioxidant, anti inflammatory and immunomodulatory properties<br>• Spices with the highest amount of antioxidants are ground cloves, dried oregano, ground ginger, ground cinnamon, turmeric powder | Zheng et al., 2016<br><br>Halvorsen et al., 2006 |
| **Strawberries** | • Contains *ellagic acid*, which prevents the activation of carcinogenic substances into cellular toxins thereby inhibiting DNA mutations which can trigger cancer | Ceci et al., 2018<br><br>Hannum, 2004 |

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| | • High in *anthocyanidins* | |
| **Tomatoes** (cooked with good quality oil, such as olive oil to increase lycopene absorption) | • High in vitamin C and A<br>• *Abundant in Lycopene*, a carotenoid that has been shown to have great potential for cancer prevention<br>• Just one meal per week containing tomato sauce may have protective effects for prostate cancer | Story et al., 2010<br>Giovannucci et al., 2002 |
| **Turmeric** | • More than 300 different bioactives<br>• Containing both *turmerones* and *curcumin*, these compounds in turmeric show anticancer and antiinflammatory activities<br>• Promising agent against colorectal, breast, prostate and pancreatic cancers | Gupta et al., 2013<br>Supic et al., 2013<br>Greger, 2015<br>Devassy, Nwachukwu, & Jones, 2015 |
| **Watermelon** | • Rich source of *lycopene*<br>• Diets high in lycopene have been associated with reduced prostate cancer risk | Naz et al., 2014<br>Rowles et al., 2017 |
| **Whole Grains** | • Rich in dietary fibre, vitamins, minerals, and phytochemicals<br>• Protect against some types of cancers, due to high fibre content<br>• Rich in *lignans* which are a group of polyphenols known to have anti-cancer effects<br>• Low glycemic index | Aune et al., 2012<br>WCRF & AICR, 2018<br>Slavin, 2000<br>Donaldson, 2004 |
| **Vitamin D Supplements** | • Major role in bone metabolism and mineralization<br>• May play a role in cancer prevention | Scaranti et al., 2016<br>Mondul et al., 2017 |

# Anti-cancer Grocery Reference List

## Ingredients to reduce

- Alcohol
- Anything overly processed or that contains a long ingredients list of additives or chemicals
- Artificial sweeteners
- Bacon, sausage, hotdogs, and red meat in general
- Dairy
- Deli meats or prepackaged meat that contain nitrites
- Foods containing high levels of fructose corn syrup
- Fried food
- High sugar containing condiments like ketchup (homemade ketchup is encouraged)
- Non BPA free canned beans and/or tomatoes (glass jarred tomatoes are preferred)
- Refined white sugar
- Simple, refined carbohydrates: white flour, white bread, soda crackers etc.
- Too much sodium (500 mg or less per entrée is ideal)
- Trans fats, hydrogenated oils, and food containing trans fatty acids

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## Ingredients to increase

- Citrus fruit (i.e. grapefruit (unless they conflict with medication), oranges, lemons, limes, etc.)
- Cooked orange vegetables
- Cooked tomatoes
- Fermented food to aid in a health GI tract i.e. miso, sauerkraut, kimchi, tempeh, etc. lower sodium varieties where possible
- Fresh & dried herbs and spices (i.e. turmeric, black pepper, cinnamon, cumin, coriander, paprika, basil, oregano, chili flakes, etc.)
- Fruits – all of the fruits – the more colourful the better – eat the rainbow
- Healthy fats i.e., avocado, nuts, seeds, olive oil, grapeseed oil

- Healthy/good quality protein (i.e. edamame, tempeh, tofu, nuts, seeds and legumes)
- Homemade vegetable stock
- Legumes (i.e. chickpeas, black beans, kidney beans, cannellini beans, aduki beans, pinto beans, black eyed peas, lima beans, lentils, etc.)
- Nuts and nut butters (i.e. walnuts, almonds, pecans, pistachios, hazelnuts, cashews, etc.)
- Seeds and seed butters (i.e. sesame seeds/tahini, pumpkin seeds, chia seeds, hemp seeds, flaxseeds, etc.)
- Vegetables – all of the vegetables particularly dark leafy greens and orange vegetables
- Whole grains (i.e. quinoa, brown rice, millet, spelt, kamut, freekeh, barley, whole rolled oats, whole grain flours, etc.)

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## General tips for healthy eating

- Eat healthy fats (i.e. avocados, walnuts, almonds, chia seeds, hemp seeds, flaxseed, pumpkin seeds, sunflower seeds, grapeseed oil, extra virgin olive oil, and canola oil)
- Eat more beans i.e. use them in soups, stews, chilis, dressings, dips, and desserts
- Eat more fibre rich foods than not (i.e. animal based foods contain no fibre and plant based foods contain fibre)
- Eat WHOLE grains not refined (i.e. rye, barley, oats, spelt, whole wheat, quinoa, brown rice, and millet)
- Focus on a whole foods diet that is mainly based on fruits, vegetables, whole grains, nuts, seeds, legumes & good quality proteins (i.e. protein that contains close to or all of the essential amino acids)

# Tips and Techniques for Managing Side Effects of Cancer and Cancer Treatment

## Malnutrition

**Reasons of Issues:** Most types of cancers and cancer treatments require extra calories and protein to support your organ functions, muscle repair, and every day daily activities

- Extra calories and protein are used to heal tissues and fight infections
- Important to eat more to keep yourself from becoming malnourished or losing too much weight as this can lead to poorer prognosis
- Aim to eat 3-6 times per day, including a source of protein with each meal
- Drink ample amounts of water- staying hydrated is important
- Eat whatever you can tolerate, aim for healthy foods, however, the most important aspect is to eat enough to maintain your weight and muscle mass
- Everyone's body is different and every cancer and treatment plan should be individualized, so speak to your treatment team to discuss meeting with a Registered Dietitian to asses and tailor your nutrition plan and goals

(from:http://chemocare.com/chemotherapy/health-wellness/managing-nutrition-during-cancer-and-treatment.aspx)

(below tips modified from
https://www.cancer.gov/publications/patient-education/eatinghints.pdf)

## Loss of appetite

- Eat smaller meals throughout the day (if you can manage, 5–6) rather than 3 large meals
- Have smaller amount of liquids with meals rather than a big drink, to prevent early satiety and feeling too full
- Exercise to promote and improve your appetite
- Try not to miss meals
- Timing of food — take advantage of the times of day you most feel like eating
- Stay hydrated — drink smaller amounts of fluids, more frequently throughout the day and after and between meals to avoid feeling full before mealtime
- Try (homemade) nutrient dense, liquid or powdered meal replacements

- Treat yourself to your favourite foods
- Choosing a variety of different foods may help increase your appetite
- Regular exercise will improve appetite
- Make small portions of visually appealing food using a variety of colours

## Change in taste/smells

- Use a kitchen fan when cooking to help quickly eliminate strong odours
- When cooking, lift lids away from you to prevent direct contact with the smell from the cooking food
- If you have a metallic taste in your mouth, try eating with plastic utensils or chopsticks and sour food may help to alleviate the taste
- Cook food in glass pots and pans rather than metal ones
- Keep up with oral hygiene to keep food tasting better
- Chilled food may help numb your taste buds. Keep drinks and meals cold/chilled if that's the only way you can tolerate the taste. For example, add ice to your drinks, make frosty smoothies, or stick your plate in the fridge or freezer to cool it down before eating

## Dry mouth

- Carry water bottles with you and sip water throughout the day
- Keep your food moist with sauces, dressings and dips to make your food easier to swallow
- Avoid alcohol
- Try blended or pureed foods for easy swallowing
- Avoid foods that are too spicy, sour, salty, hard or crunchy
- Smoothies are a great option, energy dense and help with dry mouth due to the high fruit content

## Sore mouth

- Choose easily chewable food
- Eat soft and tender food
- Take smaller bites of food, or try using a smaller spoon

- Eat cold or room temperature food
- Ice can be soothing - sucking on ice chips may help
- Avoid certain foods and drinks when your mouth is sore, such as: citrus fruits, spicy foods, acidic foods, salty foods and anything too hard or crunchy
- Avoid alcohol
- For mouth sores, eat frozen foods (for example: frozen banana pieces or frozen smoothies popsicles) that can help numb or sooth the mouth. Eating something like this first before taking a few bites of an energy dense food, may help you tolerate them more.

## Sore throat and trouble swallowing

- Eat smaller meals throughout the day rather than 3 large meals
- Select easy to swallow foods such as smoothies, scrambled eggs, and soft cereals
- Cook foods until they are soft and tender
- Cut food into small pieces, or puree foods
- Moisten foods with sauces/dips/broths
- Do not eat or drink items that can burn or scrape your throat such as: very hot food and drinks, spicy foods, high acid or citrus foods, sharp and crunchy foods, and alcohol

## Constipation

- Stay hydrated by drinking plenty of fluids throughout the day
- Incorporate warm liquids into your routine (tea, broths) to relieve constipation
- Stay active to the best of your abilities to relieve constipation
- Eat fibre rich foods daily (this includes soluble and insoluble fibre)
- Probiotic and prebiotic rich foods (Probiotics from: dairy free cultured yogurt and kefir, kimchi, and sauerkraut. Prebiotics from: garlic, leeks, onions, asparagus, bananas, jicama, dandelion greens)

**Constipation, bloating, diarrhea and irregular bowel issues**
Restoring bowel health following chemotherapy and/or radiation can be both frustrating and challenging.

**Reasons for issues:**

Pain medicines, which can slow the muscular action of the bowels that helps food move through the system. Some drugs that treat nausea and vomiting, seizures, depression, diarrhea, or blood pressure can have side effects. Chemotherapy/Opioid related. Some cancer treatments can cause constipation. These include some cancer drugs, and having surgery to your tummy (abdomen). Cancer itself can cause an obstruction or affect nerve supply to bowel. A lack of fiber, water, fruit/veg, probiotic and prebiotic foods, and exercise.

## Diarrhea

- Avoid very high fibre foods (particularly containing insoluble fibre)
- Avoid very sugary drinks (sodas, fruit juices)
- Avoid caffeinated drinks
- Avoid very greasy, fatty or fried foods
- Avoid milk products
- Avoid alcohol
- Avoid spicy foods such as hot peppers, hot sauce, chilli, and salsa
- Avoid artificially sweetened drinks, gums, and candies

## Bloating

- Choose low fibre diet and omit gas producing foods such as cabbage, cauliflower, and beans (temporary omit, as these foods are health promoting)
- avoid carbonated beverages
- not talking while eating (which causes more air swallowing)
- avoid the use of straws (also causes more air swallowing)
- avoid dairy (some people get temporary lactose intolerance)
- Adding in other herbs may help, such as fennel, ginger, and peppermint (if you don't have gastro-esophageal reflux disorder).

## Nausea

- Eat 5–6 smaller meals throughout the day
- Try snacking on dry foods like crackers, toast, cereal or breadsticks
- Eat food cold or at room temperature to decrease its smell and taste
- Avoid low-fat foods unless fats upset your stomach or cause other problems
- Distract yourself with music, a favourite TV program, and/or the company of others
- It is important to figure out what triggers your nausea and avoid these triggers
- Maintaining proper oral hygiene is very important! Keep your mouth clean by brushing your teeth at least twice a day, if mouth sores are an issue try a hydrogen peroxide mouthwash

## Vomiting

- Do not eat or drink until vomiting stops
- Once vomiting has stopped, drink small amounts of clear liquids (water and broth). Sip slowly and take little sips
- Once you are able to drink clear liquids, try full liquids such as smoothies and pureed soups. Then slowly introduce solid foods back in
- Once you can start eating solid foods again, start with 5–6 small meals per day, rather than 3 large meals
- If vomiting ensues consult with your healthcare team. In the meantime, ensure that you stay hydrated and replenish your electrolytes.

**Foods that help with nausea and vomiting**

- Apples, bananas and grapes
- Cold icy beverages like smoothies or slushies
- Fennel and fennel seeds
- Food served at room temperature
- Homemade fruit popsicles
- Lemon, ginger or peppermint teas
- Mint
- Oatmeal, chia puddings and/or brown rice
- Plain crackers, toast with nut butter or avocado
- Plain unsalted nuts

- Water, miso soup and/or vegetable broths

## To minimize weight loss

- Eat at scheduled times, rather than waiting until you're feeling hungry
- Eat foods that are high in calories and proteins
- Drink your calories if need be in smoothies, juices, and soups

## To minimize weight gain

- Eat high fibre foods
- Choose lean proteins
- Cook with healthier cooking methods such as broiling, steaming, grilling and roasting
- Be mindful of your portion sizes, particularly if eating out
- Watch your salt intake

**Nutrient deficiencies due to appetite loss, nausea and vomiting**
Cancer patients often suffer from substantial weight and energy loss. To prevent the onset of these things it is very important to stay well nourished.

Protein is the macronutrient that needs the most attention when undergoing various cancer treatments as it builds strength and preserves lean body mass.
Electrolytes – potassium, calcium, chloride, magnesium, sodium.

## To aid with headaches

- Ensure that you are properly hydrated
- Avoid alcohol and caffeine
- Avoid any foods that may be triggering for you

## Foods to strengthen your immune system

- Citrus fruit (ensure that they do not interfere with medication)– oranges, limes, lemons, grapefruit

- Eat a diet rich in fruits and vegetables in general
- Eat foods rich in zinc, vitamin C & A, and B vitamins
- Echinacea
- Garlic
- Ginger
- Green Tea
- Hot peppers
- Leafy Greens
- Probiotic rich foods such as miso, tempeh, sauerkraut, kimchi, plant-based yogurts
- Turmeric
- Vitamin E rich foods – almonds, walnuts, avocado, seeds

## Tips for staying healthy during cold and flu season

- Drink plenty of fluids
- Eat a healthy, balanced, and fruit/veggie focused diet
- Exercise regularly
- Speak to your trusted health care practitioner about the flu vaccine
- Keep alcoholic beverages to a minimum
- Keep your home clean and free from harmful bacteria

## Other tips

- Relax – minimize stress using deep breathing exercises, stretching, yoga, meditation
- Sleep
- Take your vitamin D – particularly during the winter months when natural sunlight is scarce
- Wash hands regularly with soap and water particularly after washroom use, use of tissues, before and after touching your face, physical contact with others, and before and after handling food

# Boosting Brain Health!

Many suffer from “brain fog” post chemotherapy, radiation therapy and hormonal therapy. This can often lead to difficulties thinking and communicating as well as increased memory loss.

## Side effects of “chemo” brain

- Confusion or mental fogginess
- Difficulty concentrating and speaking
- Lack of sleep
- Patients with cancer who are receiving chemotherapy experience negative behavioral changes and decreased cognitive performance
- Gastrointestinal issues

## Fuel foods to boost your brain

- Foods rich in Omega-3 fatty acids – i.e. walnuts, hemp seeds, chia seeds, flaxseeds and algae
    - Omega-3s are needed to build brain and nerve cells that are essential for memory and learning
    - May aid in slowing age related mental decline
    - Helps to fight depression
    - Nuts are also rich in vitamin E which is an important antioxidant
- Dark colour fruit – blueberries, raspberries, blackberries
    - Contain anthocyanins that contain anti-inflammatory and antioxidant properties
    - May help with communication between brain cells
- Turmeric
    - Has been shown to benefit brain health, reduce depression and help with new brain cell growth
- Foods rich in Vitamin C
    - Vitamin C is an important antioxidant that has been shown to protect against mental decline
    - Good sources include citrus fruit, red peppers, strawberries, kiwi, and tomatoes

- Foods rich in Vitamin K i.e. broccoli
    - Essential for forming sphingolipids, a type of fat that's densely packed into brain cells
- Foods rich in magnesium i.e. pumpkin seeds, cacao or cocoa powder
    - Important for memory and learning
- Foods rich in iron to reduce brain fog and impaired brain function
    - Sources include beans, leafy greens, lentils, tofu, tempeh, nuts, seeds, whole grains, dried fruits
- Foods rich in B vitamins – whole grains, fruits, nuts, herbs, nutritional yeast
- Your brain is made up of 75% water so including liquids and foods rich in water and electrolytes (calcium, potassium, chloride, magnesium, sodium) – chia seeds, coconut water, bananas, smoothies, homemade sports drinks (citrus juice, maple syrup, pinch of salt and mineral water)
- Foods rich in prebiotics and probiotics to improve gut flora associated with influencing changes in the intestinal microbiome which can negatively affect cognitive performance and sleep and promote fatigue i.e. miso, tempeh, sauerkraut, kimchi

## Foods to avoid

- Foods rich in high simple carbohydrates as they can spike blood sugar levels leaving fatigue and mental fuzziness once blood sugar levels drop i.e. white processed sugar, brown sugar, cane sugar, etc.
- Highly caffeinated drinks or foods – sodas, energy drinks, and/or too much coffee or tea
- Alcohol may increase the loss of brain cells in general
- Salty foods – dehydrates our bodies and creates an imbalance in our electrolytes

## Additional tips

- Get a good night's rest
- Exercise – studies have shown that an active body equals an active brain
- Go green – eat leafy green vegetables daily to increase your vitamin and mineral consumption
- Do not skip meals
    - Maintaining stable blood sugar levels will help with keeping mental clarity

    - Plan ahead! Pack nuts or whole fruits for an energy dense, easy and quick snack on the go.
- Stay hydrated!

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# Mood altering edibles!

Many suffer from a variety of mood changes after and during cancer treatment including anxiety, depression and mood swings. This can often lead to increased stress and unnecessary inflammation in the body. Below you will find tips, tricks and food suggestions related to improving your mood and minimizing anxiety and mood swings and reducing the risk of depression.

"Depression (and anxiety) is more typically thought of as strictly biochemical-based or emotionally-rooted. On the contrary, nutrition can play a key role in the onset as well as severity and duration of depression. Many of the easily noticeable food patterns that precede depression are the same as those that occur during depression. These may include poor appetite, skipping meals, and a dominant desire for sweet foods. Nutritional neuroscience is an emerging discipline shedding light on the fact that nutritional factors are intertwined with human cognition, behavior, and emotions (Rao et al., 2008)."

## Mood related side effects of cancer treatment

- Irritability
- Fatigue
- Mood swings
- Depression
- Anxiety

## Fuel foods to boost your mood

- Plant based foods in general have been linked to a reduced risk of depression and anxiety particularly whole grains, nuts, seeds, beans/legumes, fruits and vegetables (Akbaraly et al., 2009). The Mediterranean diet in particular which includes all of the above has been directly linked to a reduced risk of depression (Sanchez-Villegas et al., 2009; Lassale et al., 2019).
- Foods rich in omega-3 fatty acids – i.e., walnuts, hemp seeds, chia seeds, flaxseeds and algae
    - Helps to fight depression and anxiety (Arab, Guo, & Elashoff 2019).

    - Omega -3s are needed to build brain and nerve cells that are essential for memory and learning
    - Omega-3s appear to affect neurotransmitter pathways in the brain
    - Nuts are also rich in vitamin E which is an important antioxidant
- Eat foods rich in B vitamins, particularly folate and B12 i.e. whole grains, fruits, nuts, herbs, nutritional yeast
- Get your daily dose of vitamin D – fortified beverages, IV exposed mushrooms, sunshine and/or supplements for improved mood regulation
- Selenium rich foods – seeds and nuts, particularly brazil nuts, whole grains, beans/legumes
    - Has been linked to a reduction in depression
    - Low selenium intake has been associated with poorer moods
- Consume foods rich in iron to reduce brain fog, impaired brain function and irritability that can lead to depression and anxiety
    - Sources of iron include beans, leafy greens, lentils, tofu, tempeh, nuts, seeds, whole grains, dried fruits
    - Remember to consume these non-heme sources of iron with vitamin C rich foods to improve the bioavailability of the mineral
- Prebiotics and probiotics rich foods help to improve gut flora associated with influencing changes in the intestinal microbiome which can negatively affect cognitive performance and sleep and promote fatigue
    - Good sources include miso, tempeh, sauerkraut, kimchi
    - Studies have shown that when people take probiotics (supplements containing the good bacteria) or eat probiotic rich foods, their anxiety levels, perception of stress, and mental outlook improve, compared with people who did not take probiotics

## Foods to avoid

- Foods rich in high simple carbohydrates i.e. white processed sugar, brown sugar, cane sugar, etc.
    - They can spike blood sugar levels leaving us fatigued and mentally fuzzy once blood sugar levels drop indirectly affecting one's mood
    - Multiple studies have found a correlation between a diet high in refined sugars and impaired brain function — and even a worsening of symptoms of mood disorders, such as depression.
- Highly caffeinated drinks or foods – sodas, energy drinks, and/or too much coffee or tea

    - High caffeine consumption may inter with your sleep patterns and thus negatively affect the amount of sleep you get and consequently leaving you tired and irritable
- Reduce or eliminate alcohol consumption
    - Alcohol is a depressant and alters your brain's delicate balance of chemical reactions and processes
    - Negatively affects our brain's neurotransmitters that are needed for good mental health
    - Can increase anxiety and depression even though it temporarily relieves it
- Unhealthy fats – a high consumption of saturated and trans fats have been linked to increased depression

## Additional tips

- Get a good night's rest
- Exercise – studies have shown that an active body = a happy body and brain
- Choose whole, complex carbohydrates i.e. whole grains, fruits, vegetables, and legumes, which also contribute important nutrients and fibre – tryptophan found in carbohydrates increases the amount of serotonin (a neurotransmitter that contributes to feelings of well-being and happiness) produced and released in the brain
- Do not skip meals
    - Maintaining stable blood sugar levels will help with keeping moods stable and reducing fatigue and anxiety
    - Plan ahead! – pack nuts or whole fruits for an energy dense, easy and quick snack on the go.
- Eat with a friend or two – eating together provides social and emotional support and reduces social isolation and the negative influence it has over our mood

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# Eating for Everyday Energy

Are your cancer and cancer treatments often leaving you feeling sluggish and lethargic? Below are some tips and foods to consume to help optimize your energy levels and reduce fatigue.

## Causes of fatigue

- Cancer and cancer treatment
- Stress
- Anemia
- Lack of B vitamins
- Medication
- Sedentary lifestyle

## Side effects of fatigue

- Lack of sleep
- Loss of appetite
- Dehydration
- Mental fuzziness
- Coordination is off
- More accident prone
- Irritable

## Everyday foods to fuel your body and increase your energy

- Foods rich in iron – beans, leafy greens, lentils, tofu, tempeh, nuts, seeds, whole grains, dried fruits
- Foods rich in B vitamins – whole grains, fruits, nuts, herbs, nutritional yeast
- Foods rich in vitamin C – red peppers, strawberries, citrus fruit, kiwi, mango, raspberries, sweet potato, spinach
- Foods rich in electrolytes (calcium, potassium, chloride, magnesium, sodium) – chia seeds, coconut water, bananas, smoothies, homemade sports drinks (citrus juice, maple syrup, pinch of salt and mineral water)

## Foods to avoid

- Foods rich in simple carbohydrates – white processed sugar, brown sugar, cane sugar, etc.
- Highly caffeinated drinks or foods – sodas, energy drinks, and/or too much coffee or tea
- Alcohol
- Salty foods – dehydrates our bodies and creates an imbalance in our electrolytes

## Tips for more energy

- Get a good night's rest
- Exercise regularly
- Eat leafy green vegetables and orange vegetables daily to increase your vitamin and mineral consumption
- Do not skip meals!
- Plan ahead! Bring healthy snacks with you everywhere you go to avoid dips in blood sugar levels. I.e. pack nuts or whole fruits for an energy dense, easy and quick snack on the go.

## Recipes for sustainable energy

1. Mango Turmeric Lassi
2. Roasted cauliflower with tahini dressing & cilantro
3. Fig and orange date truffles

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# Physical Activity — Cancer Prevention and Cancer Care

More people who have been diagnosed with cancer are living more than 5 years due to improvement in cancer diagnosis (Rock et al., 2012; Ferrer et al., 2011). With this extended lifespan, there is a need for informed lifestyle choices to help successfully complete therapy and improve long term outcomes (Rock et al., 2012). Weight management, a healthy diet, and physical activity are all important for preventing recurring incidences of cancer (WCRF & AICR, 2018). Overall quality of life can be improved through these lifestyle changes as they may decrease physical and psychosocial consequences associated with cancer (Ferrer et al., 2011).

Since 2006, new evidence has emerged on the relationship between nutrition, physical activity, quality of life, comorbid conditions, cancer recurrence, the development of second primary cancer, and overall survival (Rock et al., 2012). The evidence is incomplete, however conclusions and recommendations can be drawn relating to choices about body weight, food intake, physical activity and dietary supplement use (Rock et al., 2012). Cancer related fatigue (CRF) is one of the most common and most distressing cancer related symptoms reported by cancer survivors (Brown et al., 2010). CRF affects almost 100% of cancer survivors and it can persist for years post treatment (Brown et al., 2010). New evidence is emerging that suggests exercise interventions may help with regulating CRF (Brown et al., 2010).

## Physical activity during cancer treatment

There has been an increasing amount of studies examining the value of physical activity during primary cancer treatment (Rock et al., 2012). In addition to being safe and feasible, the evidence suggests that exercise during cancer treatment can improve physical functioning, fatigue and overall quality of life (Rock et al., 2012). Additionally, some studies have suggested that exercise may help with successful chemotherapy completion (Rock et al., 2012).

Physical activity, as with diet should be individualized based on the patient's circumstances and preferences. For those who were previously on an exercise plan prior to chemotherapy/radiation, fulfilling their exercise goals overall might not be feasible, but the main goal should be to maintain activity as much as possible (Rock et al., 2012).

## Physical activity in cancer survivors

Several observational studies have shown that physical activity after cancer diagnosis is associated with reduced risk of cancer recurrence, as well as reduced mortality rates among

cancer survivors from breast, colorectal, prostate and ovarian cancers (Rock et al., 2012). In a large survey it was found that more than 50% of cancer survivors are not meeting physical activity recommendations (Blanchard et al., 2008). Many studies show that exercise improves quality of life, fatigue, psychosocial distress, depression, as well as self esteem (Rock et al., 2012). A meta-analysis on quality of life outcomes showed that exercise interventions resulted in improved quality of life during and after the intervention (Ferrer et al., 2011). Another meta-anlaysis showed that cancer survivors randomized to an exercise intervention showed significantly reduced cancer related fatigue, with a linear relationship to the intensity of resistance exercise (Brown et al., 2010).

**ACS Guidelines on Nutrition and Physical Activity for Cancer Survivors**

Achieve and maintain a healthy weight: If overweight of obese, limit consumption of high-calorie foods and beverages and increase physical activity to promote weight loss

Engage in regular physical activity: avoid inactivity and return to normal daily activities as soon as possible following diagnosis; aim to exercise at least 150 mins per week; Include strength training at least 2 days per week

Achieve a dietary pattern that is high in vegetables, fruit and whole grains: Follow the American cancer society guidelines on nutrition and physical activity for cancer prevention

(Rock et al., 2012)

## Physical activity for cancer prevention

The Expert Panel on the World Cancer Research Fund believes that the more physically active people are the lower the risk of developing some cancers (2018). There is strong evidence that being physically active decreases the risk of colon, breast (postmenopause) and endometrial cancers (WCRF & AICR, 2018). According to the 2008 Physical Activity Guidelines for Americans, adults should engage in at least 150 minutes of moderate intensity or 75 minutes of vigorous intensity activity each week, or a combination of both, ideally spread throughout the week (Kushi et al., 2012). It is recommended for children and adolescents to engage in a minimum of one hour of moderate or vigorous intensity activity on a daily basis, with vigorous activity occurring at least 3 times per week for cancer and disease prevention (Kushi et al., 2012).

Sedentary behaviours should be limited as much as possible and lifestyle choices should be changed where possible to include more physically active behaviours, in order to maintain a healthy weight and to reduce the risk of cancers including breast, colon and endometrial (Kushi et al., 2012).

Furthermore, research suggests that increased levels of physical activity may be associated with further reductions in cancer risk (Blanchard et al., 2008). Optimal intensity, length and frequency of physical activity is unknown, however, 300 minutes of moderate intensity, or 150 minutes of vigorous intensity exercise on a weekly basis is likely associated with further cancer prevention (Kushi et al., 2012). Additionally, for individuals who are inactive, or have just started to engage in regular physical activity, levels below the recommended guidelines can be beneficial, with a gradual increase towards recommended amounts (Kushi et al., 2012).

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