

## G10: Nrf2 promoting Foods

### G10.1: Nrf2 is the nuclear factor E2-related factor 2 protein.

Nrf2 is the easy way to say the long chemical name of a protein that promotes an increase in gene activity of a gene with a similar long name - Nrf2 - the nuclear factor E2-related factor 2 - a name so long it has its own abbreviation - E2 stands for erythroid-2 or erythroid-derived 2. It is important enough for health however to make it worth trying to remember the short or long name because it helps protect our body from our own oxidative stress or external causes of oxidative stress. Reducing oxidation helps protect against cancer and other inflammatory conditions.

Every cell of our body has to produce energy every day, all day, and during that production waste products are made that have to be detoxified and excreted or recycled for additional use. When nutrients or water or organ health are insufficient for the daily detoxification process then the waste products can collect and lead to damage in the cells. Over time the damage can lead to different types of scarring and result in long term damage that can not be repaired by the body as easily as simply clearing out waste products through our excretion systems.

The science is complicated but the solution for helping the body produce more Nrf2 is delicious - colorful fruits and vegetables, flavorful herbs and spices, and wholesome grains, beans, nuts and seeds. This section is going to discuss the foods that may help and leave the complicated science for the scientists. but first, a list is included of the health conditions that Nrf2 may have a role in preventing or treating. People with these conditions may find relief by eating more of the foods that are discussed later. This is a new area of research and finding individual health care providers who are familiar with the area of study may be difficult however many are familiar with strategies to increase the use of fresh produce and whole grains and beans. Cookbooks and cooking classes can also be helpful and fun.

### G10.2 Conditions that may be helped by promoting Nrf2 with diet.

The role of Nrf2 *“has been studied by a number of different groups in the prevention or treatment of:*

- *Cardiovascular diseases including atherosclerosis, ischemic cardiovascular disease, vascular endothelial dysfunction, and heart failure;*
- *Neurodegenerative diseases including Alzheimer’s, Parkinson’s, ALS, Huntington’s diseases;*
- *Cancer (prevention);*
- *Chronic kidney diseases;*
- *Metabolic diseases: Type 2 diabetes; metabolic syndrome; obesity;*
- *Several types of toxic liver disease; (not from the pdf article (G10.1) – Nrf2 helps the liver to better utilize free fatty acids and triglycerides as an alternate energy source during times of starvation/malnutrition, which speculatively then, a deficiency of Nrf2 might be a factor in fatty liver disease (G10.8))*
- *Chronic lung diseases including emphysema, asthma, and pulmonary fibrosis;*
- *Sepsis; — (sepsis is a serious type of infection that spreads throughout the blood system.)*
- *Autoimmune diseases;*
- *Inflammatory bowel disease;*
- *HIV/AIDS;*
- *Multiple sclerosis;*
- *Epilepsy;”*

- See *Table 1* for the list of studies regarding *Nrf2* and the above conditions: (G10.1).

Other diseases or conditions that may also be helped by adequate levels of *Nrf2* have been less well studied but the same mechanism of reducing oxidative stress might also benefit in the prevention or treatment of:

- “hemoglobinopathies including sickle cell disease and  $\beta$ -thalassemia [35], malaria [36],
- spinal cord injury [37], traumatic brain injury [38,39],
- altitude sickness [40,41],
- the three classic psychiatric diseases, major depression, schizophrenia and bipolar disorder [42–45],
- gastric ulcers [46,47],
- glaucoma [48], age-related macular degeneration [49], cataract [50,51],
- pathophysiological responses to herpes activation [52] and
- benign prostatic hyperplasia [53,54].”
- “*Nrf2* was reported to lower skin sensitization produced by sensitizing chemicals [57,58].” — (“skin sensitization..” – this likely refers to chronic itch type of conditions that are exacerbated by chemicals that activate TRP channels, which I discuss in more detail in a series of posts. TRP channels are also a big topic that could use more discussion time: (G10.2, G10.3, G10.4, G10.5,))
- See *page 3*, for the quotes and see the *citation list of the pdf* for the bracketed [ ] references: (G10.1).

To summarize in simpler terms - reducing oxidative stress by promoting *Nrf2* protein and increased gene activity might be helpful to protect against hemoglobin conditions such as sickle cell anemia, malaria and beta-thalassemia; traumatic brain or spinal cord injury; sickness symptoms associated with being at high altitudes - in the mountains or on an airplane possibly; mental health conditions of depression, schizophrenia and bipolar disorder; stomach ulcers; eye diseases associated with aging such as glaucoma, macular degeneration and cataract; symptoms associated with herpes lesions; prostate gland enlargement; sensitive skin reactions which may suggest chronic itch type conditions.

### G10.3: Foods and phytonutrients that may help promote *Nrf2*.

So skipping over the medical jargon and moving onto the chemical jargon, a list is available of phytochemicals/nutrients found in plants that have been found to help promote *Nrf2* production. I've added some specific food examples with the list of chemical groups. Each type of phytonutrient may have several or many individual examples that differ slightly between plants but chemically act similarly to each other. Later I will share some recipes and menu ideas that incorporate some of these foods and phytonutrients. (The list of phytonutrients were quoted from this pdf: (G10.1))

Specific foods or phytochemicals mentioned to help increase *Nrf2* include:

- *sulforaphane from cruciferous vegetables*, (such as broccoli and cauliflower);
- *foods high in phenolic antioxidants*, (This is a large group including bright yellow and red fruits and vegetables, and deep purple produce. The group includes the subgroup flavonoids which

include anthocyanins, flavonols, and it also includes the less familiar subgroup chalcones which are found in the commonly used fruits apples, pears and strawberries. The group also includes aldehydes which are found in vanilla and cinnamon, phenolic acids which include salicyclic acid, and tannins which are found in tea, coffee and wine. Baking cocoa and cherries, beans and whole grains are also mentioned, the summary point would be eat more fruits and vegetables; see: (G10.11))

- *the long-chained omega-3 fats DHA and EPA*, (salmon, tuna, sardines, krill oil, ground flax meal, walnuts, hemp seed kernels);
- *carotenoids (especially lycopene)*, (beta-carotene is found in carrots, winter squash, sweet potatoes, cantaloupe, apricots; and lycopene is in tomato, watermelon, pink grapefruit, guava; to name a few sources);
- *sulfur compounds from allium vegetables*, (such as onions, garlic, shallots, green onions);
- *isothiocyanates from the cabbage group* (such as Brussel sprouts, cabbage, kale)
- *and terpenoid-rich foods*. (Terpenes are found in real lemon and lime oil, sumac, rosemary, oregano, basil and other aromatic green herbs).
- The Mediterranean and the traditional Okinawan Diets are also mentioned as being Nrf2 promoting diets. See: (G10.1.1)

#### G10.4: Menu Ideas using Nrf2 promoting foods and ingredients.

- Add more fruits and vegetables to any meal or snack.
- Add a dash of real lemon or lime juice to salads or soups. A large spoonful can help aid digestion as we reach middle age. The digestive system tends to produce less natural acidity and it is needed for better absorption of B vitamins. Or sprinkle fresh lemon or lime zest grated from the peel or add a teaspoon of *Ground Dried Lemons / Citron Seche Moulu / Limon Seco Molido* which may be available at an India foods market. A spoonful of apple cider vinegar or other food grade vinegar could also aid digestion but would not provide the terpenoids found in lemon or lime oil. High quality apple cider vinegar or wine vinegar may contain other beneficial phytonutrients from the phenolic group from the above list as apples and wine are sources of some types.
- Add a teaspoonful or more or less or any, to taste, of dried green leafy herbs to your salad or soup for aromatic terpenoids and likely phenolic phytonutrients as well; such as *Basil, Cilantro, Italian Seasoning, Tarragon, Thyme*. Basil and Cilantro are mild and are also used fresh in larger amounts as part of the salad greens. Basil is used fresh or dried in larger amounts in *Pesto* sauces. *Parsley* is also used fresh in larger amounts in *Tabouli* salads.
- The herb *Rosemary* is also a good source of terpenoids but is slightly like pine needles and needs to be added to a dish that will be cooked about 20 minutes for better texture. I enjoy Rosemary with *beta carotene* rich orange flesh *Sweet Potatoes* which I cook as a skillet scalloped potato. I first saute an *Onion* sliced in thin rings (*allium group*) and then add thinly sliced triangles of Sweet Potato so they cook fairly quickly and a teaspoon to a tablespoon of Rosemary. Rosemary is strongly flavored and accidentally spilling too much in the pan can leave the dish inedible, scoop out the excess.

## G10.5: Hot beverages can be a good source of Nrf2 promoting phytonutrients.

- The herb *Rosemary*, mentioned in the last menu idea, is a medicinal herb which may help with pain and in traditional folk medicine has been used as a strong tea for pain and inflammation conditions but several cups can have a diuretic effect similar to too much coffee.
- While discussing hot beverages, *Herbal Teas, Green Teas and Black Teas, and Coffee* provide *phenolic* phytonutrients and other antioxidants.
- *Chamomile* is a medicinal herb that is frequently used as an Herbal Tea. It has been studied in animal based cell research to increase Nrf2. (G10.10) The amount used in a cell based study is not something that I could calculate a human recommended serving size for but the traditional medicinal information is available here: (G10.12), caution against its use for asthma, and some seasonal allergy sufferers is mentioned and it is not recommended for use in pregnancy due to a possible risk of miscarriage. Chamomile is a tiny daisy like flower with white petals and a yellow center. The bright yellow center may be a source of *phenolic* nutrients. (G10.11) Medicinal uses mention digestive and skin complaints, inflammation, relief from muscle contractions, particularly in the intestines, and relief from anxiety. (G10.12)
- *Baking Cocoa* is also a source of some *phenolic* and antioxidant nutrients and can quickly be made into a cup of *Hot Cocoa* by boiling a cup of water and adding one or two large spoonfuls of the baking cocoa powder, to taste, along with a spoonful of sweetener. If richness is desired a half teaspoon of *Coconut Oil* can be stirred in for a hint of creaminess. Less processed/cold pressed Coconut Oil is also a source of *phenolic* nutrients. (G10.6)
- Sugar itself can be a source of inflammation so limiting sugar in beverages or other foods is generally a good idea for a health promoting menu plan.

## G10.6: What about Wine and Beer?

Wine and beer can provide some phenolic nutrients, however they can also be a migraine trigger for some migraine sufferers (like me). Some of the mood lifting benefits of wine are provided by the free (not-bound-within-a-larger-protein) amino acid content found in wine while other free amino acids in wine may be part of the migraine cause.

Due to a genetic difference I discovered that I have, I found a bulk supplier of powdered free amino acids and tried *Methionine* and *Glycine* in water. A half teaspoon of each provides a cheerful mood boost without causing excess energy boosting effects – I tried a teaspoon of each initially and it could cause sleeplessness if taken late in the evening and almost too much of a energy boost to the point of having an increased heart rate. Several free amino acids act within the brain to activate or inhibit neurons/brain cells.

The free amino acids are acidic and cause a puckery tart wine or lemonade effect when added to water. Adding an ounce or two of juice, 2-4 Tablespoons of a 100% *Purple Grape Juice* or *Cherry Juice* or *Black Currant Juice*, can add a hint of sweetness and anthocyanins and makes the resulting beverage slightly more juice or wine like.

A deficiency of *Methionine* whether due to a genetic difficulty in metabolism such as I have or due to a dietary lack can increase the body's need for Nrf2. (G10.7) A deficiency of Nrf2 could negatively affect the body's supply of the amino acids *Glycine* and *Serine* as it is involved in their biosynthesis pathways. (g10.13) The pathway, called the *pentose phosphate pathway*, is shown in Figure 2: (G10.14). So speculatively *Glycine* wouldn't be helping make Nrf2 but if there was a problem with supply of Nrf2 then there might be a shortage of *Glycine* or *Serine*, and they do have biological roles throughout the body.

Glycine also has roles in the brain to inhibit overactivation and therefore may help if anxiety or other mental illness symptoms are present.

Yes, but what about the Wine and Beer? - Two servings of alcoholic beverages for a man or one for a smaller woman or man has been found to provide some cardiovascular health benefits - enjoy responsibly and designate a driver if time isn't available to detoxify the alcohol, approximately one hour per serving is needed to recover from the physical effects of alcohol on thinking and reaction time. Whiskey and other liquors may also contain some beneficial nutrients depending on the ingredients and processing and age of the liquor. (G10.26) The serving size of alcoholic beverages varies based on the concentration of alcohol. Serving sizes and more information about the medical research regarding alcohol is available on the Harvard T. H. Chan School of Public Health website: *Alcohol: Balancing Risks and Benefits*. (P.alcohol)

Fermenting fruit and other starchy plants or grains was a way to preserve the nutrients when there was no freezer or refrigerator. Jagermeister is a flavorful alcoholic beverage that was sold as a cough medicine and digestive aid. It may have health benefits because of the many nutritious seasonings used in the recipe (G10.27) but moderation is still important with alcoholic beverages. Some people have trouble stopping once they start drinking and none might be the best serving size for them. See the section *I: Addiction or Starvation?* For more information about a possible genetic difference that may be involved in addictive alcohol or other substance use.

## G10.7: Pomegranate and Pomegranate Peel - say what?

*Pomegranate* seeds and juice are very healthy and it turns out that pomegranate peel and the inner membrane may be even healthier - if you are willing to eat it or it can be made so tasty that you want to eat it. I've been working on that task and will return to the topic after discussing the more commonly eaten citrus fruits and how their peels are also nutritious and are used in cooking and baking.

### **Citrus Fruits, Dried Lemon or Lime Powder and Lemon Zest:**

The white inner membrane of *citrus fruits* such as *oranges* and *grapefruit* is also healthy so no need to trim all of it away, just eat it. The inner membrane of citrus fruits is mild in flavor and tender in texture. the colorful peel is also nutritious but is much stronger in flavor and tangy. It is available in Middle Eastern style grocery markets as a powdered spice, *Dried Lemon or Lime Powder*. It retains the most flavor when added at the end of cooking or simply sprinkled on foods at the table.

The fresh peel is also grated into zest and used fresh or dried in baked goods and some other types of recipes. It is also best to add towards the end of cooking if used in a soup or stew type of recipe. Orange or lemon peel may also be candied in strips and used as a sugary flavorful ingredient in baking or dried and dipped in chocolate for a specialty candy.

Pomegranates have a fairly short season for availability because they require a long growing season. *Anardana Powder* is a powder made of dried pomegranate seeds which can be found at some Indian food markets. *Pomegranate Juice* and frozen *pomegranate seeds* can also be found in health food type grocery markets or other grocery stores that have a wider range of products.

Research studies with animals suggest that approximately 1/3 to 1/2 cup serving of pomegranate juice or whole pomegranate extract per day may have medicinal benefits and larger amounts may be effective to treat cancer. For my own health I've found it helpful to reduce symptoms of anxiety or

mood swings (bipolar disorder symptoms) and 1/3-1/2 cup once or twice a day is needed for best symptom relief. It has also helped reduce numbness in my finger tips - undiagnosed symptoms similar to Raynaud's Disease. Patient forum comments suggest other patients have also found capsules of Pomegranate concentrate helpful for that condition.

In the animal based research on cancer treatment the largest dose might have been equivalent to four or five 1/3-1/2 cup servings per day of Pomegranate juice or whole pomegranate extract. The research study made a liquid extract from the whole fruits but a standard kitchen juicer wouldn't not be able to process the tough peel of pomegranates or even the slightly less tough peel of citrus fruits. Where there's a will, there's a way - the just figure it out motto. The solution I figured out for my home kitchen use was to make a simmered soup stock from the pomegranate peel and inner membrane.

## G10.8: Pomegranate Peel Extract Recipe

### **Pomegranate Peel Extract**

- Peel and inner membrane of two pomegranates
  - Two to three cups of water
  - Two Tablespoons of Coconut oil
1. Rinse the pomegranates before separating the seeds from the peel. Cutting the rind about a quarter inch deep in six sections can make it easier to open and remove the seeds. Save the juicy seeds for use fresh or place in a freezer container and store in the freezer for later use. Trim the peel to remove any spoiled or discolored spots on the outer peel or inner membranes. Discard. Rinse the remaining peel and chop into quarter to half inch sections.
  2. In a soup or stock pot place the chopped peel, water and coconut oil and bring to a gentle simmer and turn down the heat to continue at a gentle simmer. Try not to reach a vigorous boiling point. Simmer the mixture for 20-30 minutes while stirring occasionally to prevent the fibrous slightly sweet membrane particles from sticking to the pan.
  3. Remove from heat and strain the liquid into another large pan or bowl. The peel and membrane fiber is pulpy and can be rinsed with additional water to increase yield of the pulpy extract. Add one cup warm water and stir and strain the pulp and then add another one cup warm water, stir and strain, and maybe one or two more cups until the liquid seems more water like instead of a slightly thickened pale pinkish or creamy yellow color.
  4. Store the pomegranate extract in the refrigerator if it will be used in other recipes within a few days or freeze the excess in small containers for gradual use.
  5. It is very acidic and using a couple spoonfuls per day added to a soup or salad in place of lemon juice or vinegar can be a tasty way to use it. Diluting a few spoonfuls to 1/3 cup with an additional 2/3 cup of water or regular juice of some sort and adding a pinch of baking soda can make it tolerable as a beverage. One third cup per day should provide adequate health benefits for someone using it for that purpose.

### **Pomegranate Extract made with dehydrated pomegranate peel**

Repeat the above steps using pomegranate peel and membrane that had been prepared and diced into 1/4-1/2 inch sections and dehydrated for long term storage – planning ahead for when pomegranates were no longer in season. One pomegranate peel/membrane produced approximately 30 grams of dried



peel and which measured at slightly less than a 1/2 cup of dried pieces loosely packed. Per one pomegranate amount of peel simmer with one tablespoon of coconut oil and 2 cups of water, about 20-30 minutes on low heat. After straining the heated peel I rinsed the peel with two cups of water poured over it gradually while stirring. The yield was three cups of pomegranate extract.

**Spicy Pomegranate Extract**, Slightly less acidic and slightly thickened and emulsified:

- 6 cups of pomegranate extract ([previous post](#))
  - 2 Tablespoons Cardamom powdered spice
  - 1 teaspoon Gumbo File powdered spice (Sassafras Leaves, powdered and used in Gumbo soups or stews in Creole style cooking)
  - 1 teaspoon Baking Powder
1. Add the Cardamom and Gumbo File to the Pomegranate Extract and stir well to break apart any dry lumps of the powdered spices. The Gumbo File acts as an emulsifier and is a digestive aid and the Cardamom adds flavor, phytonutrients and would help alkalize the mixture in addition to the alkalizing power of the Baking Soda.
  2. Bring the mixture to a boil.
  3. Add the Baking Soda and stir. Remove the mixture from the heat and keep stirring. It will froth up and stirring helps keep it from frothing over the top of the pan. The color changes from pinkish to brown from the Cardamom spice.
  4. To drink as a beverage dilute with equal parts water to Pomegranate Extract.

## G10.9: Health Benefits of Pomegranate/Whole Pomegranate Extract

Pomegranate extract has been studied in animal based research to examine in more detail how it helps hypertensive blood pressure problems and reduce oxidative stress. The mechanism was found to involve increasing Nrf2. The formation of mitochondria increased, and their function improved. Before treatment the hypertensive animals had fewer of the specialized proteins that are involved in production of mitochondria. Mitochondria are the cellular organelles primarily responsible for turning blood sugar/glucose into usable energy. (G10.16)

This study uses a pomegranate extract that incorporates the peel, seeds and juice as all contain the bioactive phytonutrient, *punicalagin*, thought to be most helpful for anti-inflammatory, anti-tumor and anti-diabetic effects. The animals who received the extract were found to have better blood pressure, reduced heart hypertrophy ( a sign of worse heart health) and a lower heart rate. Neuronal/nerve cell activity and oxidative stress markers were decreased in the experimental treatment group compared to the control group which received a saline solution and no pomegranate extract. Angiotensin converting enzyme which is involved in blood pressure control was lower in the experimental group that received pomegranate extract and may be the mechanism for the lower blood pressure. Pro-inflammatory cytokines were reduced in the experimental group after treatment, an indication that hypertensive inflammation was reduced. The pomegranate extract treatment led to increased levels of phosphorylated AMPK which then leads to an increase in Nrf2 and its resulting increases in antioxidant proteins which protect against injury and inflammation from oxidative stress chemicals. (G10.16)

### **Serving size that might be needed for general health or for special health needs:**

Animal based research used a range of 1 – 10 grams/kilogram for 8 weeks was found to be beneficial for treatment of hepatocellular carcinoma (G10.17); which for a human sized person might be equivalent to a quarter to a half cup to a couple cups per day. (See [this post](#) for more details)

## **G10.10: Sumac, Rosemary Tea, Pomegranate Extract - Diuretics.**

Some precautions are necessary when using larger quantities of some medicinal foods or herbs. Rosemary tea is a traditional folk remedy for pain and other conditions and Sumac is a dried spice used in Middle Eastern cooking or at the table as a season to taste spice or in the mixture called Za'atar. Sumac has a similar color to pomegranate and a similar tart lemony flavor to lemon zest as it contains the terpene limonene. Medical research on Sumac has found it to be very beneficial for a number of conditions and it may contain some similar phytonutrients to the pomegranate extract and it is readily available in Middle Eastern grocery markets for a small price compared to pomegranate products.

The specific physiology involved is something I haven't learned yet but all three act as diuretics - increasing urine output when used in larger amounts. I found that having pomegranate extract or sumac or rosemary tea earlier in the day along with extra glasses of water helped me sleep better at night. Diuretics can be cleansing for the body and help the kidneys remove extra toxins but the extra glasses of water are needed. Overly concentrated acidic urine can cause an uncomfortable urgency to relieve the bladder, even causing you to wake up throughout the night, and it can be somewhat painful if only a small amount of more acidic urine is the result.

Coffee and black tea are also known to be diuretics and beer and other alcoholic beverages are also. Drink smaller amounts of diuretic beverages and alternate with a glass of water to make up for the increase in urine production and the result can be healthy and cleansing of toxins.

### **Sumac and Za'atar**

A spice commonly used in Middle Eastern cooking and readily available at Middle Eastern grocery market may provide some similar health benefits to pomegranate. It is a dried powdered form of Sumac that has a lemony flavor. It is typically sprinkled on food individually at the table alone or in a mix with salt or with a few other spices and sesame seeds in a mixture called za'atar ([link](#)). I have found that using more than a half teaspoon can cause the diuretic effect similar to the pomegranate extract's effects. Studies on health benefits of Sumac have found benefit for a number of inflammatory conditions so using some in small amounts daily may have preventative health benefits against oxidative stress.

## **G10.11: For the chemists - tannins may be the diuretic.**

The phytonutrient group that may have diuretic effects in black tea, pomegranate extract, sumac and rosemary may be tannins. Tannins are phenolic compounds and there are many slightly different types within the group. Tannins down regulate the angiotensin receptor which can lead to diuresis and a reduction in high blood pressure/hypertension. (G10.18, G10.21) Sumac contains gallotannins which are active within the body as gallic acid. (G10.19, G10.20, G10.22) Pomegranate extract contains ellagitannins including punicalagin, which becomes active within the body as ellagic acid. (G10.23)



For the non-chemists the recommendation remains the same - the health benefits seem to be associated with an increase in urine output so drink extra water when eating or drinking foods or beverages that contain beneficial amounts of tannins and for a better night's sleep avoid having excessive amounts of pomegranate extract, sumac, rosemary tea, or black tea, wine or coffee late at night.

## G10.12: Using Pomegranate Extract & pomegranate products.

Dried powdered pomegranate seeds are available at some Indian food grocery stores or websites look for a small box labeled Anardana. It seems to be a dried powder of the whole seeds and it is gritty and tart with a fruit flavor. I added a couple tablespoons to a batch of soup and that seemed to soften the gritty effect. It was also good when I added it to food after cooking, giving a nice tartness, but there was a slight gritty texture occasionally. The gritty texture was not too noticeable though. Anardana Powder, dried pomegranate seed powder – an example of the product available online:

- Yogijis.co.nz      Phone: (03) 390 3434      Email: orders@yogijis.nz
- Anardana Powder, Powder of Dried Pomegranate Seeds: net Wt. 100 g/3.5 oz for \$3.99

An organic pomegranate juice concentrate is also available in the same quantity for a larger price. That seems like a lot of money for a 3.5 oz package which is slightly less than a half cup amount, unless you were comparing it to prepared capsules of a pomegranate product which might cost 20 to 30 dollars for one bottle of capsules:

- Matakanasuperfoods.com, PO Box 18, Matakana 0948 New Zealand / Physical address: 108 Omaha Flats Rd. Auckland, New Zealand, Phone: 09 422 9618      Outside New Zealand: +64 9 422 9618
- Organic Pomegranate Juice Powder, 100g, \$NZ 29,95

If I have pomegranate extract that I made according to the recipes included earlier on this page, available either fresh or frozen, I use a few tablespoons to about 1/3 cup per day and find it even more beneficial for relieving symptoms of anxiety or nerve numbness than when I only have pomegranate seeds or juice available. However I feel better with 1/3-1/2 cup of pomegranate seeds or juice everyday than when I don't have any.

The pomegranate extract made according to the recipes found earlier on this page is quite tart and can be used in place of lemon juice in a salad dressing or added to a soup or stew. As we age the stomach acidity levels can become reduced and having a small side dish that is acidic such as pickles, chutney, salsa, or a couple spoonfuls of table vinegar, apple cider vinegar, or lemon wedges can help promote better digestion of the meal and improve B vitamin absorption.

The pomegranate extract or pomegranate juice can also be used in larger amounts as a substitute for part of the liquid of a baked good. See the next section for a few example recipes.

## G10.13: Baked Goods made with Pomegranate Extract & other Nrf2 promoting ingredients.

When more liquid from juice or pomegranate extract is used in place of part of the coconut oil/butter ingredient, the cookie recipes included in G8: Cookies & Bean Soup can be modified into a slightly lower sugar and lower fat version that bakes up as moist Brownie or Fudge like cookies. The emulsifying power

of eggs can be made with Golden Flax Meal as was described in G8: Cookies & Bean Soup or the powdered spice called Gumbo File also can be used in place of eggs when prepared similarly to the Golden Flax Meal technique. Both Gumbo File powder and Golden Flax Meal are Nrf2 promoting ingredients and might help protect against cancer and other inflammatory conditions.

**Cheerful Chocolate Cookies** - I called them Cheerful because the Pomegranate Extract ingredient gives me a very cheerful mood - even more cheerful than just having chocolate cookies would provide. The image shows the unbaked cookies and a tray of baked cookies. The chocolate is very dark rather than burnt. Check for doneness by the crispness of the crust rather than watching for much change in the color. This recipe is a double batch compared to the G8: Cookies & Bean Soup recipes. It will make four pans of 24 cookies approximately instead of two pans of 24.

**Dry ingredients** - measure and mix in a large bowl:

- 1 1/4 cup Brown Rice Flour
- 3/4 cup Cocoa Powder (Regular or "Dutched" would work similarly)
- 2 cups Coconut Flour
- 1 cup Almond Meal
- 1/2 cup Tapioca Flour/Starch
- 1 teaspoon Salt
- 1 teaspoon Cardamom Powder
- 1 1/4 teaspoon Baking Soda

**Emulsifier step**- gently heat Pomegranate Extract or Juice to a simmer in a saucepan then remove from heat and stir in the Gumbo File Powder until the mixture is thickened.

- 1 1/2 cups Pomegranate Extract
- 6 Tablespoons Gumbo File Powder

**Wet ingredients** – in a another large bowl combine the thickened warm emulsifier liquid with the Brown Sugar and then stir in half of the remaining juice. Reserve part of the juice to add to the dry ingredients after first mixing in the emulsifier/sugar mixture. (This method is more like making a cake than a cookie, you combine small amounts of the liquid at a time for a smooth cake batter that is not over-stirred.)

- 2 cups Brown Sugar
- 2 teaspoons Vanilla
- 2 1/2 cups Pomegranate Juice, (100 percent, unsweetened organic is what I used – with the goal of a functional/healing food in mind)

The dough should be moist and able to be rolled or spooned into a sticky round shape that doesn't crumble – a soft playdough-like consistency.

The Baking time is longer than for a cookie dough made with butter or coconut oil – 20-25 minutes for those became 30-35 minutes for these Brownie or Fudge like Energy Bites. I bake two pans of 24 cookies at a time and rotate the pans from top shelf to bottom shelf and turned around front to back at 20 minutes to get a more even baking. These low fat juice containing cookies then take an additional 10-15 minutes. My typical coconut oil/ butter cookies are rotated at 15 minutes and then left for another 10-15 minutes. If baking only one tray use the top shelf and rotating the pan is less important as the oven heat is directed at the top and bottom of the pan more evenly.

Most of the ingredients in this recipe may be providing beneficial phytonutrients that might help promote our own production of NRF2 which then helps promote our own anti-inflammatory and anti-cancer abilities. Health may never have tasted so good – enjoy!

### **Spicy Molasses Cookie Variation:**

**Dry ingredients** - measure and mix in a large bowl:

- 2 cups Brown Rice Flour
- 2 cups Coconut Flour
- 2 cups Almond Meal
- 1 teaspoon Salt
- 1 teaspoon Cardamom Powder
- 2 1/2 teaspoons Baking Soda

**Emulsifier step-** gently heat Pomegranate Extract or Juice to a simmer in a saucepan then remove from heat and stir in the Gumbo File Powder until the mixture is thickened.

- 1 1/2 cups Pomegranate Extract
- 6 Tablespoons Gumbo File Powder

**Wet ingredients** – in a another large bowl combine the thickened warm emulsifier liquid with the Brown Sugar and then stir in half of the remaining juice. Reserve part of the juice to add to the dry ingredients after first mixing in the emulsifier/sugar mixture.

- 1 cup Brown Sugar
- 1 cup Blackstrap Molasses
- 4 rounded tablespoons minced Candied Ginger
- 2 1/2 cups Pomegranate Juice, (100 percent, unsweetened organic is what I used – with the goal of a functional/healing food in mind)

### **Cracker or Pancake Variation:**

**Dry ingredients** - measure and mix in a large bowl:

- 1 1/2 cups Brown Rice Flour
- 1 1/2 cups Coconut Flour
- 1 1/2 cups Almond Meal
- 1 cup Tapioca Starch/Flour
- 1 teaspoon Salt
- 1 teaspoon Cardamom Powder
- 2 1/2 teaspoons Baking Soda

**Emulsifier step-** gently heat Pomegranate Extract or Juice to a simmer in a saucepan then remove from heat and stir in the Gumbo File Powder until the mixture is thickened.

- 1 1/2 cups Pomegranate Extract
- 6 Tablespoons Gumbo File Powder

**Wet ingredients** – in a another large bowl combine the thickened warm emulsifier liquid with the Brown Sugar and then stir in half of the remaining juice. Reserve part of the liquid to add to the dry ingredients after first mixing in the emulsifier/sugar mixture.

- ¼ to 1 cup Coconut Oil, melted amount varied depending on desired richness of pancake or cracker dough
- 2 1/2 cups Water or Pomegranate Juice or Vegetarian Soup Stock for a savory flavor for crackers, for Pancake Batter about double the liquid would be needed for this amount of dry ingredients. Making a half batch might be a better idea.

To form the cracker dough, sprinkle a dry surface with additional almond meal and roll the dough into a ¼ inch thick sheet. The dough may be easier to work with if chilled overnight. Cut into squares or rounds and place on a greased baking sheet. Bake at 350-400°F for 20-30 minutes or until crisp. Let cool and store in an airtight container.

#### G10.14.1: Egg Substitutes: Gumbo File & Flax Meal are Emulsifiers.

Pictures of the mixing process for making cookies with an emulsifier other than eggs can be seen in [G8: Cookies & Bean Soup](#). An emulsifier is a type of chemical that can mix with water and with oil so it helps to form a baked good that will be stable and instead of crumbly. Before baking it helps the dough or batter mix together more easily when combining oil or melted butter and other liquid ingredients. The Gumbo File powder used in the Cheerful Chocolate Cookies on this page and the Golden Flaxmeal Powder used in the recipes on [G8: Cookies & Bean Soup](#) are both vegetarian sources of an emulsifier.

It is not uncommon in the plant world for seeds to have some emulsifying ability as phospholipids are a chemical found in membranes that can mix with water and with oil. Phospholipids are found throughout cell membranes and the group of chemicals add flexibility to the membrane when the plant or human cells are alive. Flax Seeds are a good source of essential omega 3 oil and other beneficial oils in addition to being a source of phospholipids and other emulsifying phytonutrients.

Mustard seed powder from which we make the yellow table condiment known as mustard also has emulsifying power and it can help the oil and vinegar of a salad dressing to stay mixed together even when egg yolk isn't used. Egg yolk adds the emulsifying power that can make mayonnaise out of oil and vinegar. When allergies are a problem and egg can't be used there are many common foods and recipes that need to be modified or given up by the person with the allergy because egg is used in mayonnaise and other foods as an emulsifier. Wild mustard blooms in spring to early summer and turns to seed by late summer. The pollen may cause seasonal allergy symptoms in sensitive individuals. (G10.30. [Wild Mustard](#)) Eating more Nrf2 promoting foods and ingredients such as mustard may help the body to be less sensitive to allergens. Nature has many beneficial plants that human ingenuity has developed into edible and delicious foods.

The *Gumbo File Powder* used in the Cheerful Chocolate Cookies earlier on this page is a more unusual source for a baked good but it traditionally has been used to thicken liquids by Native Americans and was originally known as Choctaw Spice and more recently is used in Creole style cooking of Gumbo soups and stews where it became better known as Gumbo File. It is a powder of dried *Sassafras Leaves* and as Choctaw Spice it was a major export crop during the 1700s from the American colonies, second only to tobacco. *Sassafras Leaves* and *Sassafras Root* have medicinal value and the root is the original flavoring agent that gives the carbonated beverage Root Beer its name. *Sassafras Root* was found to have an

active ingredient that may promote cancer and the seasonings lost some of the early popularity. The chemical can be removed from the root and traditionally flavored Root Beer is still available as a specialty item. The chemical is not abundant in the Sassafras Leaves so there is no need to avoid using the Gumbo File in soups and stews - and with the Cheerful Chocolate Cookie recipe I found that it works in baked goods too. The replacement of oil with liquid makes that recipe moister than typical cookies so I wanted to try a more typical style cookie and I've wanted to try Fennel Powder in a baked good - and the result is delicious.

*Fennel Seeds* are very nutritious and help with digestion but they are very crunchy and some people with health issues also have pain with chewing. Inflammatory conditions may increase inflammation of the gums. *Fennel Powder* can be found at specialty spice shops or sometimes at Indian grocery markets. The whole Fennel Seeds are typically available in bulk amounts at Indian grocery markets as they are served whole as an appetizer or left in a dish at the end of a meal somewhat like an after dinner mint. The seeds have a mildly minty flavor mixed with licorice flavor.

#### G10.14.2: The Fennel Cookie Recipe and a Lime Variation.

##### **Fennel Cookies:**

Wet ingredients:

- 3 Tablespoons Golden Flaxmeal
- 10 Tablespoons boiling Water
- Stir the Flaxmeal into the boiling water in a small bowl for a couple minutes until it thickens and turns opaque slightly. Then add the melted Coconut Oil and stir until it turns creamy white and opaque. Then add the Brown Sugar, Vanilla, and Apple Cider Vinegar.
- 3/4 cup Coconut Oil, melted
- 1 cup Brown Sugar
- 1/2 teaspoon Vanilla
- 2 1/2 teaspoons Apple Cider Vinegar

Dry ingredients, mix together in a large bowl:

- 1 cup Brown Rice Flour
- 3/4 cup Coconut Flour
- 1/2 cup Tapioca Flour/Starch
- 1/2 cup ground Fennel Seed Powder
- 1/2 teaspoon Salt
- 3/4 teaspoon Baking Soda

Add the wet ingredients from the small bowl to the dry ingredients and stir gently until well mixed. The dough will be soft and sticky, moist enough to easily roll or spoon into small rounds. The batch makes two trays of 24 cookies about one inch around.

Coat the pans with a small amount of coconut oil or pan spray to prevent sticking. Bake at 350°F for 25-30 minutes. Rotate the pans from the top and bottom racks at 15 minutes. Let cool on a wire rack and then store in an airtight container in the refrigerator, freezer or at room temperature. Chilling in the

refrigerator or freezer will convert the Tapioca starch into a form that can become a healthier form in the digestive system (called resistant starch).

### **Lime or Lemon Peel Cookies**

Dried lime powder or dried lemon powder are available in Middle Eastern grocery stores. I used two tablespoons of dried lime powder instead of the half teaspoon of vanilla. The flavor blended into the cookie better after a couple days so it might work better if it were added to the melted coconut oil in advance of mixing the cookie dough – melt the oil, mix in the dried lime powder, stir and let it sit for ten or twenty minutes while measuring the other ingredients and then add it to the emulsified Flaxmeal or Gumbo File Powder.

The fennel powder could be replaced with more of one of the other flours or the flavor blended well after couple days and both the lime and fennel have anti-inflammatory phytonutrients content – so give it a try either way and maybe both would be enjoyable.

### **Disclaimer**

- *Disclaimer: Opinions are my own and the information is provided for educational purposes within the guidelines of fair use. While I am a Registered Dietitian this information is not intended to provide individual health guidance. Please see a health professional for individual health care purposes.*
- The Academy of Nutrition and Dietetics has a service for locating a nutrition counselor near you at the website [eatright.org](http://eatright.org): ([eatright.org/find-an-expert](http://eatright.org/find-an-expert))

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