

Aunt Cathy



## By Request: The Kale Brownie Recipe (and some info on Lutein and Zeaxanthin)

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**The brownie recipe starts with a plain brownie mix of your choice ... I usually use the 9x13" size.**



### Home-made, Generic or Famous Brand?

Any mix will do ... and you can certainly make the brownies from scratch if you want to show off. ☺ I think you may get extra points for that ...



### Kale Prep:

I prepare the kale by drying fresh kale leaves in my little table-top food dehydrator (I just happen to have one because I dehydrate a lot of tomatoes and apples every year.) Otherwise, you can dry the kale easily at about 200 degrees in any oven. They dry nice and fast.

After drying the leaves I crumble some up by hand and put them in a jar with a screw-on lid and keep it in the fridge. Then, when I make things with a LOT of flavor (chili, meatloaf, soups, enchiladas, whatever) I just throw some in there. It looks like parsley and generally escapes notice.

Some of the dried leaves I put into a food processor and in hardly any time at all it is a very fine powder with some plant backbone sticks. Sift out the backbone sticks because they will stab you in the mouth. I know this from experience. Be warned!

**Into the dry brownie mix I add a tablespoon or two of powdered kale and mix well.**

This plain green powder is the ultimate “stealth vegetable” ingredient. I keep a jar (with a tight lid) of the powdered form in the fridge as well, and it also freezes well in baggies, so you could have a “kale-a-thon” with friends and make a year’s supply all at once, which makes it a lot easier to actually add it to things.

### **Historical Aside:**

I first started doing this because years ago a friend was doing some research on using pureed spinach as a fat replacer in chocolate cake. (Remember that brief trend? People were suggesting replacing oil in cake mix with apple sauce or prune whip and assuring everyone that it tasted “just like regular cake!” ... Not.)

In those days, it wasn’t about the added nutritional value of the plants used as fat replacers ... a lot of the many benefits of many plant “phytochemicals” had not yet been identified. The health message at the time was also not yet well developed. It was simple (and erroneous.) It could be summarized as “Don’t Eat Any Fat ... EVER!”

Sigh ... the Good Old Days! ☺

Anyway, that particular trend has ended, for oh, so many reasons. My researcher friend found that everyone loved the spinach/chocolate cake as long as they did not know about the spinach. It never caught on just because spinach/chocolate cake just wouldn’t fly with consumers.

But nothing one learns is ever wasted, and for me **the take-away message from my friend’s research was that one could use chocolate to get green plants into people!** It also rang another memory bell for me because I was in college in 1968 so I knew what “Funny Brownies” were. [People baked marijuana into brownies so there was no smoke to be detected ... it was a popular hostess gift in the dorm. Kale brownies are an extension of the same principle ... green plants can be served in chocolate ... with the additional benefits of being legal and not impairing judgment.]

So, I set about to find a way to happily eat kale, a “nutrient champion” emerging in the scientific research that happens to taste really bitter to about half the population, including me. It was important because **kale has great vitamin K content**. Vitamin K is now known to be low in many people’s diets and it is only now known to have a role in **preventing osteoporosis, cardiovascular disease, diabetes and certain cancers**.

It is also (by far!) the **best source of the green phytochemical pigment** (green-colored plant chemical) **called lutein**. Lutein and zeaxanthin (a yellow pigment also found in kale) are potent antioxidants that help to protect against damaging free radicals. They have been shown to be especially helpful in decreasing the risk of a type of damage to the retina of the eye called “macular degeneration.” (See page 6-12 for details.)

Diabetes is the #1 cause of blindness in America, and macular degeneration is the #2 cause. Kale is rich in nutrients helpful in prevent the development of these diseases and/or slow their progression. Kale is truly a soldier helping to fight many health battles. But finding a way to eat (and enjoy) the kale is the big problem.

Now, kale tastes way less bitter with enough hollandaise sauce, crumbled bacon, or something sweet added to it. When I first started talking about eating kale at conferences a few years back it was relatively unknown as a “Super Food” and I would note that I found it to be too bitter to enjoy eating it. People always kindly sent me their grandma’s fabulous kale/potato soup recipe that is so delicious nobody could dislike it.

The problem, of course, is that the soup recipe invariably started out with  
“Brown a pound of bacon ...”

I mean, really ... if you put a pound of bacon into pretty much anything it’s going to taste way better ... including kale. But it isn’t always practical or desirable.

Anyway, I began tinkering with kale in brownies. The first time I tried this there was no recipe, so I just dried and powdered a whole bunch of kale and added the whole thing to a brownie mix. That first time I sort of overshot ... and the brownies had a distinctive greenish cast and a bit of a bitter aftertaste.

But we ate them all anyway...  
we just had to put more ice cream on them than usual!



← prototype

Now, I just add the tablespoon or two of the green powder per brownie recipe instead of the whole darned truckload of kale, and the brownies still look appropriately brown.

## Back to the recipe ...

### Oil Specs:



I use light olive oil because it is light in taste and great for monounsaturated fat, which helps tinker with the ratio of omega-6:omega-3 in our diet by displacing that “almost-all-omega-6” corn oil and similar vegetable oils. Peanut oil (another monounsaturated fat) would be the same in that regard.

The oils all have the same amount of calories, but the monounsaturated fats are the kinds most prevalent in the heart-healthy “Mediterranean Diet.” For this reason, I like to think of monounsaturated fats as “Happy Fats: Dangerous to your butt but not to your heart!” Pick your battles ...

Of course, you may also choose to omit the oil entirely if your goal is pure Nutrition Martyrdom and you don’t care if they taste icky and dry. ☺

### Eggs and Water:



Add regular eggs and water in amounts shown on the package directions. Two eggs makes for a fudgier texture and 3 eggs results in a cake-ier texture. This ratio adjustment is not something I discovered ... it is just old “Home Economics Brownie Lore.” (My hubby likes the cake-ier texture, so even when the box says 2 eggs I use 3.)

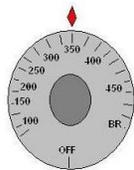
## Nuts:



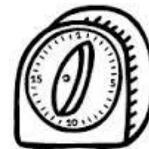
Then I throw in a **big bunch of walnuts or almonds** (or the nutrient-rich “baby plants” of your choice) ... and I mean a BIG bunch. My brownies appear to be about 1/2 nuts, more or less. I never actually MEASURE them. There will be nuts in every bite so there is a lot of “nutrient density” for the caloric cost of the brownie.

I get big bags or bins of unsalted nuts at those big warehouse grocery stores. (I can't mention any names ... but you get the idea.) They are a lot cheaper than one can get in the grocery store, so I can fling them into the brownie mix with wild abandon!

I keep the bags of nuts (and the boxes of brownie mix) in the freezer in zip-lock bags so I always have fresh ones on hand. You never know when you might suddenly need a brownie ... but I am always prepared for that kind of eventuality! Sometimes I use almonds and arrange them close together in the same direction on the top of the brownies to totally cover them. I use the ones with the coating still on them (even more fiber!) but blanched is fine. When the brownies bake, the nuts get roasted and they have a really nice flavor.



## Baking Time and Temperature:



**Bake as directed on the package or in the cookbook, but it will likely take an extra 10 minutes or so** because of the increased size of the recipe with all those nuts in there. I usually set the timer as it says, but then check with a knife in the middle to see if it comes out clean. I may need to add increments of 5 or 10 minutes and I re-check with a knife until they are done. (There is no other reliable way to know if they are done because the amount of nuts, etc., can be quite variable.) Let cool, and then eat the entire pan of brownies at one sitting. 😊

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**Here are 3 reviews about lutein and zeaxanthin from reliable sources (and not selling anything):**



Center for Healthy Vision Caring for Your Vision Diet & Nutrition

## **Lutein & Zeaxanthin**



Lutein (LOO-teen) and zeaxanthin are important nutrients found in green leafy vegetables as well as other foods such as eggs. Many studies have shown that lutein and zeaxanthin reduce the risk of chronic eye diseases, including age-related macular degeneration (AMD) and cataracts.

AMD and cataract incidence are growing. Worldwide, more than 25 million people are affected by age-related macular degeneration and the formation of cataracts. AMD is the leading cause of blindness in people over age 55 in the Western world and the incidence is expected to triple by 2025.

## **Benefits to Eye Health**

Lutein and zeaxanthin are carotenoids that filter harmful high-energy blue wavelengths of light and act as antioxidants in the eye, helping protect and maintain healthy cells. Of the 600 carotenoids found in nature, only two are deposited in high quantities in the retina (macula) of the eye: lutein and zeaxanthin. The quantity of lutein and zeaxanthin in the macular region of the retina can be measured as macular pigment optical density (MPOD). Recently, MPOD has become a useful biomarker for not only predicting disease but also visual function. Unfortunately, the human body does not synthesize the lutein and zeaxanthin it needs, which is the reason why green vegetables are essential to good nutrition. Daily intake of lutein and zeaxanthin through diet, nutritional supplements, or fortified foods and beverages is important for the maintenance of good eye health.

## **Lutein, Zeaxanthin and Cataracts**

The primary function of the crystalline lens (or natural lens in the eye) is to collect and focus light on the retina. To properly provide this function throughout life, the lens must remain clear. Oxidation of the lens is a major cause of cataracts, which cloud the lens. As antioxidant nutrients neutralize free radicals (unstable molecules) associated with oxidative stress and retinal damage, lutein and zeaxanthin likely play a role in cataract prevention. In fact, a recent study demonstrated that higher dietary intakes of lutein and zeaxanthin and vitamin E was associated with a significantly decreased risk of cataract formation.

## Lutein, Zeaxanthin and Age-Related Macular Degeneration

Much evidence supports the role of lutein and zeaxanthin in reducing the risk of AMD. In fact, The National Eye Institute presently is conducting a second large human clinical trial, Age-Related Eye Disease Study (AREDS2), to confirm whether supplements containing 10 mg a day of lutein and 2 mg of zeaxanthin per day affect the risk of developing AMD. Beyond reducing the risk of developing eye disease, separate studies have shown that lutein and zeaxanthin improve visual performance in AMD patients, cataract patients and individuals with good health.

Although there is no recommended daily intake for lutein and zeaxanthin, most recent studies show a health benefit for lutein supplementation at 10 mg/day and zeaxanthin supplementation at 2 mg/day.

### Food Sources

Most Western diets are low in lutein and zeaxanthin, which can be found in spinach, corn, broccoli and eggs. The following table lists foods known to be high in lutein and zeaxanthin. If you are not getting enough lutein and zeaxanthin through diet alone, consider adding supplements to your daily routine.

**Although there is no recommended daily intake for lutein and zeaxanthin, most recent studies show a health benefit for lutein supplementation at 10 mg/day and zeaxanthin supplementation at 2 mg/day.**

Foods with lutein and zeaxanthin		
FOOD	SERVING	mg
Kale ( <i>cooked</i> )	1 cup	23.8
Spinach ( <i>cooked</i> )	1 cup	20.4
Collards ( <i>cooked</i> )	1 cup	14.6
Turnip greens ( <i>cooked</i> )	1 cup	12.2
Spinach ( <i>raw</i> )	1 cup	3.8
Corn ( <i>can or cooked</i> )	1 cup	2.2
Green peas ( <i>canned</i> )	1 cup	2.2
Broccoli ( <i>cooked</i> )	1 cup	1.6
Romaine lettuce ( <i>raw</i> )	1 cup	1.3
Green beans ( <i>cooked</i> )	1 cup	0.8
Eggs	2 ( <i>large</i> )	0.3
Orange	1 ( <i>medium</i> )	0.2

The USDA Nutrient Database offers comprehensive information on raw and prepared foods.

The George Mateljan Foundation, a not-for-profit foundation with no commercial interests or advertising, is a new force for change to help make a healthier you and a healthier world.

## **Lutein and Zeaxanthin**

### **What can foods rich in lutein and zeaxanthin do for you?**

Defend your cells from the damaging effects of free radicals  
Protect the eyes from developing age-related macular degeneration and cataracts

### **What events and lifestyle factors can indicate a need for more foods rich in lutein and zeaxanthin?**

Smoking and regular alcohol consumption  
Low intake of fruits and vegetables

**Food sources of lutein and zeaxanthin** include eggs, kale, spinach, turnip greens, collard greens, romaine lettuce, broccoli, zucchini, corn, garden peas and Brussels sprouts. To maximize the availability of the carotenoids in the foods listed above, the foods should be eaten raw or steamed lightly.

### **What are lutein and zeaxanthin?**

Lutein and zeaxanthin are two of the most abundant carotenoids in the North American diet. Unlike beta-carotene, alpha-carotene and beta-cryptoxanthin, these two carotenoids are not considered to be "provitamin A" compounds, as they are not converted in the body into retinol, an active form of vitamin A.

The names of both of these yellow colored phytonutrients reflect their natural hue with *lutein* being derived from the Latin word *luteus* meaning golden yellow while *zea* refers to the corn genus and *xantho-* is derived from a Greek word that means yellow. While these carotenoids both have yellow pigments, they are found concentrated in foods of other colors, notably leafy green vegetables, since these foods also feature a host of other phytonutrients pigments in addition to lutein and zeaxanthin.

## **How it Functions**

### **Antioxidant Activity**

In recent years, carotenoids have received a tremendous amount of attention as potential anti-cancer and anti-aging compounds. Carotenoids are powerful antioxidants, protecting

the cells of the body from damage caused by free radicals. Carotenoids, and specifically beta-carotene, are also believed to enhance the function of the immune system.

## **Promote Eye Health**

The eyes are repositories for carotenoids with lutein and zeaxanthin concentrated in the retina and lens. Observational studies have noted that higher dietary intake of lutein and zeaxanthin is related to reduced risk of cataracts and age-related macular degeneration, two eye conditions for which there is minimal options when it comes to effective prevention. Researchers speculate that these carotenoids may promote eye health through their ability to protect the eyes from light-induced oxidative damage and aging through both their antioxidant actions as well as their ability to filter out UV light.

## **Deficiency Symptoms**

A low dietary intake of carotenoids such as lutein and zeaxanthin is not known to directly cause any diseases or health conditions, at least in the short term although long-term inadequate intake of carotenoids is associated with chronic disease, including heart disease and various cancers. One important mechanism for this carotenoid-disease relationship appears to be free radicals.

Research indicates that diets low in carotenoids can increase the body's susceptibility to damage from free radicals. As a result, over the long term, carotenoid-deficient diets may increase tissue damage from free radical activity, and increase risk of chronic diseases like heart disease and cancers.

## **Toxicity Symptoms**

High intake of carotenoid-containing foods or supplements is not associated with any toxic side effects. As a result, the Institute of Medicine at the National Academy of Sciences did not establish a Tolerable Upper Intake Level (UL) for carotenoids when it reviewed these compounds in 2000.

## **Impact of Cooking, Storage and Processing**

Lutein appears to be sensitive to cooking and storage. Prolonged cooking of green, leafy vegetables is suggested to reduce their lutein content. The concentration of lutein found in roasted barley that has been water extracted was shown to decrease as roasting temperature increased. Additionally, the lutein content of wheat seeds has been found to decline with longer storage times. There is minimal research specifically focusing upon the effects of cooking, storage or processing upon zeaxanthin.

## Factors that Affect Function

Carotenoids such as lutein and zeaxanthin are fat-soluble substances, and as such require the presence of dietary fat for proper absorption through the digestive tract. Consequently, your carotenoid status may be impaired by a diet that is extremely low in fat or if you have a medical condition that causes a reduction in the ability to absorb dietary fat such as pancreatic enzyme deficiency, Crohn's disease, celiac sprue, cystic fibrosis, surgical removal of part or all of the stomach, gall bladder disease, and liver disease.

Due to low consumption of fruits and vegetables, many adolescents and young adults do not take in enough carotenoids such as lutein and zeaxanthin. In addition, if you smoke cigarettes and/or drink alcohol, you may have lower than normal blood levels of carotenoids. Statistically speaking, smokers and drinkers eat fewer foods that contain lutein and zeaxanthin. Also, researchers suspect that cigarette smoke destroys carotenoids. However, if you do smoke or drink, use carotenoid supplements with caution

## Nutrient Interactions

A human study published in the August 2004 issue of the *Journal of Nutrition* shows that lutein is much better absorbed from egg yolk than lutein supplements or even spinach.

A carotenoid, lutein is found in green vegetables, especially spinach, as well as kale and broccoli. But egg yolks, although they contain significantly less lutein than spinach, are a much more bioavailable source whose consumption increases lutein concentrations in the blood many-fold higher than spinach.

Although the mechanism by which egg yolk increases lutein bioavailability is not yet known, it is likely due to the fats (cholesterol and choline) found in egg yolk. As mentioned above, lutein, like other carotenoids, is fat-soluble, so cannot be absorbed unless fat is also present. To maximally boost your lutein absorption, we suggest enjoying your spinach, whether steamed, sautéed or fresh in spinach salad, with a little olive oil and a topping of chopped hard-boiled egg. For a flavorful, quick and easy recipe featuring eggs and spinach, try our [Poached Eggs over Spinach and Mushrooms](#).(October 11, 2004)

Beta-carotene supplements reduce blood levels of lutein, suggesting that carotenoids may compete with each other for absorption. Supplementing your diet with pectin or other forms of supplemental dietary fiber such as guar, wheat bran, alginate, or cellulose may decrease the absorption of lutein.

# Health Conditions

**Carotenoids may play a role in the treatment and/or prevention of the following health conditions:**

Acquired Immunodeficiency Syndrome (AIDS)	Asthma
Age-related macular degeneration	Cataracts
Angina pectoris	Cervical cancer
Cervical dysplasia	Chlamydial infection
Heart disease	Laryngeal cancer (cancer of the larynx)
Lung cancer	Male and female infertility
Osteoarthritis	Photosensitivity
Pneumonia	Prostate cancer
Rheumatoid arthritis	Skin cancer
	Vaginal candidiasis

## Food Sources

Green vegetables such as kale, spinach, turnip greens, collard greens, romaine lettuce, broccoli, zucchini, garden peas and Brussel sprouts are among the best sources of lutein and zeaxanthin. *Food Source Analysis not Available for this Nutrient*

## Public Health Recommendations

To date, no recommended dietary intake levels have been established for lutein, zeaxanthin and carotenoids. In an effort to set such recommendations, the Institute of Medicine at the National Academy of Sciences reviewed the existing scientific research on carotenoids in 2000.

Despite the large body of population-based research that links high consumption of foods containing beta-carotene and other carotenoids with a reduced risk of several chronic diseases, the Institute of Medicine concluded that this evidence was not strong enough to support a required carotenoid intake level because it is not yet known if the health benefits

associated with carotenoid-containing foods are due to the carotenoids or to some other substance in the food.

However, the National Academy of Sciences supports the recommendations of various health agencies, which encourage individuals to consume five or more servings of fruits and vegetable every day.

**References** [CB note: This last paper was written a while ago so the most recent references they cite below are from 2002 or earlier. However, since then there has been a LOT more research with results in the same direction.]

Carotenoids and chronic diseases. *Drug Metabol Drug Interact* 2000;17(1-4):189-210. Lens aging in relation to nutritional determinants and possible risk factors for age-related cataract. *Arch Ophthalmol* 2002 Dec;120(12):1732-7. Identification and quantitation of carotenoids and their metabolites in the tissues of the human eye. *Exp Eye Res* 2001 Mar; 72(3):215-23. 2001. A prospective study of carotenoid intake and risk of cataract extraction in US men. *Am J Clin Nutr* 1999 Oct; 70(4):517-24. A prospective study of carotenoid and vitamin A intakes and risk of cataract extraction in US women. *Am J Clin Nutr* 1999 Oct; 70(4):509-16. 1999. Lutein bioavailability is higher from lutein-enriched eggs than from supplements and spinach in men. *J Nutr*. 2004 Aug;134(8):1887-93. Natural pigments: carotenoids, anthocyanins, and betalains-- characteristics, biosynthesis, processing, and stability. *Crit Rev Food Sci Nutr* 2000 May;40(3):173-289. Antioxidant effects of water extracts from barley (*Hordeum vulgare* L.) prepared under different roasting temperatures. *J Agric Food Chem* 2001 Mar;49(3):1455-63. Advanced Nutrition and Human Metabolism. West Publishing Company, New York, 1995. The evolving role of carotenoids in human biochemistry. *Nutrition* 2001 Oct;17(10):818-22. 2001. Carotenoids as antioxidants. *Nutrition* 2001 Oct;17(10):815-7. 2001. PMID:15110. A-Z guide to drug-herb-vitamin interactions. Prima Health, Rocklin, CA, 2000. 2000. Aging, free radicals, and antioxidants in wheat seeds. *J Agric Food Chem* 1999 Apr; 47(4):1333-9. The Textbook of Natural Medicine. The Textbook of Natural Medicine. 1998. Some dietary fibers reduce the absorption of carotenoids in women. *J Nutr* 1999 Dec; 129(12):2170-6. 1999. Neovascular age-related macular degeneration and its relationship to antioxidant intake. *Acta Ophthalmol Scand* 2002 Aug;80(4):368-71. 2002. Antioxidant and prooxidant properties of carotenoids. *Arch Biochem Biophys* 2001 Jan 1;385(1):20-7. 2001.

<http://www.webmd.com/vitamins-supplements/ingredientmono-754-LUTEIN.aspx?activeIngredientId=754&activeIngredientName=LUTEIN>

**From WebMD:** Find a Vitamin or Supplement: **LUTEIN**

**Other Names:** All-E-Lutein, All-E-Zeaxanthin, All-E-3'-dehydro-lutein, Beta,epsilon-carotene-3,3'-diol, Carotenoid, Caroténoïde, E-Lutein, Luteina, Lutéine, Lutéine Synthétique, Synthetic Lutein, Xanthophyll, Xanthophylle, Zeaxanthin, Zéaxanthine.

**Lutein Overview Information:** Lutein is called a carotenoid vitamin. It is related to beta-carotene and vitamin A. Foods rich in lutein include broccoli, spinach, kale, corn, orange pepper, kiwi fruit, grapes, orange juice, zucchini, and squash. Lutein is absorbed best when it is taken with a high-fat meal. Many people think of lutein as “the eye vitamin.” They use it to prevent eye diseases including age-related macular degeneration (AMD), cataracts, and retinitis pigmentosa. Some people also use it for preventing colon cancer, breast cancer, type 2 diabetes, and heart disease. Many multivitamins contain lutein. They usually provide a relatively small amount of 0.25 mg per tablet.

**How does it work?** Lutein is one of two major carotenoids found as a color pigment in the human eye (macula and retina). It is thought to function as a light filter, protecting the eye tissues from sunlight damage.