

The Road to Wellness: *Nutrition*

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Abramson Cancer Center

American Institute of Cancer Research Nutrition Guidelines

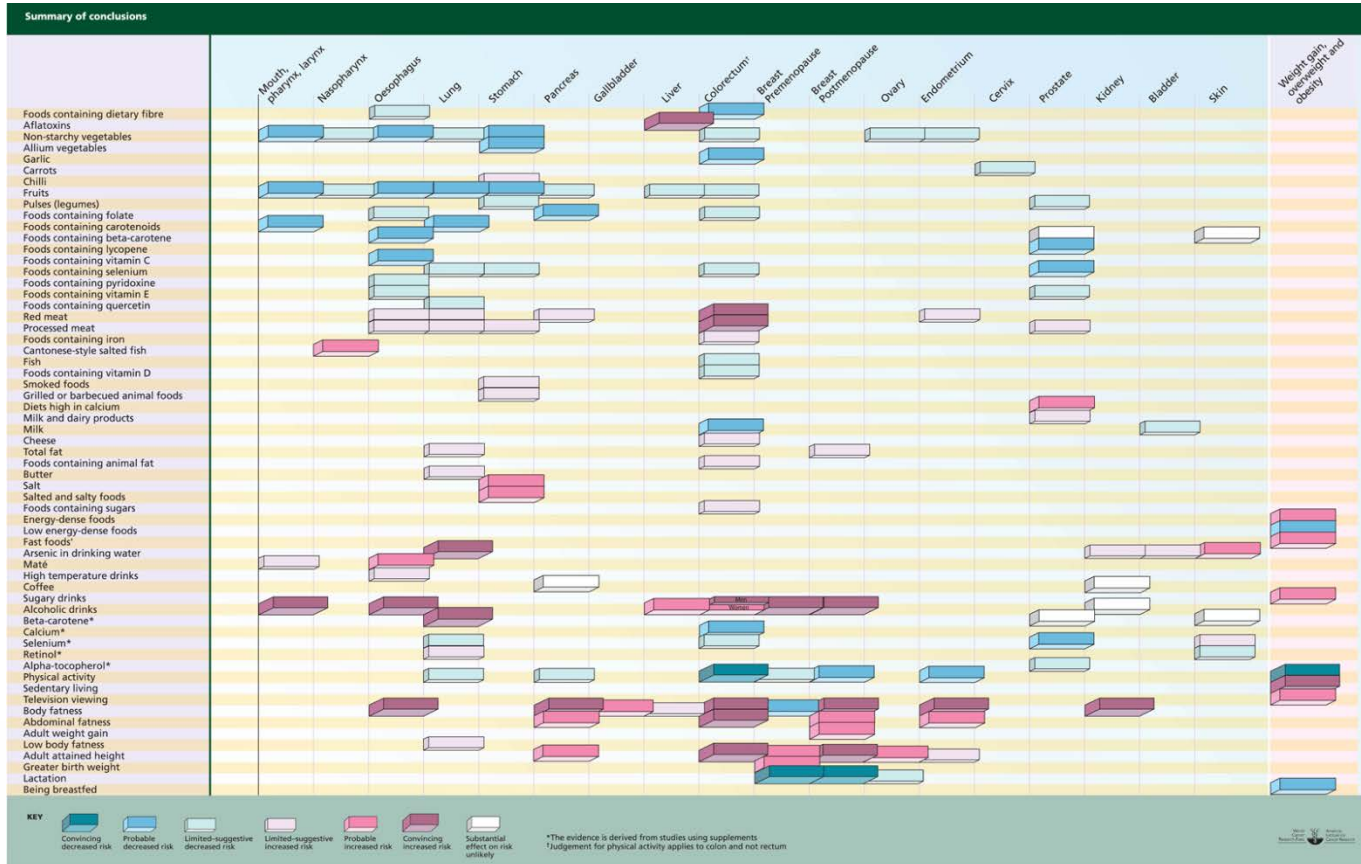


1. Be as lean as possible without becoming underweight
2. Be physically active for at least 30 minutes every day
3. Avoid sugary drinks. Limit consumption of energy-dense foods (particularly processed foods high in added sugar, or low in fiber, or high in fat)
4. Eat more of a variety of vegetables, fruits, whole grains and legumes such as beans
5. Limit consumption of red meats (such as beef, pork and lamb) and avoid processed meats
6. If consuming at all, limit alcoholic drinks to 2 for men and 1 for women a day
7. Limit consumption of salty foods and foods processed with salt (sodium)
8. Don't use supplements to protect against cancer

http://www.aicr.org/site/PageServer?pagename=dc_home_guides



Foods & Nutrients Associated with Cancer Risk



Skin

Foods containing beta-carotene

Arsenic in water

Beta-carotene
Selenium
Retinol



Nutrition for Melanoma

- **Vitamin A/Retinols:** fish, egg yolk, milk, butter, apricots, tomatoes, carrots, sweet potatoes, spinach, kale, cantaloupes, squash
- **Selenium:** Brazil nuts, beef, poultry, fish, barley, oats, whole wheat, wheat germ and milk
- **Low fat diet:** especially saturated fats
- **Fats high in omega-3 fatty acids:** walnuts, flaxseed, cold water fish, soybeans
- **Vitamin D:** fatty fish, eggs, fortified dairy
- **Green and black tea**
- **Resveratrol:** grapes, peanut butter, dark chocolate, blueberries
- **Carotenoids:** alpha-carotene, beta-carotene, lutein, lycopene
- **Vegetables/fruits**



FOODS HIGH in CAROTENOIDS

Yellow-Orange
Vegetables
Green Leafy
Vegetables
Apricots
Asparagus
Beet Greens
Bok Choy
Broccoli
Brussels Sprouts
Cabbage
Cantaloupe
Carrots
Cherries
Chinese Broccoli
Collard Greens
Corn
Cucumber, with peel
Dandelion Greens

Endive
Fruit Cocktail, juice
packed
Green Beans
Grapefruit, especially
pink
Guava
Kale
Kohlrabi
Lemons
Mangos
Mustard Greens
Okra
Orange
Papayas
Passion Fruit
Peaches
Peas, green
Peppers, all colors

Persimmon
Plantains
Plums
Prunes
Pumpkin
Salmon (wild, caught)
Spices (green, fresh)
Spinach
Squash
Sweet Potatoes
Swiss Chard
Tangerine
Tomatoes, especially
cooked
Turnip Greens
Vegetable Juice
Vegetable Soup
Watermelon



Mediterranean Diet

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doi:10.1093/ije/dyn132

A protective effect of the Mediterranean diet for cutaneous melanoma

C Fortes,* S Mastroeni, F Melchi, M A Pilla, G Antonelli, D Camaioni, M Alotto and P Pasquini

Accepted 3 June 2008

Background Many studies have investigated the Mediterranean diet as a risk factor for cancer, none of which has included cutaneous melanoma. The latter is usually fatal, rendering knowledge about prevention extremely important. We assessed the role of some food components of the Mediterranean diet and cutaneous melanoma.

Methods A hospital-based case-control study was conducted in the inpatient wards of IDI-San Carlo Rome, Italy including 304 incident cases of cutaneous melanoma and 305 controls, frequency matched to cases. Information on socio-demographic characteristics, medical history, smoking, sun exposure, pigmentary characteristics and diet was collected. Logistic regression was the method used to estimate odds ratio and 95% CIs.

Results After careful control for several sun exposure and pigmentary characteristics, we found a protective effect for weekly consumption of fish (OR, 0.65, 95%CI=0.43–0.97), shellfish (OR, 0.53, 95%CI=0.31–0.89), fish rich in n-3 fatty acids (OR, 0.52, 95%CI=0.34–0.78), daily tea drinking (OR, 0.42, 95%CI, 0.18–0.95; $P_{trend}=0.025$) and high consumption of vegetables (OR, 0.50, 95%CI=0.31–0.80, $P_{trend}=0.005$) in particular carrots, cruciferous and leafy vegetables and fruits (OR, 0.54, 95%CI=0.33–0.86, $P_{trend}=0.013$), in particular citrus fruits. No association was found for alcohol consumption and any other food items.

Conclusion Overall, our findings suggest that some dietary factors present in the Mediterranean diet might protect from cutaneous melanoma.

Keywords Epidemiology, cutaneous melanoma, Mediterranean diet



Mediterranean Diet

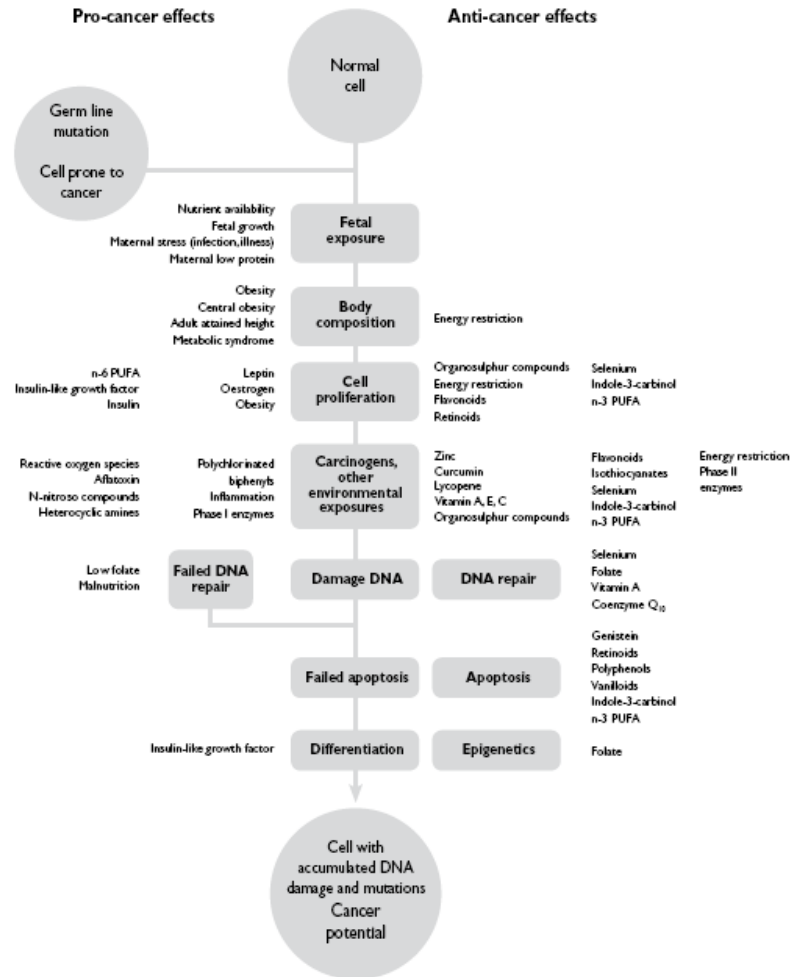


MEDITERRANEAN DIET FOOD PYRAMID

<http://www.ourfitnesshouse.com/mediterranean-diet-meal-plan.html>



Role of Diet in Cancer Etiology



Organic Foods-

The "Dirty" Dozen & "Clean" 15

12 Most Contaminated

- Celery
- Peaches
- Strawberries
- Apples
- Blueberries
- Nectarines
- Bell Peppers
- Spinach
- Cherries
- Kale/Collard
- Greens
- Potatoes
- Grapes (Imported)

15 Least Contaminated

- Onions
- Avocado
- Sweet Corn
- Pineapple
- Mangos
- Sweet Peas
- Asparagus
- Kiwi
- Cabbage
- Eggplant
- Cantaloupe
- Watermelon
- Grapefruit
- Sweet Potato
- Honeydew melon

**The research shows that the benefits of eating plant foods – organic or conventional – outweigh the risk of pesticide exposure*



Environmental Working Group

<http://www.ewg.org/foodnews/>

Cancer Protective Diet Guidelines

- Aim for 7 to 9 servings of fruits and vegetables per day
 - 3-4 servings of fruits
 - 4-5 servings of vegetables
- 2 servings of fruits/vegetable per meal
- Variety is important - include fruits and vegetables of all different colors daily ("rainbow")
- Include whole grains daily e.g. whole wheat bread, oatmeal, brown rice, bran cereal
- Increase fiber to 25-30 grams/day - choose bread and grain products with >2 gm fiber/serving

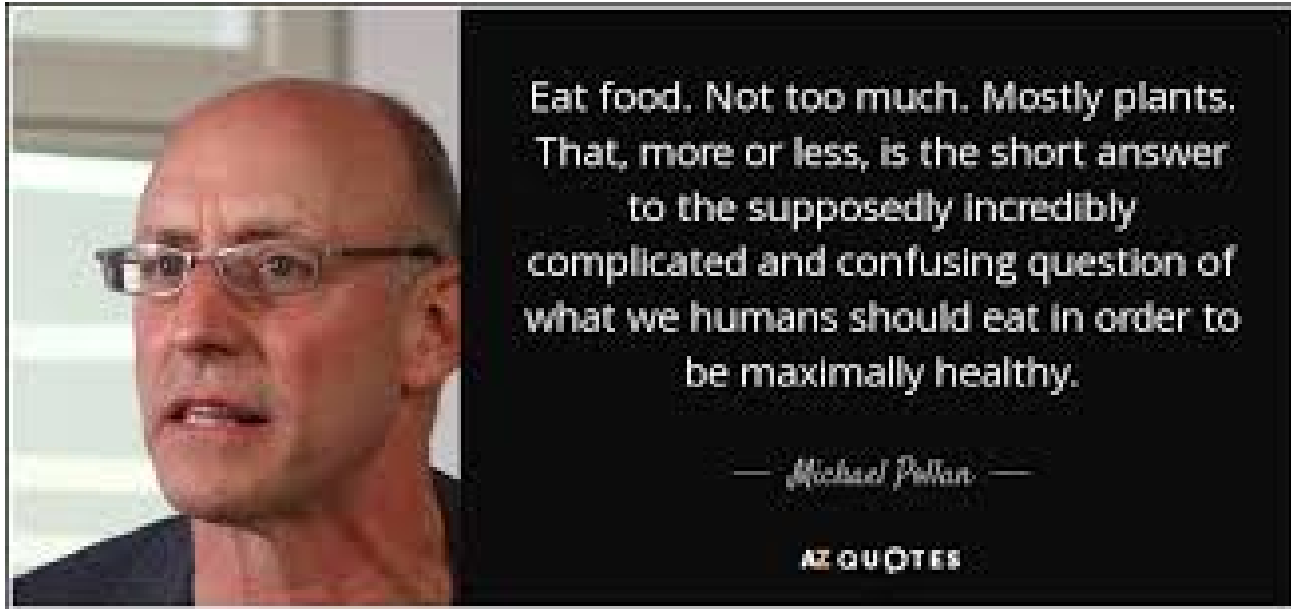


Cancer Protective Diet Guideline

- Use low fat sources of protein: beans, nuts, soy, chicken, fish, and low fat dairy products
- Limit consumption of saturated fats - use canola, olive and nut oils
- Include fish regularly in your diet – at least twice a week
- Limit alcohol



Eat Plant Foods





Diet Analysis

- Free diet analysis sites on the Internet:

- USDA's My Plate

- <http://www.choosemyplate.gov/supertracker-tools.html>

- My Fitness Plate

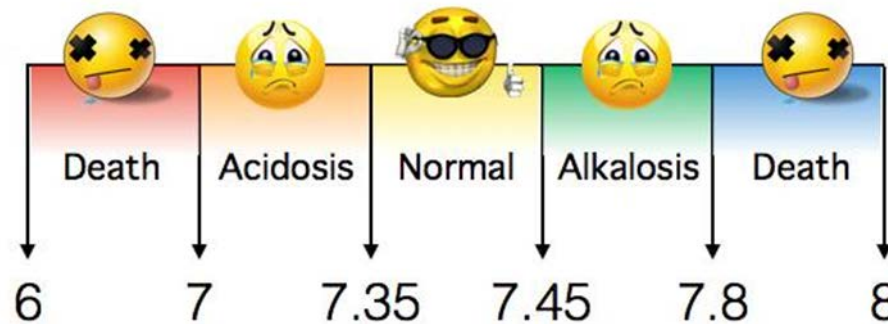
- http://www.myfitnesspal.com/welcome/learn_more



Acid/Alkaline Diet

- The body maintains a tight pH range 7.35 and 7.45

Actual results of pH changes in blood



- The tumor and area around it is more acidic
- Plant foods promote an alkaline environment



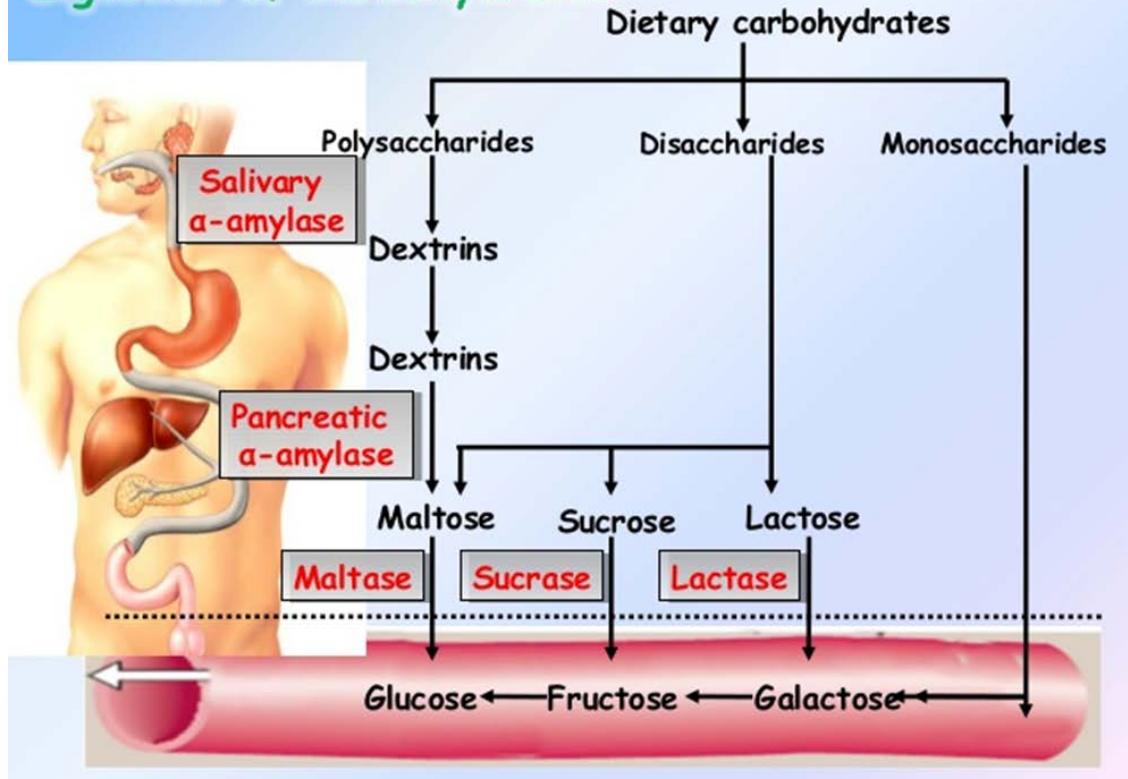
Sugar

- Does sugar “feed” cancer cells?
- Glucose (sugar) is our body’s fuel—feeds every cell in body
- Simple sugar from foods produces large insulin response
- Insulin is a hormone that promotes cell growth
- Higher hormone levels are the problem—not the sugar



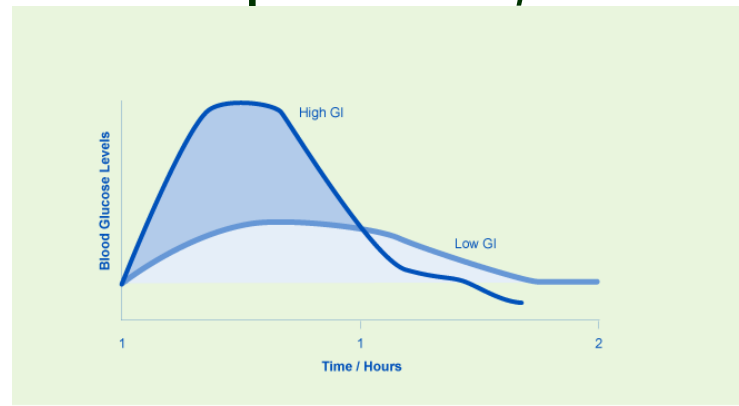
Sugar

Digestion of Carbohydrates



Sugar

- Goal is to maintain your blood sugar and lower production of insulin
- Eat complex carbohydrates: vegetables, whole grains, legumes, fruit
- Limit intake of simple carbohydrates – table sugar, soda, candy, highly refined snacks, and sweet baked items
- Eat sugar containing foods with protein, fat and fiber
- Eat small frequent meals



Anti-Inflammatory Food Pyramid



Sleep, exercise, avoiding stress are also important for a healthy immune system

What are my calorie needs?

- To calculate calories:
 - Weight in kilograms x 25-35
e.g. $150 \text{ lbs} \div 2.2 = 68 \text{ kgs}$
 $68 \text{ kg} \times 30 = 2040 \text{ calories}$
- Or use an online calorie calculator
e.g. American Cancer Society Website
 - <http://www.cancer.org/healthy/toolsandcalculators/calculators/app/calorie-counter-calculator>



Eat Plant Foods!



- Plant foods: fruits, vegetables, grains, beans, nuts, spices, herbs, teas
- Reason:
 - Low in saturated fat
 - High in fiber
 - Provide vitamins, minerals, and bioactive compounds



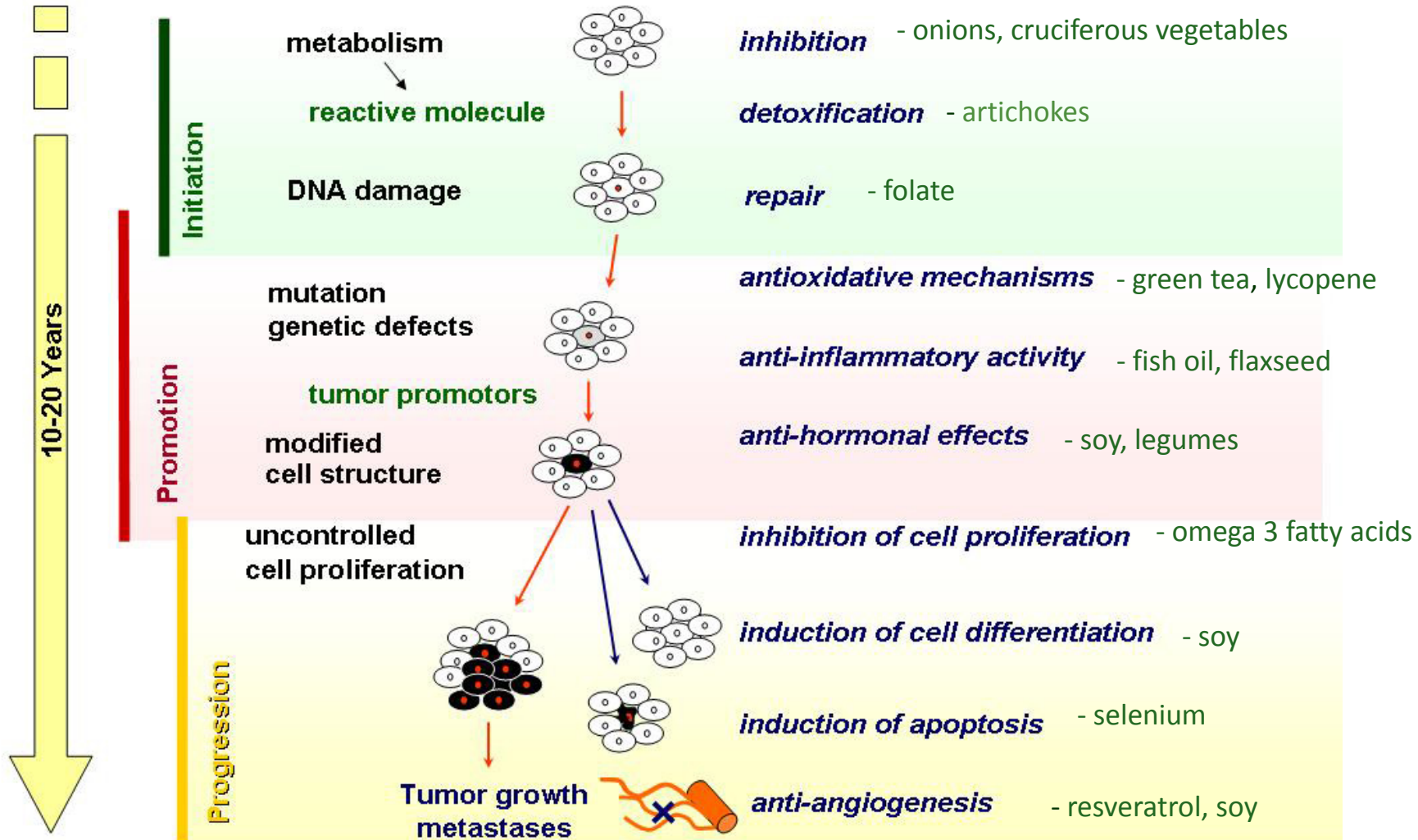
Cancer Protective Diet Guidelines

- Half your plate should be vegetables;
3/4 of your plate should be plant foods



Impact of Nutrients on Cancer Progression

Carcinogenesis and Mechanisms of Chemoprevention



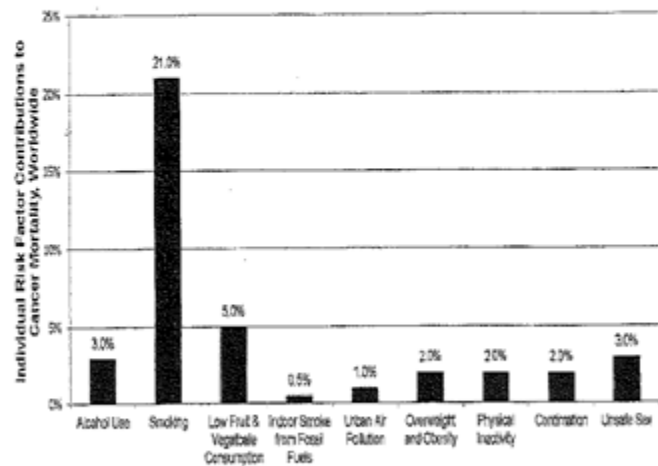
Melanoma Protective Diet Guideline

- A diet high in fruits, vegetables, grain products and flavonols
- Micronutrients/phytochemicals can act as:
 - - Ultraviolet absorbers or as antioxidants
 - - Modulate signaling pathways elicited on ultraviolet exposure



Sies and Stahl, 2004

Risk Factors Contributing to Cancer Mortality



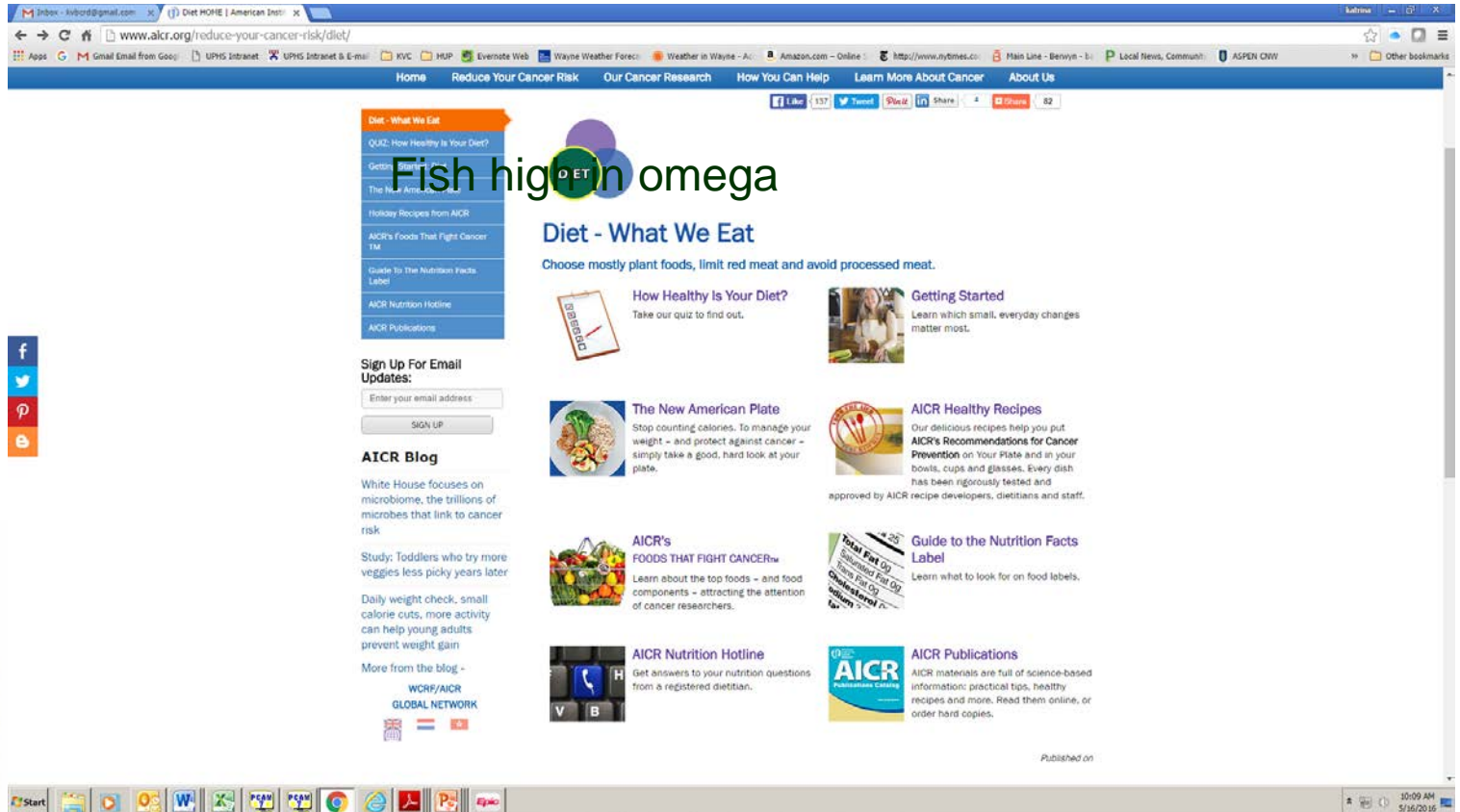
Brown, J.C. *Compr Physiol*. 2012 Oct;2(4): 2775-2809.



Developing a cancer protective diet

American Institute of Cancer Research

- <http://www.aicr.org/>



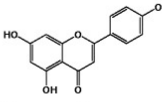



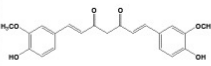

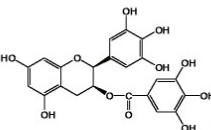

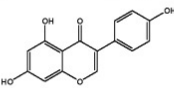

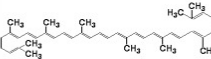

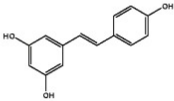

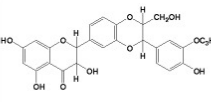

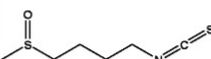

The screenshot shows the website www.aicr.org/reduce-your-cancer-risk/diet/. The main heading is "Diet - What We Eat" with a sub-heading "Choose mostly plant foods, limit red meat and avoid processed meat." The page features several articles and resources:

- How Healthy Is Your Diet?**: Take our quiz to find out.
- Getting Started**: Learn which small, everyday changes matter most.
- The New American Plate**: Stop counting calories. To manage your weight - and protect against cancer - simply take a good, hard look at your plate.
- AICR's FOODS THAT FIGHT CANCER™**: Learn about the top foods - and food components - attracting the attention of cancer researchers.
- AICR Nutrition Hotline**: Get answers to your nutrition questions from a registered dietitian.
- AICR Healthy Recipes**: Our delicious recipes help you put AICR's Recommendations for Cancer Prevention on Your Plate and in your bowls, cups and glasses. Every dish has been rigorously tested and approved by AICR recipe developers, dietitians and staff.
- Guide to the Nutrition Facts Label**: Learn what to look for on food labels.
- AICR Publications**: AICR materials are full of science-based information: practical tips, healthy recipes and more. Read them online, or order hard copies.

On the left side, there is a "Sign Up For Email Updates" form and a "Sign Up" button. Below that is the "AICR Blog" section with a post titled "White House focuses on microbiome, the trillions of microbes that link to cancer risk." and another post titled "Study: Toddlers who try more veggies less picky years later." There is also a "More from the blog -" section with a link to "WCRF/AICR GLOBAL NETWORK".

At the bottom left, there is a social media sidebar with icons for Facebook, Twitter, and Pinterest. At the bottom right, it says "Published on 10:09 AM 5/16/2016".



Dietary agents	Structure	Epigenetic effect on Cancer*	Picture of the sources
Apigenin (Parsley) ¹ (<i>Petroselinu m</i>) ²		DNMT inhibitor (Fang M et al 2007)	
Allyl Mercaptan (Garlic) ¹ (<i>Allium sativum</i>) ²		HDAC inhibitor (Lee et al 2001; Druesne et al 2004)	
Curcumin (Turmeric) ¹ (<i>Curcuma longa</i>) ²		DNMT inhibitor (Liu et al 2009; Fang et al 2007; Fu and Kurzrock 2010) HDAC and HAT inhibitor (Chen et al 2007; Liu et al 2005; Kang et al 2006; Cui et al 2007; Batasubramanyam et al 2004)	
Epigallocatechin-3-gallate (EGCG) (Green tea) ¹ (<i>Camellia sinensis</i>) ²		DNMT inhibitor (Fang et al 2003; Kato et al 2008; Pandey et al 2010; Lee et al 2005) HAT inhibitor (Choi et al 2009)	
Genistein (Soybean) ¹ (Glycine max) ²		DNMT inhibitor (Majid et al 2008; Kikuno et al 2008; Fang et al 2005; Li et al 2009) HDAC inhibitor and HAT activator (Fang et al 2005; Li et al 2009; King-Baloon et al 2008; Majid et al 2008)	
Lycopene (Tomatoes) ¹ (<i>Solanum lycopersicu m</i>) ²		Demethylates the GSTP1, RARβ2 and hIN-1 genes in breast cancer cells (MDA-MB-231 and MCF10A) (King-Baloon et al 2008)	
Resveratrol (Red grapes) ¹ (<i>Vitis vinifera</i>) ²		DNMT inhibitor (Papoutsis et al 2010; Stefanska et al 2010) SIRT1 activator (Kaeberlein et al 2008; Wang et al 2008; Bally et al 2009)	
Silymarin (Milk thistle) ¹ (<i>Silybum marianum L.</i>) ²		SIRT1 activator (Li et al 2007)	
Sulforaphane (Cruciferous vegetables) ¹ (<i>Brassicaceae</i>) ²		DNMT inhibitor (Meehan et al 2010; Traka et al 2005) HDAC inhibitor (Myzak et al 2007; Dashwood and Ho 2007; Ho et al 2009; Myzak et al 2004)	

*limited references given, full list available in text

¹ Source
² Botanical name

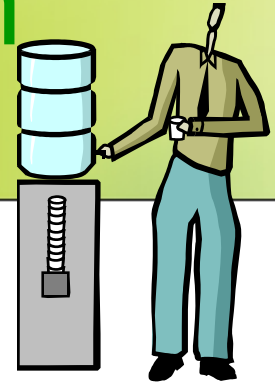


Nutrition for Melanoma

- Low fat diet: avoid saturated fats and linoleic acid
- Soy foods/soy protein
- Flaxseed: lignans
- Green, white and black tea
- Vitamin D
- Carotenoids: alpha-carotene, beta-carotene, beta-cryptoxanthin, lutein, lycopene
- Lupeol – triterpene
- Omega 3 fatty acids
- Resveratrol
- Avoiding alcohol



What are your nutrition needs: Fluids



- 2/3 of the body is water
- Symptoms of dehydration: fatigue, dry mouth, light headed, headaches, irritability, constipation, nausea
- Need about 64 oz a day
- To calculate cups required a day:
estimated calorie needs \div 240 =
cups/day fluid
- e.g. 2040 calories \div 240 = 8.5 cups



Protein Needs

- Requirements:
 - 0.8-1.2 grams protein/kilogram body weight
- To calculate protein needs:
 - Weight in kilograms x 0.8–1.2
e.g. 150 lbs ÷ 2.2 = 68 kgs
68 kgs x 0.8-1.2 = 54-82 grams protein
- Quick method:
 - Divide weight in lbs in half to get approximate grams protein required/day



What are your nutrition needs: Protein

- The “building block” of the body
- Required for repair and maintenance of muscles, blood cells, as well as for transporting nutrients, maintaining a healthy immune system
- Try to include in all meals/snacks
- Sources: meat, fish, poultry, eggs, dairy products, nuts, seeds and dried beans (legumes)
- If you don't get enough calories, protein will be used for energy!



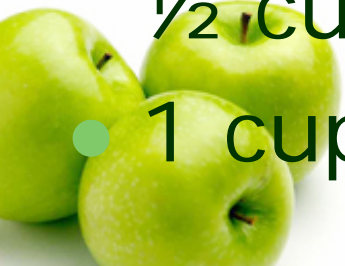
Limit Alcohol

- Limit alcohol to 1 drink a day for women and 2 drinks a day for men
- One serving size=
 - 12 oz. beer
 - 5 oz. wine
 - 1 ½ oz. 80-proof distilled spirits
- Discuss with your doctor



How Many Servings of Fruits & Vegetables?

- At least 5 but ideally 7+ servings per day
- Think **COLOR** – lots of it!
 - Greens, berries, citrus, and cruciferous veggies
- Serving size: 1 piece fruit, ¼ cup dried fruit, 4 oz fruit or 6 oz vegetable juice, ½ cup canned or cooked vegetable,
- 1 cup raw vegetable



Fruits and Vegetables

Three C's: **COLOR**, **Cruciferous**, **Citrus**

COLOR : Deep yellow-orange-red colors

Cruciferous: Arugula, broccoli, cauliflower, Brussels sprouts, cabbage, watercress, bok choy, turnip greens, mustard greens, collage greens, rutabagas, Chinese cabbage, radishes, turnips, kohlrabi and kale

Citrus: Oranges, limes, lemons, tangerines and grapefruit



Juicing

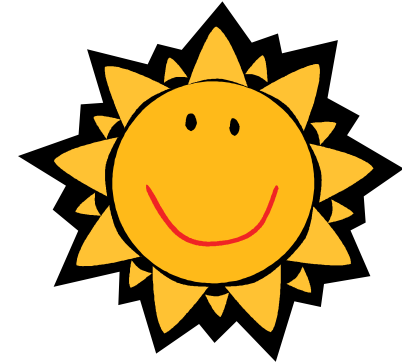
- Recipe

- ½ cup beets - red
- 1 cup kale – dark green
- 2 ribs celery
- 3 carrots - orange
- 1 cup cabbage - cruciferous
- 1 apple – for taste and quercetin



Doses of Vitamin D

- RDA is currently
 - 600 IU/day for <50 years old
 - 600 IU/day 51-70
 - 800 IU/day >70 years old
- Safe Upper Limit
 - 4000 IU/day
- Check vitamin D levels – test is 25 OH-D
- Vitamin D3 form (calciferol) is the best absorbed and has the best shelf life
- NIH Office of Dietary Supplements fact sheet on vitamin D <http://ods.od.nih.gov/factsheets/vitamind.asp>



Food Sources of Vitamin D

- Fatty fish (salmon, tuna, mackerel), liver and egg yolk are the only foods that naturally contain vitamin D
- Look for fortified foods and beverages (milk, soy milk). Unless stated on the label, dairy foods may not contain vitamin D
- Made in the body – “sunshine vitamin”
 - 5 to 30 minutes of exposure to the skin (without sunscreen) two times every week provides about 3000 – 20,000 IU





Food Sources of Vitamin D

Food	Serving Size	Amount of Vitamin D Per Serving In International Units (IU)
Salmon	3.5 ounces, cooked	360 IU
Mackerel	3.5 ounces, cooked	345 IU
Sardines, canned in oil, drained	3.5 ounces	270 IU
Shrimp, Mixed Types	4 ounces, cooked	162 IU
Milk, nonfat, lowfat and whole	8 oz (1 cup)	98 IU
Fortified Whole Grain Cereal Bars	1 bar	50 IU
Fortified Cereal	3/4 cup	40-50 IU
Egg (Vit D is in the yolk)	1 whole	25 IU



Supplements



- Problems seen with large amounts of vitamins and mineral: beta carotene, vitamin D, folic acid, (vitamin E?)
- Points to consider:
 - Any known interactions?
 - Reputation of the manufacturer?
 - Is the product standardized? USP label guarantees purity and accuracy of dosing. Check Consumer Labs.
 - Does it sound too good to be true?
 - Discuss with your medical team
- **Can you get the nutrient from food source?**



Food Sources of Supplements

- Silymarin in milkthistle - artichokes
- Selenium – Brazil nuts
 - Brazil nuts 1 oz (6-8 nuts) = 840 mcg
- Mushroom tonics - Maitake, shiitake, and reishi mushrooms
- IP6 (phytic acid) - in fibrous foods e.g. whole grains, nuts, seeds, vegetables



Curcumin



- Curcumin, which has powerful antioxidant and anti-inflammatory properties, is the most active compound in turmeric
- Sources: turmeric and curry powder
- Medicinal actions: anti-inflammatory, antioxidant, antineoplastic, antihepatotoxic, anticholesterolemic, antiplatelet aggregation, choleric
- Dose used in studies 400 to 2000 mg turmeric extract
- Turmeric may slow blood clotting and increase bruising and bleeding. Do not use if you have gallbladder problems.



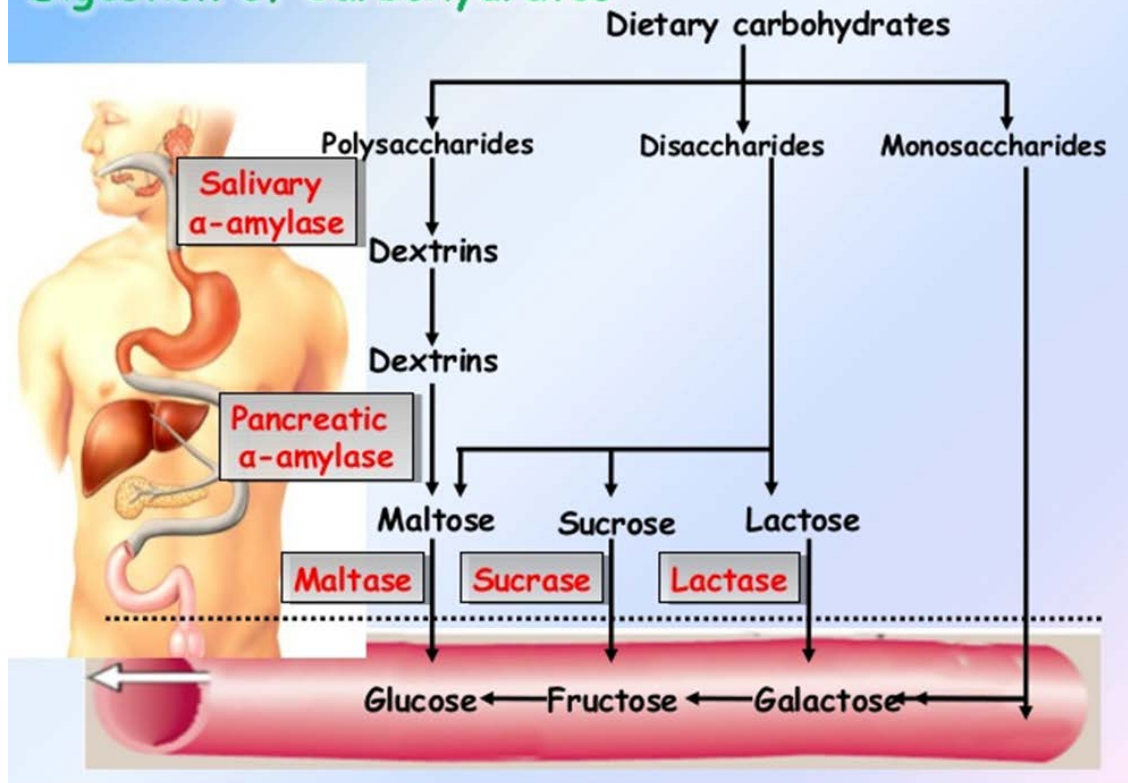
Sugar



- Does sugar “feed” cancer cells?
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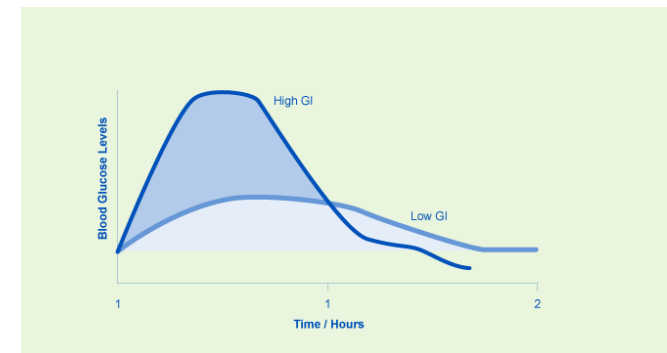
Digestion of Carbohydrates



Sugar



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- Eat complex carbohydrates: vegetables, whole grains, legumes, fruit
- Limit intake of simple carbohydrates – table sugar, soda, candy, highly refined snacks, and sweet baked items
- Eat sugar containing foods with protein, fat and fiber
- Eat small frequent meals



Artificial Sweeteners

Benefits: weight loss, diabetes, dental

Many different types:

- Natural – Stevia (herbal supplement)
- Derived from sugar – Splenda
- Safety – GRAS approved
- Issues: quantity? increase insulin? used in empty calorie foods?
- Bottom-line: safe in moderate amounts



Detoxification

- Benefits: regulate digestion, remove toxins, improve mental clarity, etc.
- Claim that our bodies are assaulted by chemicals from environment, food, water which stresses our bodies
- Theory that fasting or juicing – gives filtering organs a break from processing nutrition and they can release stored toxins



Detoxification

- Body is a detox powerhouse: liver, kidneys, lung, colon. We are cleansing all the time
- Many plant foods have detox properties
- Problems: electrolyte losses, stress of fasting, bowel perforations w/colonics/enemas
- Claims of benefits unsubstantiated and undefined

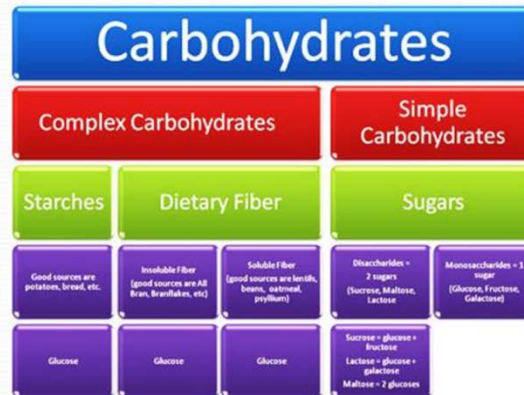


Super Greens Drinks

- Source: green algae, supper greens drinks
- Ingredients: blend of “super foods”, sea vegetables and herbal extracts, enzymes, fruits and vegetables
- Used to: improve immunity, increase energy
- Benefit: may stimulate immune functions
- Concerns with chlorella:
 - may interfere with immunosuppressant therapy by stimulating immune function
 - may cause pathogenic colonization in some immunosuppressed patients
 - may exacerbate autoimmune diseases by stimulating disease activity
 - may contain iodine



Complex vs. Simple Carbs.



Evidence of Lifestyle Link

For the cancers listed below, evidence emerged that diet, weight and physical activity can raise or lower risk:

[Colorectal Cancer](#)

[Breast Cancer](#) [Breast Cancer Survivors](#)

[Endometrial \(Lining of the Uterus\) Cancer](#)

[Esophageal Cancer](#)

[Gallbladder Cancer](#)

[Kidney Cancer](#)

[Liver Cancer](#)

[Cancers of the Mouth, Pharynx and Larynx](#)

[Pancreatic Cancer](#)

[Prostate Cancer](#)

[Stomach Cancer](#)

[Ovarian Cancer](#)

<http://www.aicr.org/reduce-your-cancer-risk/cancer-site/>

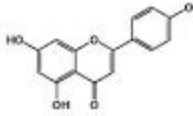



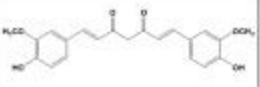

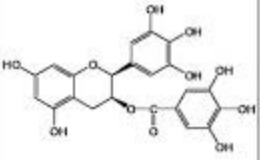

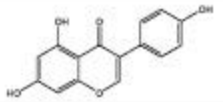

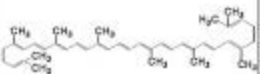

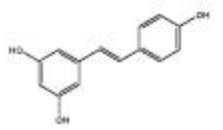

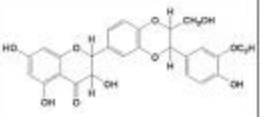

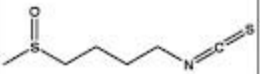

Accessed 4/10/16



- **Skin Cancer**

That skin cancer is directly caused by excessive sun exposure is well-established. The expert panel specifically examined the evidence linking skin cancer to aspects of diet, weight and physical activity. No strong evidence emerged, with the exception of arsenic in drinking water, for which a probable link to skin cancer was found.



Dietary agents	Structure	Epigenetic effect on Cancer*	Picture of the sources
Apigenin (Fenugreek) (Festuca ovina) ¹		DNMT inhibitor (Fang M et al 2007)	
Alyl Mercaptan (Garlic) ¹ (Allium sativum) ²		HDAC inhibitor (Lea et al 2001; Druvsho et al 2004)	
Curcumin (Turmeric) ¹ (Curcuma longa) ²		DNMT inhibitor (Liu et al 2009; Fang et al 2007; Fu and Kurecak 2010) HDAC and HAI inhibitor (Chen et al 2007; Liu et al 2005; Kong et al 2006; Cui et al 2007; Balasubramanyam et al 2004)	
Epigallocatechin-3-gallate (EGCG) (Green tea) ¹ (Camellia sinensis) ²		DNMT inhibitor (Fang et al 2008; Kato et al 2008; Pandey et al 2010; Lee et al 2005) HAI inhibitor (Choi et al 2009)	
Genistein (Soybean) ¹ (Glycine max) ²		DNMT inhibitor (Majid et al 2008; Kitano et al 2008; Fang et al 2005; Li et al 2009) HDAC inhibitor and HAI activator (Fang et al 2005; Li et al 2009; King-Baloon et al 2008; Majid et al 2008)	
Lycopene (Tomatoes) ¹ (Solanum lycopersicum) ²		Demethylates the GSTP1, KAM2 and HM-1 genes in breast cancer cells (MDA-MB-231 and MCF10A) (King-Baloon et al 2008)	
Resveratrol (Red grapes) ¹ (Vitis vinifera) ²		DNMT inhibitor (Papoutsis et al 2010; Stefansko et al 2010) SIRT1 activator (Kaeberlein et al 2008; Wang et al 2008; Boly et al 2009)	
Silymarin (Milk thistle) ¹ (Silybum marianum L.) ²		SIRT1 activator (Li et al 2007)	
Sulfonaphthale (Cruciferous vegetables) ¹ (Brassicaceae) ²		DNMT inhibitor (Mewar et al 2010; Itoke et al 2005) HDAC inhibitor (Myzak et al 2007; Dashwood and Ho 2007; Ho et al 2009; Myzak et al 2004)	

* Limited references given, full list available in text

¹ Source

² Botanical name



CARBOHYDRATE BREAKDOWN

Carbohydrates

A large group of compounds occurring in foods that include sugar, starch, and cellulose, and can be broken down to create energy in the body.

Simple Carbohydrates

Such as glucose, that consists of one or two sugar molecules. They are absorbed in the blood in the form of glucose and provide quick burning energy that tends to elevate blood sugar quickly.

Complex Carbohydrates

Carbohydrates that are made up of longer chains of sugar molecules. They take longer to break down and therefore require longer to digest and provide a more constant and sustaining source of energy.

Monosaccharides

Are basic compounds that cannot be reduced into another simple sugar. e.g. glucose, fructose, galactose.

Disaccharides

Contain two sugar molecules bonded together. e.g. maltose, sucrose, lactose.

Polysaccharides

Are non-water soluble and consist of 10+ sugar molecules bonded together, including starches and non-starches. e.g. starch, glycogen, cellulose.

Fructose

A very sweet sugar occurring in many fruits and in honey; often bonded to glucose to form sucrose.



Galactose

Commonly derived by milk sugar by hydrolysis; less sweet than glucose and usually found combined with lactose.



Glucose

The principal circulating sugar in the blood and major source of energy for cells.



Lactose

Found in milk and formed from the combination of galactose and glucose.



Maltose

A sugar consisting of two linked glucose units, produced by the breakdown of starch.



Sucrose

Often referred to as common white table sugar or beet sugar, formed from the combination of glucose and fructose.



Starch

Found commonly in and produced by plant material, consisting of a large number of glucose units formed by glycosidic bonds.



Glycogen

A multi-branched form of glucose made primarily in the liver and muscles; that serves as the main storage form of this sugar in the body.



Cellulose

Often referred to as dietary fiber, cellulose is made from hundreds to thousands of D-Glucose. It comprises the structural component of many plants and algae.



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