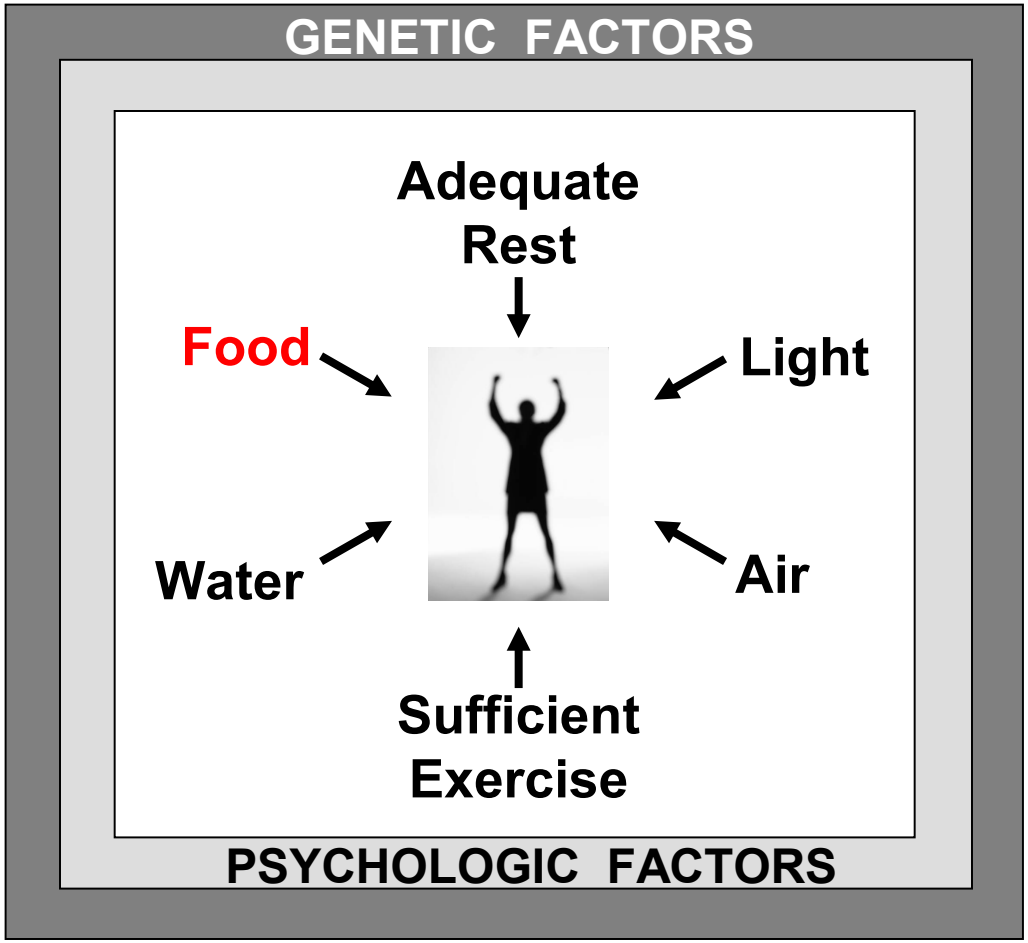
To Your Health

Today's Topic: FATS / OILS

- **Health disorders that justify learning about fats**
- **Oils that look the same behave very differently**
- **There are different kinds of saturated fat**
- **The essential fats**
- **Unnatural / altered fats**
- **More about Cholesterol**
- **The sugar-fat connection**

Foods are only one aspect of what contributes to our sense of well being:



Degeneration is caused by:

- Malnutrition (deficiencies)
- Excesses
- Internal Pollution

(more controllable)

- Genetic Disorders
- Aging

(less controllable)

Understanding nutrition provides power to make informed decisions that can improve health and well being.

Fats and Degeneration Factors

Most common **deficiency** in our diets relative to fats is the inadequate consumption of an essential fatty acid (one that our body cannot make) called linolenic acid (also known as omega 3 oil).

The most common **excess** is a high consumption of saturated fat, or refined carbohydrates that create high triglyceride levels in our body.

The most common **altered substances** associated with fats are the refined, hydrogenated, partially hydrogenated and non-nutritive fats that have been introduced since the 20th century.

Some Disorders / Health Conditions and Fats

Hypercholesterolemia (high cholesterol)

- reducing intake of saturated fats, increasing essential fats, and adding adequate fiber can reduce cholesterol and increase HDL

Arterosclerosis (thickening, hardening, and loss of elasticity of the walls of the blood vessels)

- omega 3 oils reduce blood stickiness and increase HDL which mops up cholesterol buildup on blood vessels

High blood pressure

- essential oils remove sodium and excess water and relax blood vessels.

Obesity – 2013 the rate is 27% of all Americans are obese

Muscle fatigue & cramping

- omega 3 oils facilitate the conversion of lactic acid to H_20 and CO_2 thus reducing muscle fatigue and pain

Arthritis

- essential oils (omega 6 and 3) have anti-inflammatory effects on the overall body

Yeast and fungus infections

Common Terminology for Natural Fats

There are basically four main categories of Fats
(scientifically called Fatty Acids):

SATURATED – called saturated because all the carbon atoms are saturated with hydrogen atoms which gives this fat unique characteristics such as being solid a room temperature.

MONO-UNSATURATED – also known as **Oleic Acid** and also known as **Omega 9** oil. The molecule has one double bond and therefore is not saturated with hydrogen, hence the term mono-unsaturated.

POLY-UNSATURATED – also known as **Linoleic Acid** and also known as **Omega 6** oil. The molecule has two or more double bonds, hence the term poly-unsaturated.

SUPER-UNSATURATED – also known as **Alpha Linolenic Acid** and also known as **Omega 3** oil. The molecule has three or more double bonds and at a closer location than poly-unsaturates making it more reactive, hence the term super-unsaturated.

Description of the Basic 4 Types of Natural Fat

SATURATED FAT

Butyric Acid

Stearic Acid
(beef fat)

Primary Sources:

- Meat and dairy products
- Tropical fats (coconut and palm kernel)

Properties:

- Different types of saturated fat are different lengths. The longer the chain, the more stable the fat and also the longer it takes to break down in the body.
- Melting temperature for most saturated fats is over 100 ^{o}F and they can be heated to high temperatures because of their stability.

Use in the body:

- Primarily it is used for energy, but in the presence of high blood sugar, it is stored in fat cells. However, short to medium chain saturated fats are rarely stored in the body and are burned up quickly for energy (e.g. goat cheese (6-10 carbons, vs. cow cheese 18-20 carbons).
- The longest chains – found in beef, pork and fried foods create a load on the liver and can produce a heavy, tired feeling.
- 50% of the fatty-acids in coconut oil are lauric acids. In human body, lauric acids are processed to be monolaurin, which functions as an anti-virus and anti-bacteria.
- Caprylic acid (goat's milk products) is a medium chain saturated fat and reduces the growth of yeast and fungus.

Description of the Basic 4 Types of Natural Fat

SATURATED FAT **Comparing Goat Cheese and Cow Cheese:**

Similarities;

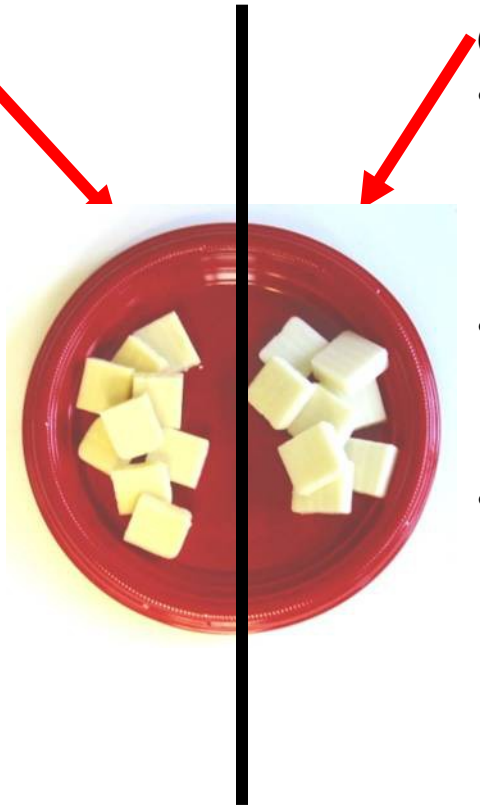
Taste & texture: Very similar

Calories: The same per ounce

Differences:

Cow Cheddar Cheese:

- Made up primarily of stearic acid saturated fat with 18-20 carbons in the chain.
- Used primarily for energy or storing in the body when there is glucose in the blood.
- Associated with higher levels of triglycerides.



Goat Cheddar Cheese:

- Made up primarily of caproic, caprylic and capri acids – saturated fat with 6-10 carbons in the chain.
- Converts easily and quickly for energy – body does not typically store this fat.
- These short chain fats are unique in supporting the immune system. Caprylic acid specifically slows the growth of yeast and fungus.

Description of the Basic 4 Types of Natural Fat

MONO-UNSATURATED FAT – Oleic Acid, Omega 9

Primary Sources:

- Olive, Peanut and Canola oils.
- Many nuts are high in Oleic Acid (pecans, almonds)
- Avocados are also high in this type of fat.

Properties:

- Liquid at room temperature. Melting points typically about 40 ^{o} F
- Readily available in *unrefined* form in virgin olive oil.
- Fairly stable - can be stored at room temperature. Heat on low-med.

Use in the body:

- Primarily it is used in cell functions (cell membrane, etc).
- Other substances in olive oil also contribute to health benefits (e.g. a vitamin-like chemical called squalene which is is also present in shark liver oil – Mediterraneans get about 10-15 times the amount of American intake and it is associated with lower incidence of cancer.
- Lowers cholesterol, increases HDL, lowers triglycerides
- Stimulates bile activity and pancreatic enzymes.
- Decreases the absorption of cholesterol from foods.
- Has some anti-inflammatory effects.

Description of the Basic 4 Types of Natural Fat

MONO-UNSATURATED FAT – Oleic Acid, Omega 9

Note: There are many varieties of olive oil, but **only the Extra Virgin Cold Pressed Olive Oil is truly an *unrefined oil*** with all the vitamins, co-factors and other substances that contribute to cardiac health. They are green in color.

The lighter olive oils have been refined to reduce the bouquet flavor that is stronger in the extra virgin oil. The lighter the color, the more refining has been done.

Description of the Basic 4 Types of Natural Fat

POLY-UNSATURATED FAT – Linoleic Acid, Omega 6

Primary Sources:

- Safflower, sunflower, corn, sesame and soybean oils
- A unique form is found in black currant seed and evening primrose oils.
- Also found in high quantities in poultry.

Properties:

- Liquid at room temperature. Melting points typically about 23 ^{o} F
- Fairly stable – store at room temp or fridge. Heat on low-med.
- It is an "essential fat' which the body cannot make and must have in the diet.

3 tsp /day per 100 lbs.

Use in the body:

- Primarily it is used in producing potent chemical messengers (prostaglandins series 1 and 2 – Pg_1 and Pg_2) that regulate everything from blood pressure to the firing of nerves. Secondarily it is used for cell functions, chromosome stability and to remove fat soluble toxins. Lastly, in excess, it can be stored as fat.
- PG_1 reduces blood platelets stickiness, removes sodium and excess water, relaxes blood vessels, slows cholesterol production, decreases inflammation, aids the effectiveness of insulin, and improves nerve function.
- PG_2 has all the opposite effects of PG_1. Note that PG_2 is created when there is excess saturated fat in the diet, or extended stress on the body.

Description of the Basic 4 Types of Natural Fat

SUPER-UNSATURATED FAT – Alpha-Linolenic Acid, Omega 3

Primary Sources:

- Flax seed oil, hemp seed oil, small amounts in walnuts, pumpkin seeds and in canola oil.
- Fish, snake

Properties:

- Liquid at freezing temperature. Melting points typically about 12° F
- Unstable at room temp, store in or fridge or freezer. **Do not heat for cooking.**
- It is an "essential fat' which the body cannot make and must have in the diet.

1 tsp /day per 100 lbs.

Use in the body:

- Primarily it is used in producing the potent chemical messengers prostaglandins series 3. Secondarily it is used for cell functions. Lastly, in excess, it can be stored as fat. Enzymes convert this fat four times faster than poly unsaturates resulting in increased stamina and energy levels. It is also one of the few food items than can increase the metabolic rate.
- PG_3 reduces water retention, reduces inflammation, and softens the skin.
- PG_3 facilitates the conversion of lactic acid to water and CO2 so muscle fatigue recovery is faster and there is less muscle pain.
- PG_3 suppresses the production of PG_2 resulting in beneficial PG_1 production.

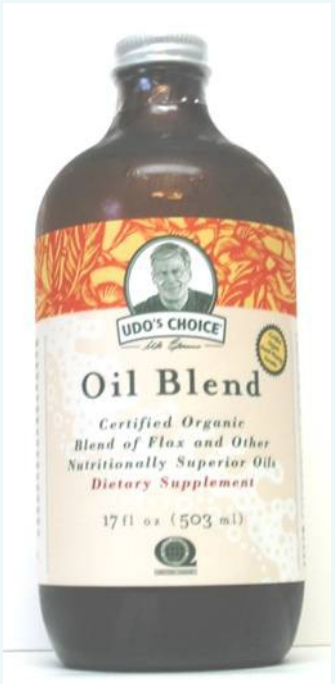
Description of the Basic 4 Types of Natural Fat

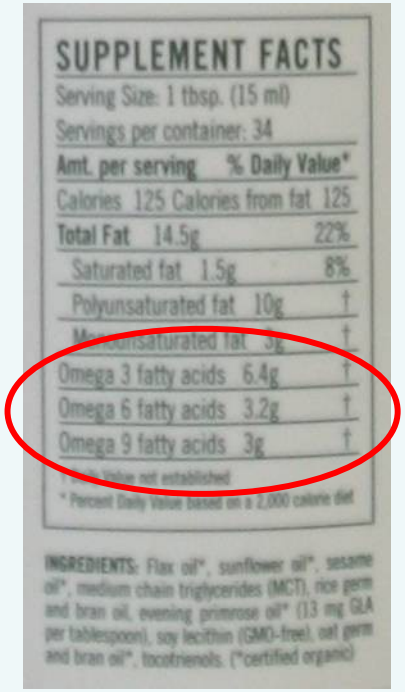
SUPER-UNSATURATED FAT – Alpha-Linolenic Acid, Omega 3

Flax seeds

One tablespoon of flax seed will provide ½ tsp of omega 3 and about ¼ tsp of omega 6 and ¼ tsp of omega 9 and lots of fiber. (2 tbsp ground per 100 lb person per day)

It is important to grind the DRY seeds (15 seconds in a blender – they are slippery and grind easily)
OR
Use Flax Seed Oil from the health food store – check expiration date!
(Keep in fridge! Do not cook with it – pour over pasta, veggies, baked potatoes, salads, - add fresh onion/garlic, etc)

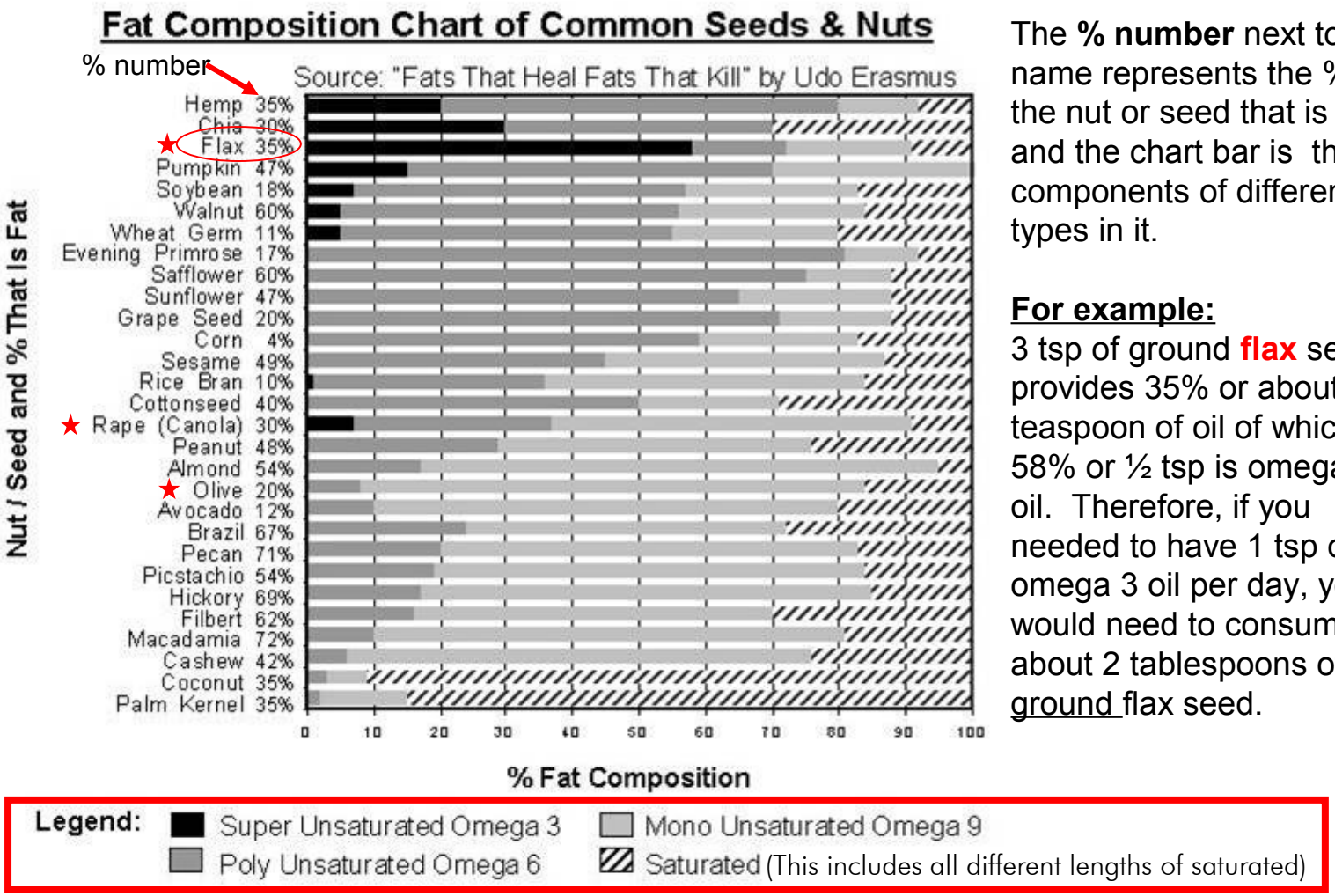




This bottle of freshly processed unrefined oils contains all types of healthy fats combined in one mixture. Oils like this are available at health food stores, but must be kept in the fridge and not used for heating, but poured over foods or dipping. It is a convenient way to get your minimum daily requirements. It will **satiate your appetite** and reduce cravings.

Types of Natural Fats In Seeds and Nuts

Note: **There are no natural occurring natural fat sources that have only one type of fat.**
Olive oil is called mono-unsaturated only because the *majority* of the oil is mono-unsaturated.



The **% number** next to the name represents the % of the nut or seed that is fat, and the chart bar is the % components of different fat types in it.

For example:
3 tsp of ground **flax** seed provides 35% or about 1 teaspoon of oil of which 58% or ½ tsp is omega 3 oil. Therefore, if you needed to have 1 tsp of omega 3 oil per day, you would need to consume about 2 tablespoons of ground flax seed.

Stability of Natural Fats For Storage and Cooking

Common Name	Carbon Atoms	Double Bonds	Sources	Melting Point
Butyric acid	4	0	butterfat	18 degrees F
Caproic Acid	6	0	Butterfat, goat milk	27 degrees F
Caprylic Acid	8	0	coconut oil, goat milk	63 degrees F
Capric Acid	10	0	coconut oil, goat milk	90 degrees F
Lauric Acid	12	0	coconut oil	111 degrees F
Myristic Acid	14	0	palm kernel oil	129 degrees F
Palmitic Acid	16	0	palm oil	145 degrees F
Palmitoleic Acid	16	1	animal fats	32 degrees F
Stearic Acid	18	0	animal fats	158 degrees F
Oleic Acid	18	1	olive oil	41 degrees F
Linoleic Acid	18	2	corn oil	23 degrees F
Alpha-Linolenic Acid (ALA)	18	3	flaxseed (linseed) oil	12 degrees F
Gamma-Linolenic Acid (GLA)	18	3	borage oil	18 degrees F
Arachidic Acid	20	0	peanut oil, fish oil	167 degrees F
Gadoleic Acid	20	1	fish oil	77 degrees F
Arachidonic Acid (AA)	20	4	liver fats	-56 degrees F
EPA	20	5	fish oil	-65 degrees F
Behenic acid	22	0	rapeseed oil/Canola	176 degrees F
Erucic acid	22	1	rapeseed oil/Canola	93 degrees F
DHA	22	6	fish oil	-47 degrees F
Lignoceric acid	24	0	small amounts in most fats	183 degrees F

stable

unstable

Bond Codes: Red=saturated fat, Black=unsaturated fat, Blue=melting point is below freezing water

Important Properties about Fats:

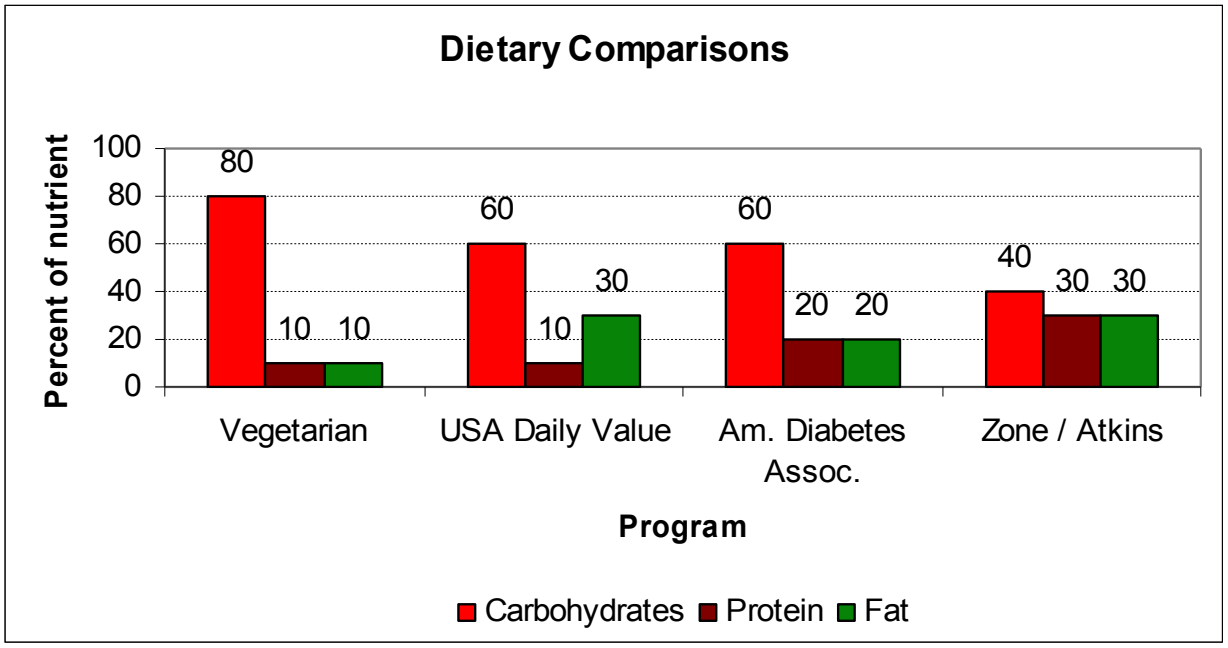
For 0 double bonds (saturated fats):
The longer the carbon chain, the more stable it is (e.g. Stearic acid (beef fat) with 18 carbons is stable for 2 years at room temp.

For >0 double bonds (unsaturated fats):
The higher the number of double bonds, the lower the melting point and more unstable the oil is. (e.g. Flax oil must be stored at 30-40 degrees F (in fridge) and keeps only about 6 months)

Stable fats (saturated) can take higher heat (for cooking). Unsaturated fats with 1 or 2 double bonds can be used for low – med heat cooking. ***Oils with more than two double bonds (e.g. Flax oil) should not be heated or used for cooking as heat can alter the chemistry). However flax seeds can be used in cooking.***

How Much Fat?

How much is the right amount? Different programs have different recommendations



Generally, the daily recommended amount of fat is no more than 30% of your total calorie intake. For 100 lb person of moderate activity level, that would be about 540 calories = 60 gms = ~ 2.1 ounces
(540 calories = just over 5 tablespoons of fat total maximum per day).

Of the 5 tbsp. per 100 lb body weight, a minimum of 1 tsp. omega 3 oil and 3 tsp. omega 6 oil **<u>are essential</u>** and must be included in the diet for health.

Where Do We Get Most of Our Fat In Our Diet?

1. Meat and meat products.
2. Milk and dairy products.
3. Cakes and biscuits.
4. Non-dairy spreads (e.g. margarines).
5. Snacks and sweets.

Many of the fats in the above items (especially 3-5) are not natural fats but made of altered, manufactured fats.

Types of Fats In Foods

Altered fats have been shown to reduce health *Natural fats in appropriate quantity improve health*

ALTERED FATS			NATURAL FATS			
					ESSENTIAL FATS	
PARTIALLY HYDROGENATED FATS	**REFINED UNSATURATED OILS**	**FULLY HYDROGENATED FATS**	**SATURATED FATS**	**UNREFINED MONO UNSATURATED OILS**	**UNREFINED POLY UNSATURATED OILS**	**UNREFINED SUPER UNSATURATED OILS**
Most store bought baked goods: Cookies, crackers, chips, cereals Margarine Shortening Some peanut butters	All store bought oils (except virgin olive oil) -canola, peanut, soybean, corn, etc. Salad dressings Mayonnaise	Processed lard Added to some peanut butters	Beef Pork Butter Dairy products Palm oil Coconut oil	Virgin Olive oil * Peanut * Canola ***= If the bottle states that is is unrefined***	* Safflower * Corn * Sesame * Soybean * Sunflower *** If the bottle states that is is unrefined**	Fish Flax oil *Small Amounts In:* Walnuts Pumpkin Seeds

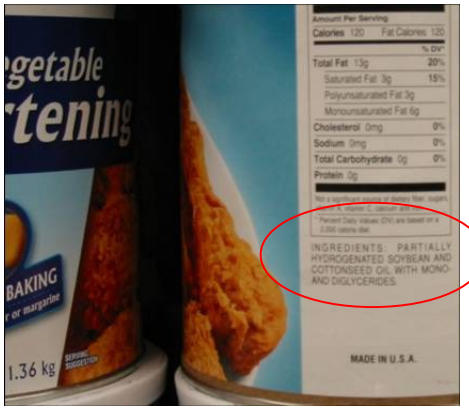
Note: Non-calorie fake fats – such as Olestra, Salatrim, Appetize, etc are not assimilated in the body, but can remove fat soluble vitamins in the digestion track. Fake fats also can cause side effects of diarrhea and gastritis like symptoms.

Major Sources of Altered Fats

Refined oils (all of the above) are low in natural vitamins and contain lipid peroxides which can cause free radical activity and gastritis like symptoms.

All **hydrogenated products** contain a large amount of unnatural fat that the body cannot use for normal functions. **The most dangerous of these are "trans fats".** These are mostly consumed in shortenings and margarines.

These are natural butters with no "trans fats" or hydrogenation, but full of saturated fat.



Major Sources of Altered Fats

Chips and snacks

Fake Fat Chips

… and more chips !

Cookies and all baked goods, breads, cake mixes…

Crackers

Fruit roll ups and many breakfast cereals also have partially hydrogenated fats.

How Fats Are Altered

LIGHT:
- produces free radical in oil (photon energy)
- creates rubber-like substances (polymers)

OXYGEN:
- breaks down oil making it rancid

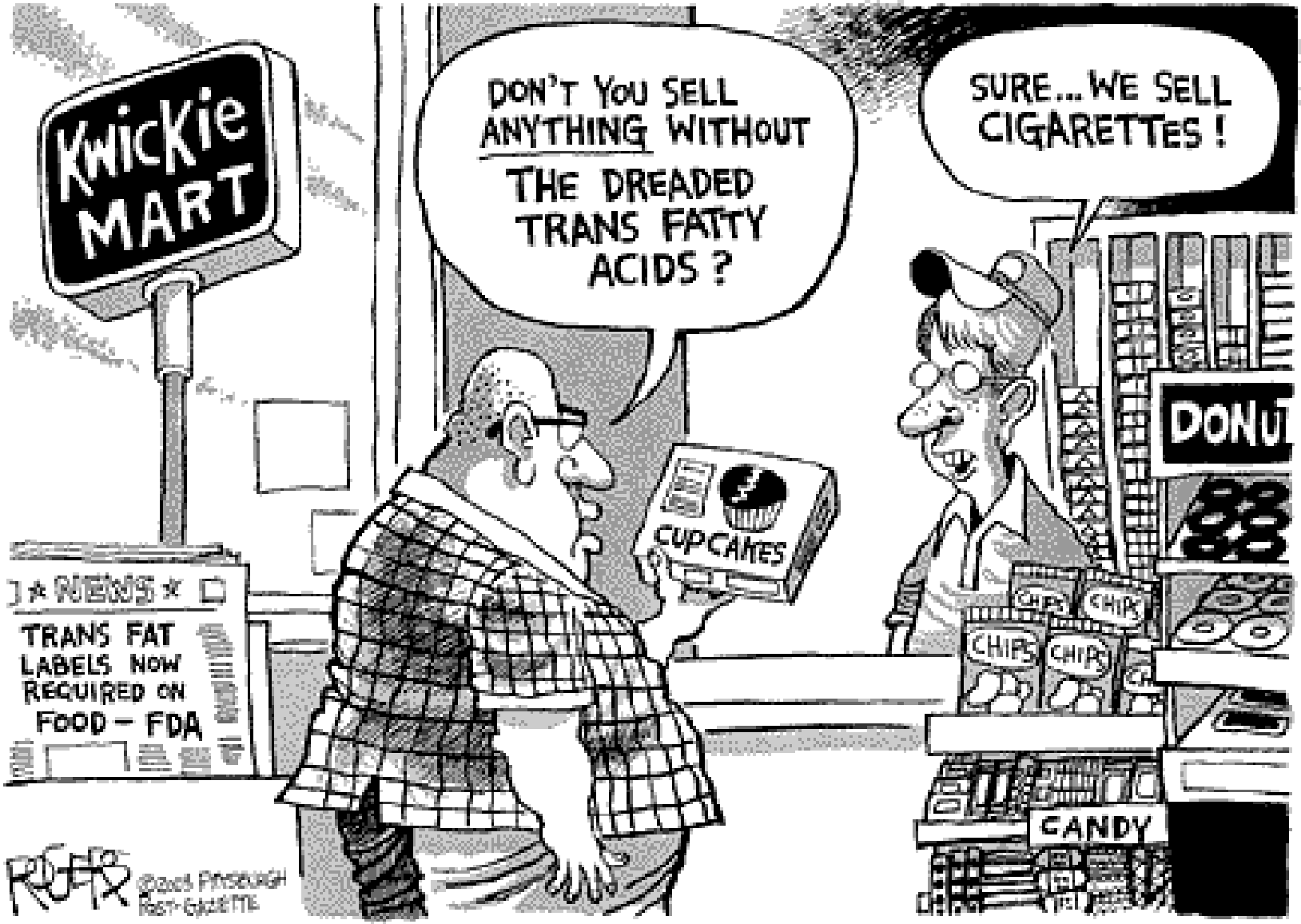
HEAT (used in deodorizing, hydrogenation, frying):
- creates harmful "trans fatty acids"

- **Fats are the most sensitive of all food types to being altered by light, air and heat.**
- **The more unsaturated the fat, the more easily it is altered.**

REFINING:
- most oils are extracted using solvents (hexane, heptane)
- degumming (removes phospholipids)
- bleaching (removes chlorophyll and beta carotene, creates **lipid peroxides**)
- deodorizing (uses very high temperatures and creates some "trans fatty acids")
- synthetic antioxidants are added back in to extend shelf life.

HYDROGENATION:
- *Fully Hydrogenated:* Saturates all double bonds but leaves some production artifacts like nickel and aluminum and some altered fats.
- ***Partially Hydrogenated:***
  - contains dozens of intermediate non-natural fat substances
  - contains large amounts of **"trans fatty acids"** (up to 25% or more0
  - consumption is largely in margarines and processed baked goods.
  - some of the unnatural components cannot be used in the body and cause stress on the system for removal – in low fiber diets these altered fats are reabsorbed and recirculated.

So what are Trans Fats?



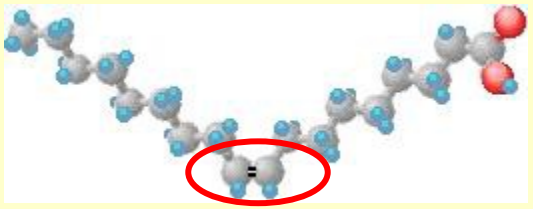
How Fats Are Altered

What are "Trans Fats" ?

Trans Fats are created when natural unsaturated fat molecules are hydrogenated or partially hydrogenated and the added hydrogen at the double bond is altered from a "cis" form to a "trans" form.

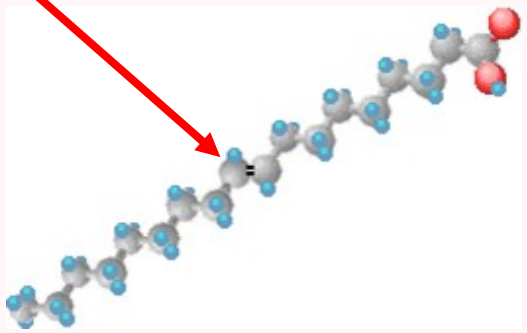
The most common foods that have hydrogenated fats in them are margarines and baked processed goods. Read your labels to **avoid trans fats.**

Other alterations occur to fats at high temperatures. What is formed under high-temperature cooking and frying is a **polymerized oil**, and this is because the heat helps to **form free radicals** and then various breakdown products.



Natural Oil – in normal "Cis" form

- Enzymes can break this down
- Melting point is 41° F
- Can be used for cell functions
- Is non-sticky



– Trans Fat molecule in it's"Trans" form

- Melting point is approx 110° F
- Cannot be used for cell functions
- Is sticky

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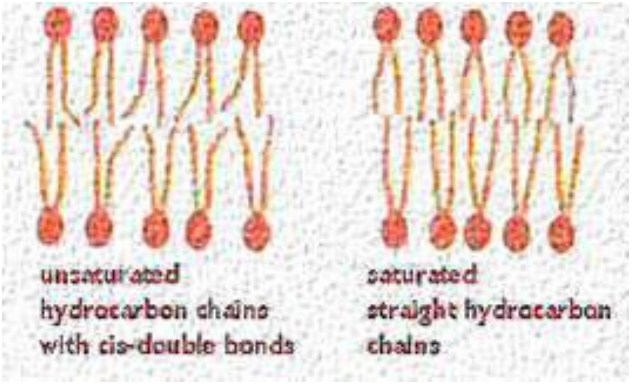
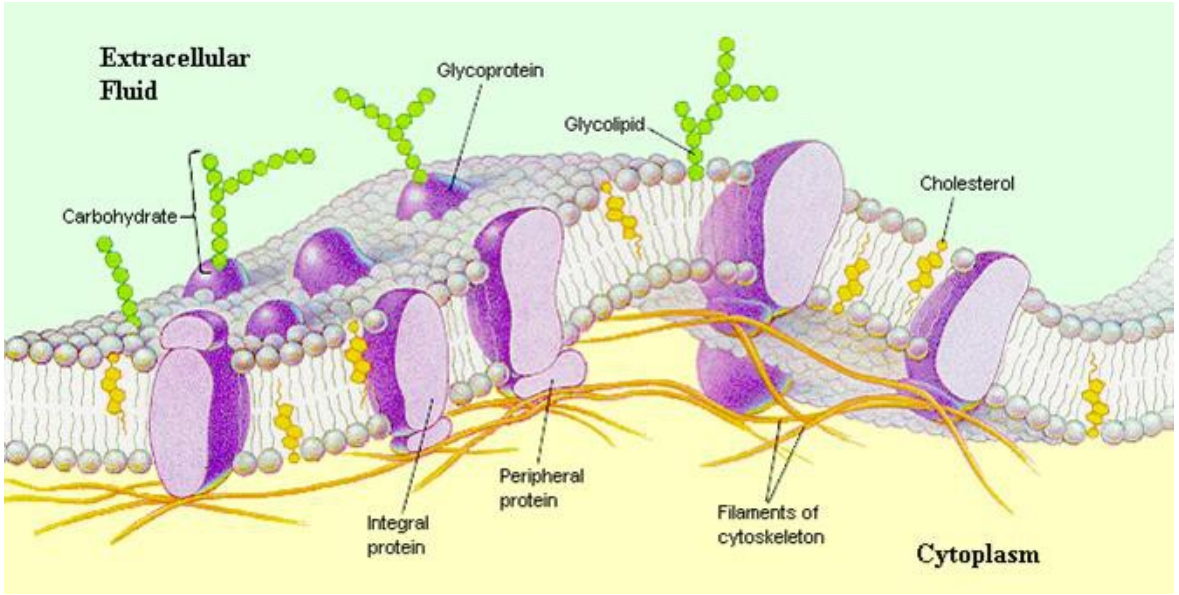
Fats And the Cell Membrane

Cell membranes are made up of a double layer of fat molecules in the phospholipid form. Cholesterol is also in the cell membrane and supplies structure to the cell wall. However, when the cell membrane becomes stiffer from too much saturated fat in our diet, the cell signals the cholesterol to leave (where it goes out into the blood and raises the serum cholesterol level). When our diet has plenty of unsaturated fats, the cell membrane will draw cholesterol from the blood serum to help maintain a certain structure level to the membrane (thereby reducing serum cholesterol). In the event there is not enough cholesterol in the blood, the cell can produce its own. The whole cholesterol story is not this simple, but this is a large part of how the body gets involved.



Unsaturated fats provide more fluid responsive cell function.

Saturated fats result in rigid and congested cell membranes.



http://bioweb.wku.edu/courses/BIOL115/Wyatt/Biochem/Lipid/Lipid3.htm#phospholipid

Cholesterol

What is Cholesterol?

- It is a hard waxy substance that melts at 300° F
- We can obtain it three ways:
    1. From the foods we eat (eggs, shrimp, etc)
    2. Primarily is made in the liver (about 1,000 milligrams a day)
    3. Every cell in our body can also produce it.

Functions of Cholesterol:

- Stabilizes cell membrane fluidity.
- Component of hormones (estrogen, progesterone, testosterone, aldosterone (regulates water balance), cortisone, etc)
- Part of Vitamin D
- Bile Acids contain cholesterol
- Protects our skin from infection and dehydration
- Can operate as an antioxidant when the body is deficient in antioxidants.

Cholesterol and Heart Disease

High levels of serum cholesterol have been associated with heart disease. You should get your cholesterol tested every three to five years, more often if you have high cholesterol levels. Please refer to the table below for guidelines for total cholesterol, LDL and HDL levels.

	Desirable	Borderline	Undesirable
Total Cholesterol	Below 200	200-240	Above 240
HDL Cholesterol	Above 45	35-45	Below 35
LDL Cholesterol	Below 130	130-160	Above 160
Total Cholesterol/HDL	Below 4.5	4.5-5.5	Above 5.5
LDL/HDL	Below 3	3-5	Above 5
Triglycerides	Below 150	150-199	Above 200

It is important to know that about half of the people who have a heart attacks have normal levels of cholesterol, so it is known that **cholesterol may only be one indicator**. There are other blood tests that you can have done that are also associated with heart disease risk. These are:

Level of **Homocysteine** (this is a protein associated with "stickiness" of cholesterol. Daily intake of 400 mcg of folic acid helps reduce homocysteine)

C reactive protein marker (CRP) – associated with inflammatory response.

Reducing Body Fat

There are basically only two ways to naturally reduce body fat:

1. **Burn it off:**
   - Increase physical exercise. Turn on your fat burning hormones by simply doing a high active exercise for 1 minute 1 to 3 times a day.
   - Lower calorie intake so the body access the fat stores
   - Include co-factors in your diet that facilitate access to the fats in the cells (e.g. Acetyl L-Carnitine)
   - Eat fats that burn more easily (shorter chain saturated fats and healthy unsaturated fats)
   - Make sure your thyroid is functioning normally (low thyroid lowers the Basal Metabolic Rate, or in other words does not provide the hormone necessary for burning more energy).
   - Raise BMR with cayenne.
2. **Excrete it:**
   - **Eat adequate fiber** (at least 30 grams fiber per day). Fiber helps remove excess cholesterol and bile acids from our body preventing their reabsorption and recirculation. Without fiber, up to 94% of fat will be reabsorbed! A good fat soluble fiber is oat bran.
   - Avoid altered fats that cause digestive problems and trans fats. Your body tries to eliminate fats it cannot use and if it cannot eliminate them, they can be reabsorbed and cause health problems.

Fiber - Metabolic co-factor for Fats and Carbohydrates

Fiber: Although fiber is non-nutritive, eating foods that are high in fiber has beneficial effects on glycemia, insulineamia and lipemia. Insoluble fiber, also known as roughage, does not dissolve in water and moves more quickly through the digestive tract. Soluble fiber, on the other hand, mixes with liquid and binds to fatty substances to help remove them from the body. It's important to include both types of fiber in a healthful diet.

Insoluble Fiber

Functions and Benefits of Insoluble Fiber

- move bulk through the intestines
- control and balance the pH (acidity) in the intestines
- promote regular bowel movement and prevent constipation
- remove toxic waste through colon in less time
- keep an optimal pH in intestines to prevent disease

Food Sources of Insoluble Fiber

- Whole-wheat products
- Wheat
- Oat
- Corn bran
- Flax seed
- Vegetables such as green beans, cauliflowers and potato skins
- Fruit skins and root vegetable skins

Soluble Fiber

Functions and Benefits of Soluble Fiber

- bind with fatty acids
- prolong stomach emptying time so that sugar is released and absorbed more slowly
- lowers total cholesterol, especially LDL - therefore reducing the risk of heart disease
- regulate blood sugar for people with diabetes

Food Sources of Soluble Fiber

- Oat/Oat bran
- Dried beans and peas
- Barley
- Flax seed
- Fruits such as oranges and apples
- Vegetables such as carrots
- Psyllium husk

If you eat at least 5 servings of fruits/vegetables as well as at least 5 servings of grain products per day, you are very likely meeting the fiber requirements

Fats – Simple Principles

- **Use unsaturated fats and eat adequate amounts of the essential unsaturated fats (omega 6 (3 tsp per day) and omega 3 (1 tsp per day) - per 100 lbs of body weight).**
- ***Avoid over-heating oils*.**
- **Avoid excess fats – especially saturated fat.**
- **Consume adequate amounts of fiber (30 gms. minimum per day)**
- **Exercise regularly.**
- **Avoid altered fats (trans fats, hydrogenated)**

Book and Web Sites

A most excellent book on fats (plus other things) is:

Fats that Heal Fats that Kill by Udo Erasmus
ISBN: 0-920470-38-6 (paperback) 0-920470-40-8 (bound)

Good Websites:

body fat calculator:
www.calculator.net/body-fat-calculator.html

Cell membrane movie (very short - 30 seconds and interesting):
http://www.youtube.com/watch?feature=player_embedded&v=Rl5EmUQdkuI

All about cholesterol:
http://www.aboutyourcholesterol.com/