## The Skinny on Fats, Triglycerides and Cholesterol

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#### **Dietary Nutrients**

MACRO NUTRIENT	CALORIES PER GRAM
FAT	9
CARBOHYDRATES	4
PROTEIN	4
WATER	0

MICRO NUTRIENT	CALORIES PER GRAM
VITAMINS	0
MINERALS	0
ANTIOXIDENTS	0
PHYTOCHEMICALS	0

#### 100 GRAM (3.5 OZ) SERVING

Olive Oil (858c)	
Butter, Salted (670c)	
Almonds Raw (559c)	
Bacon (507c)	
Fried Eggs (186c)	
Chicken Leg Roasted (175c)	
Black Beans Cooked (131c)	
Quiona Cooked (119c)	
Avocado, Florida (112c)	
Rice, Brown Cooked (109c)	
Banana Ripe ( 88c)	
Broccoli Raw ( 33c)	
Percent of Grams	0% 5% 10% 15% 20% 25% 30% 35% 40% 45% 50% 55% 60% 65% 70% 75% 80% 85% 90% 95% 100%
	📕 FAT 📃 PROTEIN 📃 CARBOHYDRATE 📃 WATER



# What are the types of dietary fats?

#### **Dietary Fats**

- Saturated fats.
- Unsaturated fats.

Monounsaturated.

# **Polyunsaturated.**

Essential fats (Omega-3 and Omega-6). Other including Trans fats.



# A Monounsaturated Fatty Acid HO-Carboxyl ΗĤ

Unsaturated fatty acids are liquid at room temperature.

group.

Methyl

group.



## Essential Fatty Acids

- The human body can make most of the different types of fatty acids it needs?
- There are two polyunsaturated fatty acids the human body can not make so it is essential that they are obtained from the diet:
  - > Omega-3 the first double bond is located after the third carbon atom from the methyl end.
  - > Omega-6 the first double bond is located after the sixth carbon atom from the methy end.

#### Trans Fatty Acids

- Some meat and dairy products have a small amount of naturally occurring trans fat.
- Most trans fat is formed by an industrial process that adds hydrogen to vegetable oil to make a partially hydrogenated oil that is solid at room temperature.
- Manufactured trans fat is so unhealthy that the FDA has banned food manufacturers from adding it to foods.
- If a food contains less than 0.5 grams of trans fat per serving the food label can show 0.0 grams of trans fat.



# What Are Triglycerides?

## What Is a Triglyceride?

- Free fatty acids do not usually exist in nature.
- Dietary fatty acids are usually packaged into **triglycerides** which are structures that have three fatty acids attached to a glycerol backbone.
- Triglycerides can be utilized to create energy or stored in adipose tissue (body fat) to store energy.





# What Is Cholesterol?



#### Cholesterol In The Human Body

- Cholesterol is a small steroid molecule.
- The human body contains about **a quarter pound** of cholesterol, most of which is found in the:
  - > membranes from which cells are constructed.
  - > myelin sheath that protects your nerve cells.
- Smaller amounts are used as the:
  - > starting ingredient for synthesis of steroid hormones like progesterone, estrogen and testosterone.
  - > precursor for Vitamin D synthesis.



- Plants do not contain any cholesterol.
- All plant eating animals must make all of the cholesterol that is needed to maintain their health.

The fact that humans can make all of the cholesterol needed to maintain their health suggests that humans evolved as plant eaters.



#### Cholesterol and Digestion

- Cholesterol is a major component of the bile acids synthesized in the liver that are essential for the absorption of fat from the contents of the small intestine.
- More than 90% of the bile acids are reabsorbed into the blood stream and returned to the liver and about 10% is passed to the large intestine and excreted.
- The liver makes between 1500-2000 milligrams of cholesterol a day to replace what is lost in the bile acids that are excreted.

# What are lipids and lipoproteins?

## What Are Lipids?

A diverse group of organic compounds that are grouped together because they are insoluble in water. Fats are lipids.

Essential functions of lipids:

- Energy storage (triglycerides).
- Components of cell membranes (cholesterol).
- Formation of steroid hormones (estrogen and testosterone).
- Carrying fat-soluble vitamins (A, D, E, K).

#### What Are Lipoproteins?

Lipoproteins are biochemical assemblies that enclose the water insoluble lipids so they can be transported in the blood stream and other water based fluids in the body.

The density of a lipoprotein depends on the ratio of the protein to the enclosed lipid.

- > Low density is low protein relative to the enclosed lipids.
- > High density is high protein relative to the enclosed lipids.

## Major Types of Lipoproteins?

- Chylomicrons transport triglycerides from the intestinal tract to cells in the body.
- Very low-density lipoproteins (VLDL) transport triglycerides and some cholesterol from the liver to cells in the body.
- Low-density lipoproteins (LDL) transport cholesterol from the liver to cells in the body. (25% protein and 75% cholesterol and other lipids)
- High-density liproptoteins (HDL) transport cholesterol from cells in the body back to the liver. (50% protein and 50% cholesterol and other lipids)

# How are dietary fats digested?

#### Mouth to Stomach

Fatty acids in foods are stored in triglycerides.

- Chewing crumbles foods into smaller and smaller food particles.
- Salivary glands secrete saliva that coats the food particles.
- Saliva contains a lingual lipase enzyme that starts the breakdown of the triglycerides.
- The chewed food is swallowed into the stomach.



#### Stomach to Small Intestine

- A gastric lipase enzyme continues to breakdown the triglycerides into diglycerides and free fatty acids.
- The stomach's churning and contractions help to disperse the fat molecules.
- Very little actual fat digestion occurs in the stomach.



### Liver to Gallbladder to Small Intestine

- The liver produces bile that is mostly made up of bile salts, cholesterol, and bilirubin (a breakdown product of red blood cells).
- Bile is stored in the gallbladder.
- Fat molecules trigger the gallbladder to release bile into the small intestine.
- Bile acts like a detergent to emulsify the fats into smaller droplets.
- Smaller droplets make it easier for a pancreatic lipase enzyme to complete the breakdown of the triglycerides into free fatty acids.



#### Small Intestine to Blood Stream

- Bile salts envelope fatty acids to create micelles that have fatty cores and water soluble exteriors.
- The micelles allow for efficient transport of the fatty acids across the watery layer of mucus that lines the intestinal walls.
- The fatty acids are reassembled into triglycerides in the intestinal walls.
- The triglycerides are enclosed in chylomicrons that can transport the enclosed lipid to the liver, adipose tissue (fat cells), and muscle cells.



#### Small Intestine to Large Intestine

- Bile with its cholesterol is either reabsorbed into the blood stream and returned to the liver or it is bound to water soluble fiber and passed to the large intestine for elimination.
- Friendly bacteria in the large intestine ferment soluble fiber in the colon to produce short-chain fatty acids (acetate, propionate, and butyrate).
- Short-chain fatty acids are the main source of energy for cells lining the colon.
- There is increasing scientific evidence that short chain fatty acids can also influence brain health.

# How Do Dietary Fats Influence Health?



#### Saturated Fat Health Effects

#### Excess saturated fats:

- increase your LDL (bad) and decrease your HDL (good) cholesterol.
- increase insulin resistance.
- increase the growth of inflammatory microbes in the gut that can alter intestinal permeability.
- increase cancer risk.

USDA guidelines limit saturated fat intake to less than 10% of calories per day. (22g/day)

The American Heart Association recommends aiming for no more than 7%. (16g/day)





![](_page_33_Figure_1.jpeg)

![](_page_34_Figure_0.jpeg)

#### Unsaturated Fat Health Effects

- Unsaturated fats lower cholesterol when they replace saturated fats.
- Monounsaturated fats increase HDL (the good cholesterol).
- Some polyunsaturated fats are essential fatty acids.

Keep total fat content to no more than 30% of daily calories. (67g/day) If you have coronary artery disease or diabetes limit fat to no more than 15% of daily calories. (33g/day)

#### Essential Fatty Acids Health Effects

Important for:

- formation of healthy cell membranes.
- proper development and functioning of the brain and nervous system.
- production of hormone-like substances called **eicosanoids** responsible for regulating blood pressure, blood viscosity, vasoconstriction, immune and inflammatory responses.


## Essential Fatty Acids Health Effects

Omega-3	Omega-6			
Prevents Blood Clots	Promotes Blood Clots			
Dilates Blood Vessels	Constricts Blood Vessels			
Reduces Pain	Increases Pain			
Enhances Immune System	Depresses Immune System			
Improves Brain Function	Depresses Brain Function			
Decreases Cell Division	Increases Cell Division			



### Essential Fatty Acids Health Effects



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## Excess Omega-6 Health Effects

A high proportion of Omega-6 to Omega-3 has been associated with:

- Increased risk of inflammatory activity.
- Cardiovascular disease.
- Type 2 diabetes.
- Rheumatoid arthritis.
- Cancer.
- Depression.
- Autoimmune disease.

#### ESSENTIAL FATTY ACID RATIOS

FOOD	Omega-6 to Omega-3	FOOD	Omega-6 to Omega-3
Peanuts (raw)	4000.0 : 1	Olive Oil	12.8 : 1
Almonds (dry roast)	2010.8 : 1	Angus Cattle (grain fed)	10.4 : 1
Cashews	125.5 : 1	25.5 : 1 Butter	
Carrots	57.5 : 1	Chard (boiled)	8.2 : 1
Pistachios (raw)	52.0 : 1	Soybeans (cooked)	7.5 : 1
Corn Oil	46.0 : 1	Walnuts	4.2 : 1
Palm Oil	45.5 : 1	Lentils	3.7 : 1
Tomatoes	26.7 : 1	White Potato	3.0 : 1
Chickpeas	25.9 : 1	Canola Oil	2.0 : 1
Pecans	20.9 : 1	Angus Cattle (grass fed)	1.7 : 1

#### ESSENTIAL FATTY ACID RATIOS

FOOD	Omega-6 to Omega-3	FOOD	Omega-6 to Omega-3	
Tuna (canned in water)	1:31.1	Mangos	1: 3.0	
Atlantic Cod	1 : 29.0	Green Leaf Lettuce	1: 2.4	
Cod Liver Oil	1 : 21.1	Brussels Sprouts	1: 2.2	
Lobster (cooked)	1 : 20.0	Kidney Beans	1: 2.0	
Atlantic Salmon wild	1:11.7	Squash (winter, cooked)	1: 1.7	
Crab (soft shell, cooked)	1: 6.0	Zucchini (raw)	1: 1.7	
Spinach (boiled)	1: 5.4	Arugula (raw)	1: 1.3	
Scallops (Maine)	1: 5.0	Cabbage (red, raw)	1: 1.3	
Chia Seeds	1: 3.9	Collard Greens (cooked)	1: 1.3	
Flax Seeds	1: 3.9	Kale (cooked)	1: 1.0	

## Trans Fat Health Effects

Trans fats:

- raise your (bad) LDL cholesterol.
- lower your (good) HDL cholesterol.
- have been associated with a higher risk of developing type 2 diabetes.

Decrease intake of foods that contain small amounts of naturally occurring trans fats like beef, pork, lamb, butter and milk. Avoid any food with a "partially hydrogenated" item in the ingredient list even if the food label shows 0.0 grams of trans fat!

## Short-Chain Fatty Acid Health Effects

Short-chain fatty acids:

- are the main source of nutrition for colon cells.
- reduce inflammation in the gut.
- increase enzyme activity in the liver and muscle tissue resulting in better blood glucose control.
- may influence gut-brain communication and enhance brain function.

Increase your intake of whole plant foods that contain soluble fiber like beans, oats, brown rice, citrus fruits, strawberries and potatoes!



## High Triglyceride Health Effects

- May contribute to hardening of the arteries which increases the risk of stroke, heart attack and heart disease.
- Can be a sign of:
  - > prediabetes or type 1 diabetes.
  - > low levels of thyroid hormones.
  - > rare genetic conditions.
- Can be a side effect of taking some medications.

## Lowering Triglyceride Levels

- Reduce consumption of foods that contain added sugar and refined carbohydrates such as soda, baked goodies, candy, most breakfast cereals, flavored yogurt, and ice cream.
- Increase consumption of fiber by adding more whole plant foods, the natural source of fiber.
- Reduce consumption of saturated fat.
- Increase consumption of foods that contain omega-3 fatty acids.



## High Cholesterol Health Effects

Excess LDL cholesterol:

- increases the risk of heart disease.
- increases the risk of strokes that can cause brain damage.
- may increase the risk of gallstones.

## Lowering Cholesterol Levels

- Decrease consumption of animal foods.
- Eliminate trans-fats.
- Reduce consumption of saturated fats.
- Increase consumption of Omega-3 fatty acids.
- Increase consumption of soluble fiber to decrease absorption of cholesterol from the intestinal track.
- Exercise to increase HDL levels.
- Quit smoking.
- Lose weight.
- Drink alcohol in moderation.

#### DIETARY CHOLESTEROL

FOOD	SERV SIZE	CHOL (MG)	FOOD	SERV SIZE	CHOL (MG)
Chicken Liver	3.5 oz	631	Lobster	3.5 oz	71
Beef Liver	3.5 oz	389	Salmon	3.5 oz	63
Egg	1	212	Halibut	3.5 oz	63
Shrimp	3.5 oz	194	Ham	3.5 oz	53
Veal (top round)	3.5 oz	135	Halibut	3.5 oz	41
Lamb (foreshank)	3.5 oz	106	Milk (whole)	1 cup	33
Beef (sirloin)	3.5 oz	89	Cheddar Cheese	1.0 oz	30
Chicken (no skin)	3.5 oz	85	Butter	1 tsp	11
Pork Chop	3.5 oz	85	Milk (low-fat)	1 cup	10
Beef (ground lean)	3.5 oz	78	Any Plant Food	Any	0

## **Are Vegetable Oils Healthy?**

#### **100 CALORIE SERVING**



# How Does Fat Consumption Influence Weight?

## Why Do We Store Extra Calories as Fat?

- The body stores carbohydrate and fat but it converts excess protein into carbohydrate.
- The brain and many parts of the body prefer to burn glucose (a simple sugar carbohydrate) for immediate and between meal energy needs.
- Carbohydrate has 4 and fat has 9 calories per gram. So the most efficient way to store extra calories for long term use is to store fat.
- In times of famine, fasting, or low carbohydrate and protein intake, the body burns fat to supply energy for the brain and other essential organs.

# What Is the Role of Dietary Fats in Type 2 Diabetes?



## **Blood Glucose Regulation**

- Our bodies work hard to maintain a blood glucose level in the range of 80-120 mg/dL.
- As blood glucose levels rise, pancreatic beta cells sense the rise and produce the hormone insulin.
- Insulin signals cells throughout the body to open receptors and import the glucose and either use it for energy or, in the case of liver and muscle cells, store excess glucose as glycogen for later use.
- Excess insulin increases the risk for metabolic dysfunction in many tissues over time.

## Diabetes Types

- Type 1 diabetes occurs when an autoimmune condition injures the pancreas beta cells so they can no longer produce insulin.
- Type 2 diabetes occurs when the pancreas beta cells can still produce insulin but the insulin is unable to open the glucose receptors because the cells are **insulin resistant**:
  - > Blood glucose levels continue to rise
  - > The pancreas produces more insulin in an effort to force the glucose into the cells.



#### **HOW DOES INSULIN WORK**



**Insulin resistance** occurs when the outside or inside of the insulin receptors are clogged.

## What Is the Cause of Insulin Resistance?

- Insulin resistance is caused by too much fat in cells that are not designed to store large amount of fat.
- High-fat diets, especially saturated fat, cause whole body insulin resistance that creates insulin rejection in the liver, muscles, and adipose tissue.
- Pancreatic beta cells are also highly sensitive to the accumulation of excess fat over long periods of time. That coupled with an increasing demand to produce insulin can put so much stress on the beta cells that they begin to die.

# What is Ketosis and the Ketogenic Diet?

## What Are Ketones?

- Glucose is the preferred energy source for many cells in the body, especially the brain. The main source of glucose is digestion of carbohydrates.
- The liver can make glucose from amino acids obtained from excess dietary protein, but not enough to satisfy all of the needs of the brain.
- When there is not enough carbohydrates and excess protein to provide the glucose, the liver ramps up the conversion of dietary and body fat into ketones which can supply energy to most of the cells in the brain.

## What Is Ketosis?

- Ketosis is a metabolic state in which there is a high concentration of ketones in the blood when there is limited access to glucose and fat provides most of the fuel for the body.
- Ketosis is a metabolic adaptation to allow the body to survive during a period of famine.
- Ketosis can be initiated by fasting or starvation.
- Ketosis can also be initiated by consuming a low carbohydrate, high fat diet.

## What Is a Ketogenic Diet?

- A **ketogenic diet** is a low carbohydrate, high fat, high protein eating pattern that can initiate and maintain a state of ketosis.
- A keto diet is usually composed of 70-75 percent of calories from fat, 20-25 percent from protein, and 5 percent from carbohydrates.
- It can take from two to six weeks for the body to adjust to a keto diet.
- The keto diet was originally used to manage seizures in children with epilepsy.

## Short Term Health Effects of a Keto Diet?

- Rapid short term weight loss as water is released from burning residual stores of glucose.
- Longer term weight loss because of appetite suppression caused by decreased ghrelin, a so-called hunger hormone.
- Helps normalize blood sugar which often allows diabetics to reduce or eliminate the need for insulin or medication.
- Reduction of total cholesterol.
- Effective for controlling epilepsy in both children and adults who don't respond to medication.

## Keto Diet Risks

- Many people experience flu-like symptoms at the beginning of the keto diet.
- Eating excess animal protein can lead to acidic urine, a higher risk of kidney stones, and worsen progression of chronic kidney disease.
- The low fiber in an animal based keto diet can cause constipation and suppression of good gut bacteria which can cause negative gut health.
- Keto diets often supply insufficient vitamins and minerals leading to nutrient deficiencies.



## Keto Diet Risks (continued)

- Some studies suggest keto diets may reduce bone mineral density and trigger bone breakdown over time. Further studies are needed.
- Some evidence suggests animal based low carb diets may lead to higher death rates from heart disease, cancer, and all causes.

## Long Term Health Effects of a Keto Diet?

- There are currently no multi-year studies on the long term health effects of a keto diet.
- None of the long lived healthy sub-populations in the world follow a ketogenic eating pattern.
- Because the science clearly shows that reducing animal protein and saturated fat leads to a lower risk of all cause mortality, a plant-based keto diet may benefit health over the very long term.

## What Is Ketoacidosis?

- If the bloodstream is flooded with extremely high levels of glucose (blood sugar) and ketones, the blood becomes acidic which is seriously harmful.
- Ketoacidosis (acidic blood):
  - > Is most often associated with uncontrolled type 1 diabetes.
  - > Less often occurs with type 2 diabetes.
  - > Can sometimes be caused by severe alcohol abuse.

## **Final Notes**

## Dave March's Diet

- Mostly **whole plant foods** and some minimally processed whole plant foods with little or no added salt, sugar, or oil.
- About 10-15% fat, 10-15% protein, 70-80% carbs.
- A large variety of whole plant foods each week.
- Vitamin D3 (a hormone), vitamin B-12 and iodine supplements.

It is a high complex carbohydrate diet. It is a very low refined carbohydrate diet.



## Dave March's Weekly Food List

- oranges, blueberries, strawberries, raspberries, black berries, pineapple, grapes, watermelon
- oatmeal, shredded wheat, buckwheat, millet, brown rice, quinoa, air-popped popcorn
- sweet potatoes, white potatoes, green lentils, split peas, peas, black beans, garbanzo beans (chick peas), red lentil pasta
- mixed soup vegetables, broccoli, Brussels sprouts, spring mix salads, beets, onions, tomatoes, bell peppers
- low sodium V-8, green tea, orange spice herbal tea, cocao powder
- apple cider vinegar, ground flax seeds, nutritional yeast, various spices.

#### **TYPICAL BREAKFAST - CEREAL WITH ALMOND MILK AND FRUIT**



Data Source: USDA Food Central Legacy Database

#### **TYPICAL LUNCH - SPRING MIX SALAD TOPPED WITH LENTILS**



Data Source: USDA Food Central Legacy Database

#### **USUAL SNACK - AIR POPPED POPCORN**

3 Tbsp Air Po	opped Corr	n						
Percent of Me	al Calories	0% 5% 10	)% 15% 20%	25% 30% 35%	40% 45% 50% 5	55% 60% 65% 70%	575% 80% 85% 90	0% 95% 100%
SNACK TOTAL								
Percent of Meal Calories 0% 5% 10% 15% 20% 25% 30% 35% 40% 45% 50% 55% 60% 65% 70% 75% 80% 85% 90% 95% 100%								
FAT PROTEIN CARBOHYDRATE								
(	GRAMS		MILLI	GRAMS	CALORIES			
MEAL	WATER	FIBER	CHOL	SODIUM	FAT	PROTEIN	CARBS	TOTAL
50 (0.1 lb)	2	7	0	2	16 (8%)	24 (13%)	146 (77%)	189

Data Source: USDA Food Central Legacy Database
## TYPICAL DINNER - SPROUTED BROWN RICE WITH GARBANZO BEANS



Data Source: USDA Food Central Legacy Database

## DAY SUMMARY



Data Source: USDA Food Central Legacy Database

## The slides for this presentation are available at web4dmarch.com/nutrition/talkFat.htm

Email comments, questions and suggestions to nutrition@web4dmarch.com