



Module 4: Weight Management Approaches & The Macronutrients

News & Review:

To begin, please think about:

- Any nutrition news stories you might have heard this week
- Any upcoming campus or community events you're aware of that you might attend or would like others to know about
- And what, if anything, you have changed or been thinking about that's related to *last* week's discussion on... Behavioral Approaches in Weight Management.

For extra points, please post in the extra credit class discussion your observations and/or news.

Weight Management Approaches & Macronutrients

This presentation will review different weight management approaches and the macro nutrients (carbohydrates, fat, and protein). It begins to address the question: "What is the best diet for weight loss?". It also begins to cover the risks of dieting (especially for normal weight people). Last, the presentation provides a review of macro nutrients and, this review, prepares you for deeper information on whether or not high protein (or high carbohydrate) dieting approaches are healthy and/or are "best" for weight loss.

By the end of this lecture, you should be able to:

1. Review and classify different weight loss strategies.
2. Identify factors to consider when evaluating different weight loss strategies
3. Review and build on everything you learned in your Introduction to Nutrition course about carbohydrate, lipids, and protein
4. Outline the components of a healthy diet
5. Decide, based on available evidence, what the roles of carbohydrates, proteins, and fats are in weight management and health
6. Develop a personal answer to the question: "What is the best diet, menu plan, or meal pattern for weight loss and weight loss maintenance?"

For a brief audio overview of what to expect in module 3: [module3+audio.pptx](#)

Does Dieting Cause Weight Gain and Eating Disorders?

Here is a passage from a journal recent publication that I think sums up the answer to this questions very well:

Weight loss awakens the body's defense system in a manner that is persistent, saturated with redundancies, and well-focused on the objective of restoring the body's depleted energy reserves. Successful, long term weight loss requires recognition of the strength and persistence of these biological pressures, and a better understanding of how they may be countered with environmental

biological pressures, and a better understanding of how they may be countered with environmental, behavioral, pharmaceutical or other interventions. To be effective, interventions aimed at preventing weight regain will likely need to be as comprehensive, persistent, and redundant as the biological adaptations they are attempting to counter’.

On the other hand, given the increasing prevalence of dieting to lose weight among those in the healthy normal range of bodyweight (because of media, family, societal and sports performance pressures) and the emerging evidence that dieting in these population groups is a strong predictor of future weight gain, future heart disease and future diabetes, one may also add that among strategies to control the obesity epidemic, primary preventive measures should also target these lean ‘dieting-prone’ population groups.

MacLean PS, Higgins JA, Giles ED, Sherk VD, Jackman MR. The role for adipose tissue in weight regain after weight loss. *Obes Rev* 2015; **16** (Suppl. 1): 45–54.

When the author mentions redundancies, what she is talking about is how the body has more than one way to make you feel hungry and more than one way to slow your metabolism and make it easy for you to re-gain weight. When the author mentions primary prevention, she is talking about strategies to prevent dieting in people who are not overweight. She thinks this is important because dieting when you're not overweight increases your long-term risk for weight gain, heart disease and diabetes.

So the answer to the question? I would say: "Yes! Dieting puts you at risk for weight regain, disordered eating, heart disease, and diabetes...especially among people who are not overweight." It is something that should be carefully considered and planned if you're overweight and avoided if you're not.

Weight Loss Strategies

This link will lead you to a remarkable list of popular “diets”.

http://www.everydiet.org/weight_loss_diet.htm

Here are some things we know about weight loss strategies:

- Different things work for different people. A strategy that works for you may or may not work for someone else. It’s important to avoid the “I know this works” mentality when working with different people.
- Probably the best “diet” is a healthy eating routine that is not too strict and that each individual person develops for themselves. It is possible to get ideas from the different “diets” but each person is uniquely qualified to figure out what is likely to work, long term, in the context of their life.
- There are pros and cons to every strategy. Big cons, the ones to avoid and try to lead people away from, are the ones that endanger mental or physical health.
- Finding what works for any individual probably involves trial and error. Moreover, what works for an individual at one point in their life may or may not work at a different point in their life. Don’t let people think that they are hopeless just because they failed at a strategy. Maybe it was the wrong strategy for them. Maybe it wasn’t the right time in their life to try weight loss.
- I do not advocate or warn against any of the following strategies. I would say, however, that if ever you recommend an approach or strategy you should first become familiar with any research literature concerning the approach. And if the approach significantly deviates from things we know to be healthful (plant foods, healthy oils, fish, water/hydration, adequate in vitamins and minerals, whole grains, etc) and you cannot find any research literature on www.pubmed.gov speaking to its efficacy and safety... do not recommend it. Also, if it's really complicated to follow or very restrictive...those are also big warning signs. Most people can't add a super complicated diet to their lives all at once. Restrictive diets can lead to failure at best and extra weight regain, heart disease and eating disorders at worst.

Classifying different weight loss strategies:

Exercise more: Increase energy expenditure without increasing energy intake and you will lose weight right?

Best things about the approach:

~ A very healthy approach (exercise reduces risk for a number of diseases and it often helps people feel happier)

Problems with the approach:

~ It takes time to exercise

~ For a number of reasons it can be difficult for heavy people to exercise. Think about exercising while carrying lots of extra weight, weight bias in health clubs, heat intolerance when exercising outdoors, and finding sport specific clothing.

~ *Just exercise doesn't usually work.* Most people eat more after exercising and/or the they are less active the rest of the day.

~ Most people need exercise AND diet to be successful

Eliminate certain foods from your diet:

Examples:

- Cabbage soup diet (you can eat as much soup as you want but you can only eat cabbage soup)
- Atkins and Keto diet (you cannot eat carbohydrate so you omit grains, fruits, dairy, and some vegetables from your diet)
- Dean Ornish Diet and Vegan Diet (you cannot eat fat with Ornish or animal products on a vegan diet so you omit meat and any other food prepared with fat for Ornish and meat and dairy on a vegan diet)
- Paleo Diet (you cannot eat grains, sugar, legumes, or processed foods)

Best things about the approach:

- You don't have to count calories
- It's black and white so it's easy (in a way) and there is less opportunity to "cheat."
- Ornish diet has been shown to reverse coronary artery disease.

Problems with the approach:

- Hard to stay with it
- Often doesn't provide a healthful diet (adequacy, balance, moderation, variety) and is likely deficient in some nutrients.
- People who quickly and very significantly reduce their carbohydrate intake can experience the "keto flu", constipation, dehydration, electrolyte and and vitamin and mineral deficiency. The "keto flu" and other symptoms can mostly be avoided if people reduce their carbs more slowly, drink lots of water, and take fiber, vitamin and mineral supplements. It's best to work with a Registered Dietitian or MD if considering the Keto diet.

Note: for a quick read for more information on ketones/ketosis resulting from very low carbohydrate diets, please [click here](#).

Count and limit calories or number of servings that you eat such as Weight Watchers and using an online app.

Best things about the approach:

- Possible to construct a healthy low calorie diet.
- You learn the caloric value of many foods.

Problems with the approach:

- Counting/recording calories and/or servings of foods is can be tedious
- You can fool yourself with respect to portions and calories unless you count and weigh everything.

Follow a liquid diet like Slimfast or Medifast

Best things about the approach:

- Rapid weight loss
- Simplicity

Problems with the approach:

- If you go 100% liquid, you don't learn anything about calories, healthy menu planning,

- or food preparation.
- Questionable in terms of health and nutrition.
- If you're going 100% liquid for a long period of time, an MD's supervision is needed. You can get gallstones and overwhelm your liver and kidneys.
- Can't eat with family and friends

Eat pre-portioned home delivery foods as in NutraSystems and Jenny Craig

Best things about the approach:

- Rapid weight loss.
- Simplicity.

Problems with the approach:

- You may not learn about calories, healthy menu planning, or food preparation.
- Can be expensive.
- Can't eat with the family

Competent Eating and Mindful Eating Approaches

Here is a fascinating article on these "no diet" approaches: Enjoying the eating process without focus on dietary restrictions may be key to managing weight and staying healthy for many clients and patients. (J Nutr Educ Behav. 2007 Sep-Oct;39(5 Suppl):S189-94.)

What are competent and mindful eaters? Competent and mindful eaters are positive, flexible and comfortable with their eating habits and make it a priority to regularly provide themselves with enjoyable and nourishing food. They guide food intake based on the internal processes of hunger, appetite and satisfaction, and rely on the body's innate ability to maintain a preferred and stable weight. Satter, scientist and creator of the competent eater model/idea observes that eating competence cultivates effective eating attitudes and behavior by emphasizing permission as well as discipline:

- The permission to choose food you enjoy and eat it in amounts you find satisfying.
- The discipline to provide yourself with regular and reliable meals and snacks and to pay attention when you eat them.

There are four steps to competent eating:

- Take time to eat, and provide yourself with rewarding meals and snacks at regular and reliable times.
- Pay attention to the food as you eat and pay attention to your hunger and satiety sensations throughout the day.
- Cultivate positive attitudes about eating and about food. Emphasize providing rather than depriving; seeking food rather than avoiding it.
- Enjoy your eating, eat things you like, and let yourself be comfortable with and relaxed about what you eat. Enjoying eating supports the natural inclination to seek variety, the corner stone of healthful food selection.
- Pay attention to sensations of hunger and fullness to determine how much to eat. Go to the table hungry, eat until you feel satisfied, and then stop, knowing another meal or snack is coming soon when you can do it again.

Create Your Own Healthy Lifestyle Plan

This hasn't exactly been scientifically tested. However, you're welcome to try it and/or make suggestions on how to improve it. The basic idea is to write down your idea or vision of what an achievable healthy lifestyle looks like for you. Then you create and follow a step by step plan to achieve your vision.

- **Step 1:** Buy a full size (8x10) notebook in which you can record your plan. Think of this as sort of like building a business plan but it's really your lifestyle plan. Note: it's okay to type this electronically but there is more research literature on the benefits of old fashioned pen and paper writing. For more on the benefits of writing, see the book by James Pennebaker *Opening Up*.
- **Step 2:** Write down what a healthy lifestyle looks like for you in terms of
 - Menu plan, foods, and eating schedule (Write down what are you eating and when are you eating it. You don't have to have complete menus...just

- a general plan for now. Write down to what you're ordering and eating when you eat away from home.)
 - Exercise plans and schedule (Write down what type of exercise are you doing and when are you doing it?)
 - Physical environment (Write down what kinds of foods are in your kitchen, your backpack, and anywhere else you eat that you can control. Write down also what exercise equipment is in your garage and where the TV and video games are located.)
 - Social environment and schedule (Write about your ideal social setting. Who are you hanging out with? What are you doing for fun? How often are you going out to movies versus going for a hike? How often are you eating out versus eating at home?)
 - Life skills (Write about how you overcome adversity; take responsibility instead of being "the victim"; advocate for yourself when people/life asks too much of you; delay gratification; cope with stress, sadness, set-backs, injuries, depression; deal with any past abuses or hurts. You need to get really detailed and specific here. In truth, this is the hard part because it ties to self destructive behaviors like over eating or hanging around with the "wrong" crowd.)
- **Step 3:** Decide what areas you want to work on first, second, third, etc. You don't have to start with the hardest things but you can. You don't have to concentrate on just one area but you can.
- **Step 4:** Create two or three small goals for week one. If you're planning to "take on" your physical environment and exercise pattern first then your goals might be to:
 - Move the TV in your bedroom to the area where you keep your stationary bike
 - Get your bike out of the back of the garage and have it tuned and repaired
 - Invite your neighbor to walk with you on Wednesday morning for 20 minutes.

***Note:** You're not trying to achieve your healthy lifestyle plan any area in the first week. You are just taking first steps.

- **Step 5:** Begin the habit of planning, building, and record keeping:
 - Record how well you did following through with goals for week one. Record what went well and why it went well. Record what didn't go so well and ideas for how to overcome.
 - Record your goals and plan for next week.
 - Decide when and where you are going to record next week.
- **Step 6:** Make a deal with yourself. For example, the deal might be that if you plan, act, and record for four weeks in a row, you get to buy yourself those new songs you've been wanting. Also, if you do this for a whole year you get to go to Mexico for a vacation.

The super simple approach

Also, not exactly scientifically tested but here it is: Each morning write down three intentions you have for doing some things for yourself to live more healthfully. Example, Get at least 30 minutes of exercise. Eat only two small treats. Go to bed at a reasonable hour.

Five Minute Writing Activity:

Please take out a piece of paper and jot down your thoughts on these questions:

**What is the lifecycle of a typical weight loss "diet"?
How does it start? How does it end? Why are success rates usually so low? What type of approach likely has the highest success rates?**

What would you say the primary or most important difference between lean people and overweight? Is it willpower or would you say it's circumstance? What I mean by

circumstance: physical environment, social environment, ideological background (they way you've been raised to think about things), and biology/genetics?

How important is it that people address their circumstance?

How much willpower does a person who is living in ideal circumstances need in order to follow a healthy eating & exercise plan? How much willpower does a person in less than ideal circumstances need?

What are your health behavior-relevant circumstances?

How to Evaluate Weight Management Approaches?

Say your client came to you, new diet in hand, and asked you to evaluate it. What criteria would you use?

Here are some suggestions:

- How restrictive is it? If it's too restrictive, and your client is prone to disordered eating, the diet is likely a bad idea. Your client would be better off taking a "non diet," competent eating approach.
- How complicated is it? If the diet regimen calls for making a bunch of complicated recipes or following a complicated eating schedule and your client is not a cook and has a complicated life already, it might not be the best approach.
- Does it address the underlying causes for the weight problem? As covered in LM2, there are many reasons people eat the way that they do and have the habits that they have. A good approach is one that guides people to take a look at all of the reasons they do what they do. It guides people to make changes in their environment and ways of thinking so that new habits are not so hard to maintain.
- Does it deviate from the principles of good nutrition and healthy exercise behaviors?
- How much will it cost?

How to talk so people will listen (about weight management approaches)

You'd like your opinions about diets to be truly heard by clients, friends and family. Maybe because people's relationships with food and body are so intimate and intense (we all eat and we are all expert eaters) sometimes people ask our opinions about food and nutrition but, if they don't hear what they want to hear, they tune us out.

I recommend that whenever someone asks you for your nutrition opinion (or really any type of opinion) you lay a listening trap before you reply. Here is how you do it.

Let's say a friends asks your opinion about a diet. It's tempting to launch right into talking and telling but **don't**. Start with listening. First, turn the question around. Ask them what they know.

What can be learned from successful losers?

The National Weight Control Registry is a registry of the habits of about 5,000 people who have successfully lost 35 pounds or more and who have kept it off for 2 or more years. Some of the really interesting traits of successful losers are listed here. For more information, here is the link: <http://www.nwcr.ws/>

1. 90% of successful losers relapsed multiple times before succeeding.
2. 71% of successful losers became obese during childhood or adolescences.
3. 63% say that when they finally lost weight, they were stricter with themselves than before.
4. 20% used liquid formulas as part of their weight loss plan.
5. 90% say that after the first year or two, maintaining the weight loss “is not that hard.”
6. The overwhelming majority indicate that they enjoy food; that they do not feel

deprived; but that they know that they “can never go back to old ways.”

7. 75% weigh themselves once per week or more.
8. Most report having a plan of action that they take when their weight creeps up 5 to 10 pounds.

General Suggestions for Weight Management:

I’m not saying this is “it.” I’m saying that these would be my recommendations based both on what I know from the research literature and from personal and professional experience.

1. Find personally relevant reasons to lose weight. Take some time to figure out your specific goals. Remembering why you are losing weight can help when discouraged.
2. Have a specific plans and strategies: “I’m going to cut down” Isn’t specific enough. The best plans usually aren’t from a book or a magazine. They are usually the ones you created yourself for yourself.
3. Avoid fad diets. Instead, come up with a healthy eating lifestyle plan that works in the context of your life and that generally follows the dietary guidelines. Write down your menu/eating plan. Go shopping to buy the food you’ll need. Follow it. Don’t be too strict.
4. Make a specific exercise plan. Exercise is particularly good at reducing visceral fat.
5. Create an environment that supports your plans. For example, shop for the foods on your menu. Get rid of the tempting foods in your kitchen that aren’t. Make sure your exercise equipment is accessible and in good shape. Keep the TV and video games out of sight.
6. Get enough sleep.
7. Reduce intake of trans fat and palm oil. Increase your fiber intake to feel full.
8. Take a long look at the factors in your life that help you stay lean and the factors that don’t. Make a long creative list for each. Next, think of ways to expand and accentuate the lean factors and think of ways to address, overcome or minimize the fat factors.
9. Don’t try to lose more than 1-2 pounds per week. Eat at least 1,200 calories per day.
10. Keep in mind, if in the obese range, loss of just 10% of body weight can result in significant health benefit. Beautiful and healthy comes in many sizes. Aim for mental and physical health as measured by blood pressure, blood glucose (if pre diabetic) and blood lipids. Do not focus on a number on the scale.
11. Best weight management book I know: Volumetrics by Barbara Rolls
12. Weight loss is almost never a linear process. Usually, it’s 5 pounds down and 4 back up...or for many 20 pounds down 25 back up and, later on, down again. Have a plan for overcoming adversity.
13. To cope with adversity, find a mantra, a prayer, or a poem. Write in a journal. Find what works for you. Failure is as important to learning as is success, maybe more so. This applies to a lot of things in life. Learning to deal with adversity in weight management will help you in other areas of life too.
14. Pay attention to when and why. Eating while watching TV or as a way to deal with stress leads to consuming extra calories. Set aside times for meals. Serve yourself a portion of food rather than eating from a bag or serving dish.
15. Love life, all of life: the good, the bad, and the real bad. It’s good to feel even if it’s not all rainbows and unicorns. Just don’t obsess. Get help if you’re obsessing.

What would your top 10-15 suggestions for weight management be?

Review of Macronutrients

(Skip this last section if you remember well the applied concepts from your Intro to Nutrition course; you're not interested; and you can answer the homework questions without it.)

ABCs of Healthy Eating

There are three main considerations when assessing or planning a healthy diet – these three items are called the ABC's of healthy eating:

- A. **Adequacy** – the eating plan should contain all of the nutrients (macronutrients and micronutrients) required to maintain health.
- B. **Balance** (variety and moderation) – a balanced eating plan provides adequate amounts and variety of nutrients
- C. **Calorie** (energy) and nutrient density – a healthy eating plan focuses on low energy-dense (low calories per gram of food) foods that are also nutrient dense (high levels of specific nutrients per gram of food).

Energy Nutrients (Macronutrients)

The “Energy” nutrients include the carbohydrates, fats, protein, and alcohol. Please remind yourself that vitamins and minerals do not provide energy – one of their primary roles is to support the processes that convert the macronutrients into usable (by the body) energy.

Below are the current DRI (Dietary Reference Intakes) recommendations for a “healthy” population. These values vary for individuals with different health conditions. The levels for healthy adults are:

- 1. Total fat: 20-35% of total kcal
- 2. Saturated fat: <10% total kcal
- 3. Carbohydrate : 45-65% of total kcal
- 4. Dietary fiber: 25 gm/day for women and 38 gm/day for men ~ 14gm/1000 kcals
- 5. Protein: 10-35% of total kcal
- 6. Cholesterol: <300 mg/day
- 7. Sodium: <2,300 mg/day

Carbohydrate (CHO)

Carbohydrate (carb) is the primary dietary energy source for body. While most tissues in the body can derive energy from carb, fats, and protein, carb (glucose) is the primary energy supply for brain and nervous system. Carbohydrate is also the whole body's preferred energy source.

Carbohydrate can be "burned" by the body to form ATP. If you have enough ATP, your body can store excess carbohydrate in the form of glycogen. The liver, and the muscles are places where excess carbohydrate can be stored in the form of glycogen. If you consume more carbohydrate than is needed for ATP or glycogen, the liver can convert carbohydrate to triglyceride (fat). The liver packages the newly formed fat (made from excess carb) into lipoproteins and sends the lipoprotein out into circulation where other tissues, likely adipose tissue, can remove the fat from the lipoprotein and store the fat.

You've heard of people whose triglyceride levels are too high? One reason your triglyceride (or lipoproteins carrying triglyceride in the blood) can get too high, is from eating too much simple carbohydrate. The liver has converted that excess carbohydrate to fat and has exported it to the blood in lipoproteins filled with triglyceride.

What do I mean by preferred energy source?

Say you went to a movie and you brought a large regular soda and a large buttered popcorn (I know you wouldn't do this). Say you were not that hungry when you did this and you had not exercised recently. What would the body do with the sugar from the soda? What would the body do with the fat in the popcorn? Your answer: Well, since carb is preferred by the body, your body would "burn" the carb or, in other words, convert it into ATP. Once your body has enough ATP it would send the excess carb to the liver to become liver glycogen, or if you had exercised, to the muscles to become muscle glycogen. Fat (from the "buttered" popcorn) is the less preferred energy source. The body isn't going to burn fat when it has plenty of its preferred energy source around: carbohydrate from the coke and popcorn. So, you guessed it! When your body has plenty of carb and fat, the carb gets burned and the fat goes straight to storage in fat cells.

The key concept is that since carbohydrate is the preferred energy source, as long as there are enough calories and enough carbohydrates around, the body will burn carbs and, if fat is eaten in these circumstances, it will be stored. Note: let's not freak out about fat though, right? If you match calories consumed to calories expended the body will burn the

though right? If you match calories consumed to calories expended the body will burn the fat you ate to form ATP.

In addition to providing energy, complex CHO (fiber and other starches) play an important role in maintaining the health of the digestive tract.

CHO are almost exclusively derived from plant sources, including:

1. Fruits
2. Vegetables
3. Grains
4. Legumes
5. Nuts and seeds

* Milk is the only animal-derived food with significant amount of CHO (lactose).

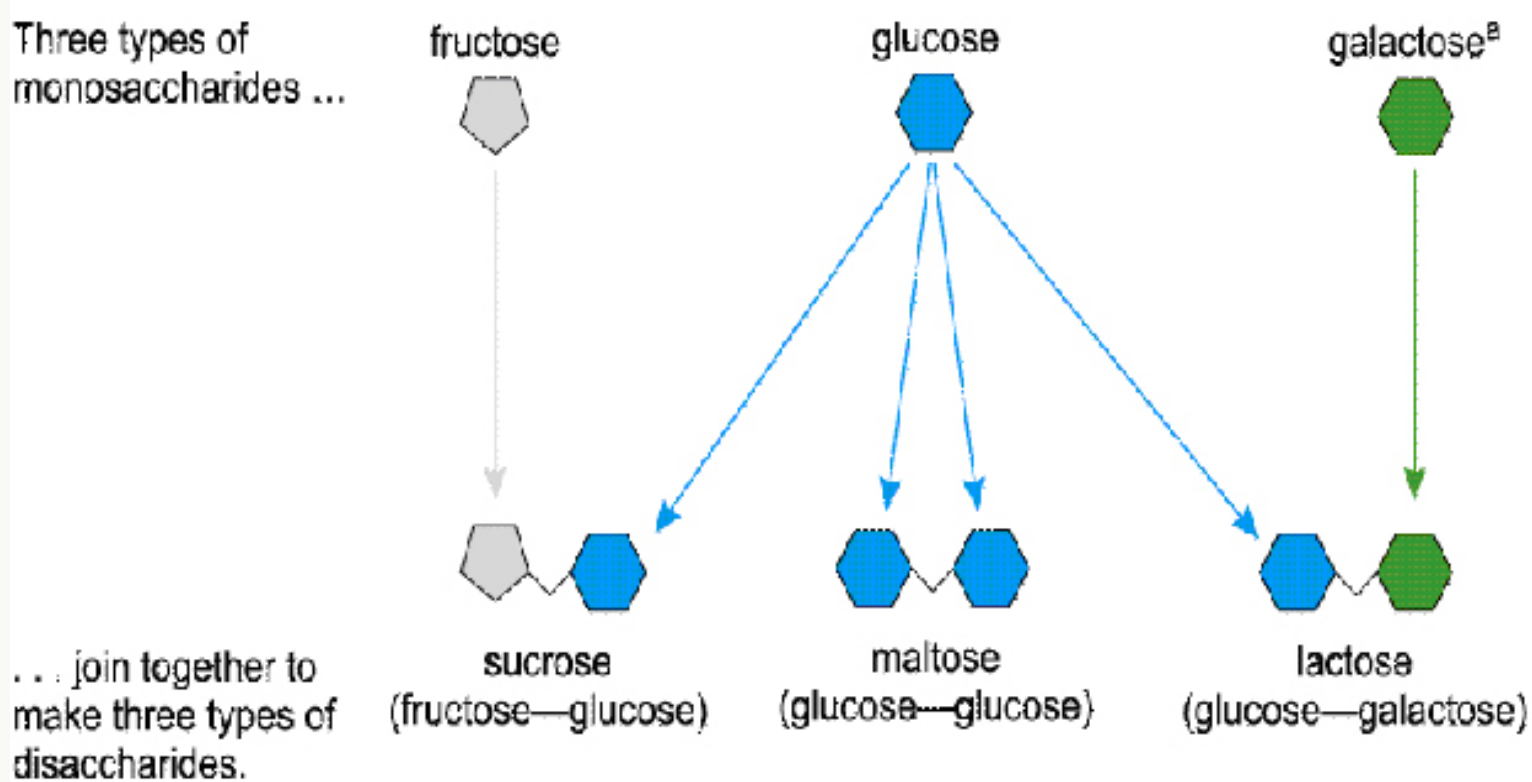
The roles and health benefits of CHO go beyond being a primary energy source. Other important physiological roles include:

1. Complex CHO increase satiety by slowing gastric emptying
2. Complex CHO help maintain control of blood glucose and insulin metabolism
3. Fiber and gastrointestinal (GI) health:
 - a. From fiber the body produces short-chain fatty acids. These short chain fatty acids promote the health of the cells in the GI tract.
 - b. Helps to maintain the cellular function of the colonic (colon) cells
 - c. Promotes movement of foods through the GI tract
4. CHO plays an important role in the regulation of cell function
5. Complex CHO (specifically soluble fiber) lowers blood cholesterol (lowers bile acid and cholesterol reabsorption)

CHO are typically characterized as either “Simple” or “Complex.” The simple CHO contain either one (monosaccharide) or two (disaccharide) sugar units connected together by “glycosidic” bonds.

The three primary dietary monosaccharides include:

1. Glucose
2. Fructose
3. Galactose



Monosaccharides:

Glucose

1. Chief energy source for cells
2. Obtained from all plant carbohydrates
3. In humans—insulin enables cells to take up glucose from the Blood and helps keep blood glucose constant

Fructose

1. Also made by plants
2. Sweetest of all sugars
3. Abundant in fruits, honey, and sap (syrup)
4. Body can convert fructose to glucose
5. Body can use fructose to make fat

Galactose

1. Appears in nature as part of lactose - milk sugar

Disaccharides:

Sucrose (Glucose + Fructose)

1. Also referred to as table sugar
2. Derived from beets or sugar cane; occurs naturally in fruits and vegetables
3. Because the body can convert fructose to glucose, one molecule of sucrose can ultimately yield 2 molecules of glucose.

Lactose (Glucose + Galactose)

1. “Milk sugar”
2. Lactose intolerance is the inability to digest lactose into glucose and galactose. This is different from a “milk allergy” where the body actually has an immune response against the proteins found in milk.

Maltose (Glucose + Glucose)

1. Found primarily in sprouted seeds and malt beers

U.S. adults tend to consume high amounts of refined sugar (table sugar and high-fructose corn syrup found in processed foods). It is estimated that ~16% (equaling 21 tsp sugar) of our total calories come from sugar, with some sugar making up to 41% (equaling = 55 tsp) of their total calories.

Due to sugar’s low nutrient density, the DRIs suggest a MAXIMUM of 25% of our total calories be from simple sugars. This is much higher than the World Health Organization (WHO) recommendations that simple sugars comprise a MAXIMUM 10% of total calories.

When looking for sugar in the diet, note that anything that ends in “ose” refers to a sugar (e.g., levulose)

Other names for sugar include

- Brown Sugar
- Confectioner's sugar
- white sugar
- dextrose
- fructose
- galactose
- glucose
- maltose
- lactose
- corn syrup
- high-fructose corn syrup
- maple sugar
- molasses
- brown rice syrup
- honey
- sorbitol
- granulated cane juice
- turbinado sugar

Sweetened drinks such as sodas, juices, drinks, alcoholic mixed drinks, specialty coffees

Sweetened drinks such as soda pop, juice drinks, alcoholic mixed drinks, specialty coffees, sports drinks, as well as candies, cookies, snack bars (granola bars, protein bars, meal replacement bars) all “count” as added sugar in the diet.

Complex CHO (polysaccharides) contain long chains of glucose units (3 or more often many more) linked together. The two primary types of dietary complex CHO are:

1. Starch: found in grains such as wheat, oats, corn, rice, also in potatoes, legumes, etc. It is a polysaccharide with hundreds of glucose molecules bonded together. Starch is only made up of “glucose” – none of the other monosaccharides. What differentiates starch from fiber is that starch is digestible by humans where fiber is not. In other words, we have gut enzymes that can break the bond between the molecules of glucose in starch and, after that bond is broken, we can absorb the glucose (move it from the small intestine to the blood and onto other body cells that need it for fuel or other purposes).
2. Fiber: Found in whole grains, legumes, fruits, vegetables, seeds, nuts. It is similar to starch in that fiber is a polysaccharide composed of hundreds of glucose molecules bonded together. However the glucose molecules are bound together in a different type of chemical bond. Mammals (humans included) do not have digestive enzymes that can break the special bond between the glucose molecules in fiber. Thus the difference between starch and fiber is that fiber IS NOT digestible by humans.

Fiber is the other main dietary source of complex carbohydrates. Although it does not serve as an energy source for the body, it still plays many important roles in maintaining one’s health.

For this reason, the DRI’s recommend that adults consume a minimum of 25 g/day for adult females and 38 g/day adult males. WHO recommends that adults consume a minimum of 20-35 g/day.

The recommended fiber intake for children is determined by adding 5 grams of fiber to the child’s age. Therefore, a 10 year old would require “10 + 5” = 15 grams of fiber per day.

Unfortunately, the current U.S. adult intake for fiber is ~1/2 of what is recommended with females consuming ~12 g/day and males ~18 g/day. These low levels of fiber consumption are reflected in the extensive use of over-the-counter laxatives (number 1 over-the-counter medication sold in the U.S.)

Dietary Fiber and Functional Fiber

Dietary fiber, which most often is a nondigestible carbohydrate, is the part of a plant not broken down by human digestive enzymes. While many in the health care community use the terms “soluble fiber and insoluble fiber,” the Institute of Medicine (IOM) recommends that we group fiber into either "dietary fiber" or "functional fiber" because recent studies have suggested that other properties of fiber, such as physical and chemical structure, fermentation capacity, and viscosity, determine the effect on health outcomes. While there are several accepted ways to classify fibers, the most popular grouping is based on how they react in water. Soluble fiber dissolves in water, forming a gel and insoluble fiber (mainly cellulose, hemicellulose, and lignin) does not.

The term soluble fiber originally was assigned to fibers that disperse in water, but it’s come to mean those fibers that form viscous gels and are fermented by colonic bacteria. Since not all fibers with those traits truly are soluble, fiber often is classified instead as viscous (forming a gel in water) vs. nonviscous or fermentable vs. nonfermentable.

Soluble fiber (Viscous) dissolves in water forming a gel-like material (e.g., gelatin). Consuming 5 to 10 g of soluble fiber per day reduces LDL cholesterol levels by approximately 5%. The National Cholesterol Education Program Expert Panel recommends consuming 10 to 25 g of soluble fiber per day and following a diet low in saturated fat and cholesterol to help lower blood cholesterol. Soluble fiber has the following properties:

1. Promotes feeling of fullness and decreases a person’s overall energy consumption. This is due to the expansion of the fiber as it absorbs the water molecules.
2. Improves glucose and insulin handling – slows down digestion and absorption of other digestible carbohydrates.
3. Interferes with the reabsorption of bile acids in the intestines. Bile acids are high

- in cholesterol.
4. Fermented by bacteria in the colon and may help lower LDL by playing a role in the production of short-chain fatty acids (SCFAs).

Types of Soluble Fiber

Type	Sources
Beta-glucan	Grains (oats, rye, barley)
Pectin (sugar acids)	Fruits, vegetables, legumes, sugar beets
Natural gums	Seeds (guar and locust bean), trees (gum acacia), seaweed (carrageenan), microbes (xanthan gum)
Inulin	Chicory, onions, wheat, Jerusalem artichokes; increasingly added to processed foods

— Source: Tunland BC, Meyer D. *Nondigestible oligo- and polysaccharides (dietary fiber): their physiology and role in human health and food.* **Comp Rev Food Sci Food Safety.** 2002;3:90-109.

Insoluble fiber (Nonviscous) does not dissolve in water. For this reason, insoluble fiber is also called “roughage” and has the following properties:

1. Prevents constipation, hemorrhoids, diverticulosis through increased motility of digested and undigested foods through the digestive tract
2. Decreases risk of colon cancer – likely due to the decreased exposure to potentially toxic elements in the colon.
3. Sources include: whole wheat, brown rice, and vegetables

Funtional Fiber

Functional fiber is fiber that has been extracted from plant or animal sources, manufactured, or synthesized and then added to processed foods. This includes natural mucilages such as psyllium; chitin from the exoskeletons of crustaceans; synthetic fructooligosacchrides, polydextrose, and polyols; and resistant dextrins. Because most Americans are not getting enough fiber, manufacturers are adding functional fibers or isolated fibers to foods and beverages to boost consumer intake. They're adding soluble corn fiber, polydextrose, and soluble fiber dextrin to foods such as cereals, soups, baked goods, and meal replacements.

Glycogen

Plants are pretty sedentary. Since they don't move they don't need to store carbohydrate in super compact ways. Animals on the other hand need to stored carbohydrate and they have to store it in a compact way so that they can move around. Whereas plants store carbohydrates in the form of “starch and fiber,” humans (animals) store carbohydrates in the form of “Glycogen.” Similar to starch, glycogen is only made up of glucose molecules connected together by glucose bonds.

The structure of glycogen is much more compact than that of starch. This allows more glucose molecules to be stored in a given volume (area within the cell) compared to starch (which is bulky).

Glycogen also has many more “ends” to the glucose strands as compared to starch, giving the enzymes that break down glycogen into individual glucose units easy access to a high number of glucose molecules. The enzymes that break off individual glucose molecules act like scissors, snipping the glucose molecules off one at a time. So, when the body needs a quick source of energy, these enzymes can easily access the glycogen to provide an immediate source of glucose to the body's cells.

Glucose to ATP

As mentioned, glucose is the primary energy source for the body. If a cell needs energy and glucose is available, it will start breaking down glucose to produce usable energy or ATP (adenosine tri phosphate). Each glucose molecule is made up of 6 carbon molecules that are arranged in a very ordered way. Whenever you go from a state of order to disorder...there is potential energy. The cells of our body contain enzymes and co-enzymes (B-vitamins) that simultaneously break the carbon molecules in glucose apart and capture the potential energy (the potential energy comes from going from highly ordered, 6-carbon glucose to highly disordered or random CO₂ molecules). We will discuss this further in LM-4: Energy Metabolism.

Carbohydrates, Calories, Nutrients and Health

Many foods contain a combination of simple sugars, and soluble and insoluble fiber. The key is to consume a diet maximizing your consumption of fiber while limiting your intake of simple sugars.

Nutrient density refers to the relative amount of nutrients per amount of energy or number of kcals. Some foods may be nutrient dense for one nutrient while supplying very minimal amounts of other nutrients.

Compare an apple and strawberries: strawberries are nutrient dense for Vit C compared to an apple, which contains relatively low levels of Vit C. If your goal is to eat more fiber, both of these fruits are considered nutrient dense for fiber.

Sugars are not nutrient dense for any nutrient except carbohydrate.

Caloric density refers to the amount of calories in a given volume (e.g., a cup or an ounce). Three ounces of spinach (one of those bags of pre-washed) would fill several salad bowls and provide about 30 calories in the whole bag. Spinach has high nutrient density but low caloric density. Alternatively, jelly beans are high in caloric density (there are 30 calories in a small handful) and low in nutrient density.

In general, whole foods tend to be more nutrient dense and less calorically dense, than processed foods. This is because food processing often destroys heat-sensitive vitamins, may remove some of the fiber, and some of the water content.

Another example: a baked potato has 10 times the amount of vitamin C as a single serving of potato chips. This same pattern is observed when comparing a whole apple versus apple sauce or apple juice.

The same trend is found when comparing “whole grain” products versus refined flours and grains. Much of the health benefits are derived from the different components of the whole grain:

Whole grains are made of three components, each of which contains different nutrients.

1. The bran is the outermost layer and contains most of the B vitamins and insoluble fiber.
2. The germ is the plant embryo, which contains vitamin E, selenium, and thiamin and is also where the vegetable oils such as corn oil and soy oil are derived.
3. The remainder of the grain is composed of the endosperm. The endosperm is primarily starch, but also contains most of the protein and some vitamins.

Whole grain products, such as whole-wheat flour, contain all three of the grain components, making them a good source of complex carbohydrates and protein, oils, fiber, and vitamins.

During the milling process, the whole grain is ground which separates the bran and germ from the endosperm. Grinding the endosperm isolated in the milling process makes refined flours. Because most of the fiber, oils, and vitamins are lost in the refining process, flour is enriched with some of the nutrients (thiamin, niacin, riboflavin, and iron) lost in the processing - but not fat, fiber, and minerals!

The refining process also pertains to other grain products such as rice. White refined rice has the outer bran layer removed and is primarily starch, whereas intact brown rice retains the outer bran containing the vitamins and insoluble fiber. Refined rice is also enriched to replace some of the nutrients lost to the refining process.

Carbohydrate and Weight Loss

1. A higher carbohydrate, lower fat diet (20-35% total kcal) rich in plant-based food has been shown to promote weight loss. Carbohydrate has been shown to:
 - a. Enhances feeling of satiety (fullness)
 - b. Be low in energy density (low kcal per gram of food)
 - c. Be high in nutrient density – (high level of nutrients per gram of food)

2. Optimum daily CHO levels for weight loss:

50-60% total kcal derived predominantly from foods rich in complex carbohydrates

A balanced carbohydrate consumption does not cause an individual to gain weight. It is only when you eat carbohydrates in excess of your energy needs that they may contribute to weight gain.

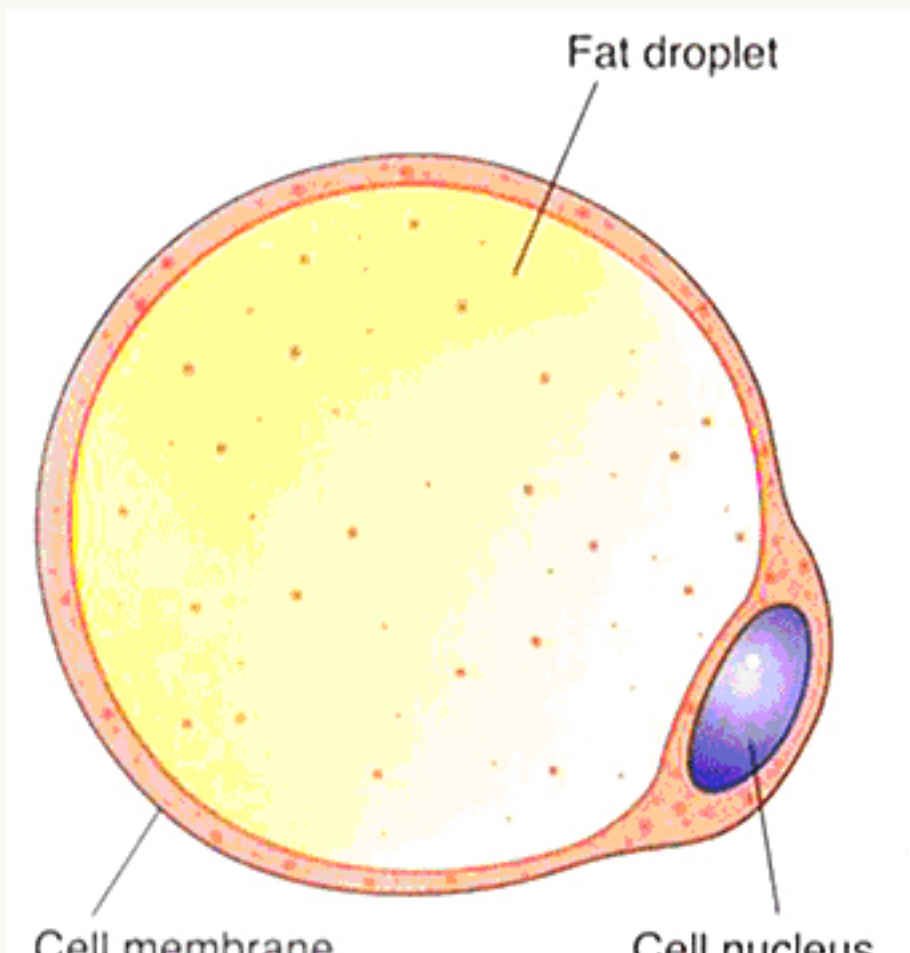
As we consume carbohydrates, we may be consuming more than what our body needs for energy at that particular point in the day. Typically, the excess carbohydrate will be stored as glycogen. If one consumes more carbohydrates (or fat or protein) on a daily basis, then yes, the body will start accumulating fat in the fat cells.

The two primary reasons for this is that the body stops breaking down stored fat for energy because there is more than enough energy being supplied by carbohydrates. Secondly, the body starts producing more fats (*De novo* lipogenesis) when one consumes higher levels of simple sugars (such as those found in sweetened drinks and juices).

The Lipids: Fats, Oils, Phospholipids, and Sterols

Lipid is the “official” scientific term for fat and oil. Fats can be found in many food products. Fats not immediately utilized by the body for energy may be stored in the fat cell. If not stored in the fat cell, fats are used for many different functions in the body. Common dietary sources of lipids include:

- Oils, butter, margarine
- Salad dressings
- Meats
- Some vegetables
- Dairy products
- Egg yolk



One very important point about body fat: carbohydrates and protein CAN be converted to fat for storage but fat cannot be turned back into carbohydrate or protein! Meaning that once excess energy is converted to fat – the fat is either stored in fat cells, burned for energy at a later time, or used in one of the following functions:

- Provide a concentrated energy reserve (9 calories per gram)
- Insulate the body from temperature & shock (stored fat)
- Precursor of vital biochemicals in body (cholesterol, vitamins, and hormones)
- Components of cellular membranes (phospholipids are the primary component of cell membranes)

Dietary reference intakes (DRIs) recommend fat intake to be between 20-35% of total kcals. Dietary fats all provide 9 kcal/gram of energy, whether they are trans, saturated, or unsaturated.

Along with having numerous functions within the body, fats also have some important functions in the foods we consume. Dietary fats...

- Are the most concentrated dietary energy source (9 kcal/g versus 4 kcal/g for protein and carbohydrates and 7 kcal/g for alcohol)
- Induce satiety – by slowing the emptying of partially digested foods from the stomach
- Fats found in foods serve as carriers for fat-soluble vitamins: Vitamins A, D, E, and K
- Fats contribute flavor, aroma, and texture to foods

Dietary fats typically contain a combination saturated, monounsaturated, and polyunsaturated fats:

- Saturated fats contain no double bonds
- Monounsaturated fats contain 1 double bond
- Polyunsaturated fats contain more than 1 double bond

Triglycerides:

- Predominant in the diet and in the body
- Three fatty acids (tri) attached to glycerol
- Saturated and unsaturated fatty acids
- Cis and trans unsaturated
- Hard or soft fat (at room temperature)?
 - Depends on which fatty acids it contains
 - Short-chain lengths are softer
 - Unsaturated are softer

Phospholipids

- Have two fatty acids plus choline, serine, or ethanolamine
- Lecithin is a common phospholipid found in eggs that is used as an emulsifier (allows fats and water-based products to mix without separating) in food products
- Part of cell membranes

Sterols:

- Includes cholesterol, vitamin D, and sex hormones (also plant sterols)
- Sterols are very complex with inter-connecting carbon rings, usually building blocks for complicated molecules instead of energy-releasing compounds

Two of the dietary fats are considered “essential.” This is because the body is not able to produce these fats and they are required for our survival. They are both polyunsaturated fats and are referred to as “**omega-3**” and “**omega-6**” fatty acids.

The omega-3 fatty acids are found in plant-based foods and also in fatty fish such as tuna and salmon. The omega-3’s are considered to be beneficial for our cardiovascular system (heart-protective) and are also beneficial for those with inflammatory conditions such as arthritis.

Because we eat an abundance of vegetable oils, most people get more than enough omega-6.

The American heart Association recommends people eat two serving of fatty fish per week to ensure that they obtain enough omega-3 fatty acid. People who do not regularly consume food sources of omega-3 can obtain the essential fat from fish oil supplements.

***Trans* fat and Hydrogenation**

Trans fats have received much attention lately due to their negative effect on the risk of developing coronary heart disease. Most *trans* fats in the U.S. diet are produced during the partial hydrogenation of vegetable oils. Hydrogenation is a food manufacturing process that turns liquid vegetable oils into the more solid margarines. This process also makes the fats more stable and less likely to turn rancid, which is an especially favorable characteristic for fats used in deep fat frying.

Hydrogenation adds hydrogen atoms to a fat molecule. The more hydrogen atoms that are added to a fat molecule, the more “hydrogenated” and solid the fat becomes. *Trans* fats are produced when the fat molecule is not completely hydrogenated, or in other words “partially-hydrogenated.” Of note, a small amount of naturally occurring *trans* fats are also found in dairy products and meats.

It is recommended to minimize your intake of fried fast foods and food products containing “partially hydrogenated” ingredients. *Trans* fats are typically found in fried restaurant foods, harder margarines, and foods made with partially hydrogenated vegetable oils.

The words “Hydrogenated or Partially Hydrogenated Vegetable Oil” indicate the presence of *trans* fatty acids in a product

Artificial trans fats raise LDL and also lower HDL cholesterol. This dual effect on cholesterol levels actually raises the total cholesterol to HDL ratio, which can increase the risk for heart disease.

Fatty Acids in Foods

Although some foods contain higher levels than others for specific fats, most foods contain a mixture of saturated, monounsaturated, and polyunsaturated fats. For example, olive oil is a good source of monounsaturated fat but also contains lower levels of saturated and polyunsaturated fats. The reverse is true for butter, where it contains mostly saturated fat, but also contains lower levels of mono- and polyunsaturated fats.

Cholesterol

Cholesterol is a sterol, “fat-like” substance that also plays an integral role in cell membrane structure. In addition, cholesterol is required for the production of bile acids (used in fat digestion) and steroid hormones (e.g., estrogen and testosterone). The body is able to produce all of the cholesterol it needs on a daily basis - ~700 mg/day. We typically consume ~300 mg/day (more than the body actually requires). Unlike the daily requirement for dietary fats, cholesterol does not need to be acquired through the diet.

The primary dietary sources for cholesterol are animal-based foods such as eggs, liver, shrimp, and ground beef. Low-fat and nonfat dairy products have minimal levels of cholesterol.

Plant-based foods (vegetables, fruits, grains, legumes) do not contain cholesterol.

Cholesterol Concerns

- Cholesterol that accumulates in arteries is manufactured largely from fragments derived from saturated and *trans* fats
- Cholesterol in food is NOT the main factor in raising blood cholesterol.
 - Total fat intake, especially saturated fat and *trans* fat intake, are more closely related to blood cholesterol levels
 - Monounsaturated and polyunsaturated fats tend to decrease blood cholesterol levels

Blood cholesterol levels are affected more from dietary saturated and trans fats than actual dietary cholesterol consumption. Cholesterol is NOT the main dietary fat that raises LDL (the bad cholesterol). Saturated and trans fats raise LDL cholesterol much more than cholesterol from foods.

Dietary Recommendations for Healthy Population

- Recommended total fat: 20-35% of total kcal
 - Currently: 34-37% total kcal
- Fatty acids:
 - Saturated: less than 10% of kcal
 - Monounsaturated: up to 20% total kcal
 - Polyunsaturated: up to 10% total kcal
 - Linoleic acid (omega-6): 5-10% of kcal
 - Linolenic acid (omega-3): 0.6-1.2% of kcal
 - Trans fatty acids: as low as possible

Fat and Weight management

The past 20 years or so have brought many “low fat” food products to the market. Although lowering your fat intake can aid in fat loss – it has to be done smartly. Many “low fat” food products replace the fat with simple sugars – making the low fat product just as calorie-dense as the regular fat product.

A study conducted by Penn State College of Health and Human Development, Dept. of Nutrition, found that people take larger portions of foods labeled “low fat” – using the label as a license to eat more...

In a separate study providing information on total calories (energy density), the study participants ate similar amounts of food, even when their meals contained less calories.

Things to consider about fat:

- Easy to overeat fatty foods – energy dense foods
- Fats taste good to most people – promoting tendency to overeat
- Excess fat is more readily stored as body fat than excess CHO
- Satiety – due to slower digestion, takes longer for “satiety” message to reach brain
- Lipoprotein lipase – activated by high fat intake promotes fat storage

Since fats consumed in excess of the body’s energy needs are more likely to be stored as body fat, it is recommended to keep fat intake to 20-35% total kcal. Fats are considered calorie-dense (high amount of calories per volume or weight of food), thus contribute to consuming excess calories if one doesn’t keep track of the types of foods consumed (e.g., potato chips, cookies, desserts).

Lipoprotein lipase is the key enzyme responsible for removing fat from the bloodstream. It hydrolyzes (digests) the triglycerides found in circulating chylomicrons and LDL cholesterol and which allows the fatty acids to be stored in the fat cell. Lipoprotein lipase is considered the “gatekeeper” of the fat cells.

Lipoprotein lipase enzyme levels increase after eating, in the presence of insulin, and by dieting! The reason why dieting may cause lipoprotein lipase to increase (resulting in fat storage) is because the body is trying to hold onto whatever fat it can for survival purposes – the body does not differentiate between dieting and starvation in the Sahara desert!

Summary of kcal eaten in excess of energy needs:

- Carbohydrates are broken down (digested) to glucose for absorption. Once absorbed, most of the unneeded glucose is converted to glycogen with minimal amounts converted to fat.
- Fat is broken down to its component parts (including fatty acids) for absorption. Once absorbed, these components are easily converted back to triglycerides to be transported to the fat cells where lipoprotein lipase digests the triglycerides and the fatty acids are stored in fat cells.

What Fat Intake Level is Best for Weight Loss?

- Bottom line – the jury is still out!
- Lower fat diets (20-25% total kcal) have been shown to facilitate weight loss – but so have moderate fat diets (30-35% total kcal)!
- The key appears to be the composition of the “total” diet:
 - If your diet has a higher fat content, then best if majority of remainder of diet is high in vegetables and moderate in carb foods.
 - If your diet has a lower fat content, then room for more rice, pasta, bread, fruit.

Protein

- Most abundant and functionally diverse molecules in living systems
- Working proteins:
 - Enzymes
 - Antibodies
 - Transport vehicles
 - Hormones
- Structural proteins:
 - Muscles, tendons, ligaments
 - Skin
 - Cores of bones and teeth
 - Hair and nails

With all of these important functions, you can see why it is important to consume enough protein each day to replace lost and destroyed proteins. But how much is enough and is more better?

Recommended Protein Intakes

- DRIs: 10-35% total kcal
- Recommendations based on body weight for healthy adult (ADA & WHO):
 - 0.8 g protein/kg (1 kg = 2.2 lbs)
 - 130 lb woman (59 kg) = 47 g protein
 - 165 lb man (75 kg) = 60 g protein
- U.S. women and men average 63 g and 80 g protein/day, respectively
- The recommended protein intakes for adults range from 10-35% of total kcal based on the DRIs.

Amino Acids – Building Blocks

- Although extremely diverse, all proteins share similar features...
 - Composed of linear chains of amino acids linked together by peptide bonds
 - Although hundreds of amino acids have been identified in nature, only **20** are commonly found in human proteins

To understand what happens to excess dietary protein, we first have to review the basic structure of proteins and their basic structural unit – the amino acid.

All proteins are made up of 20 amino acids linked together by peptide bonds.

All amino acids contain nitrogen, carbon, oxygen, and hydrogen molecules. In addition, based on the specific amino acid, it also may contain other molecules such as sulfur.

General structure of amino acid includes carbon atom bonded to 4 groups:

- Amino group (NH₃ +)

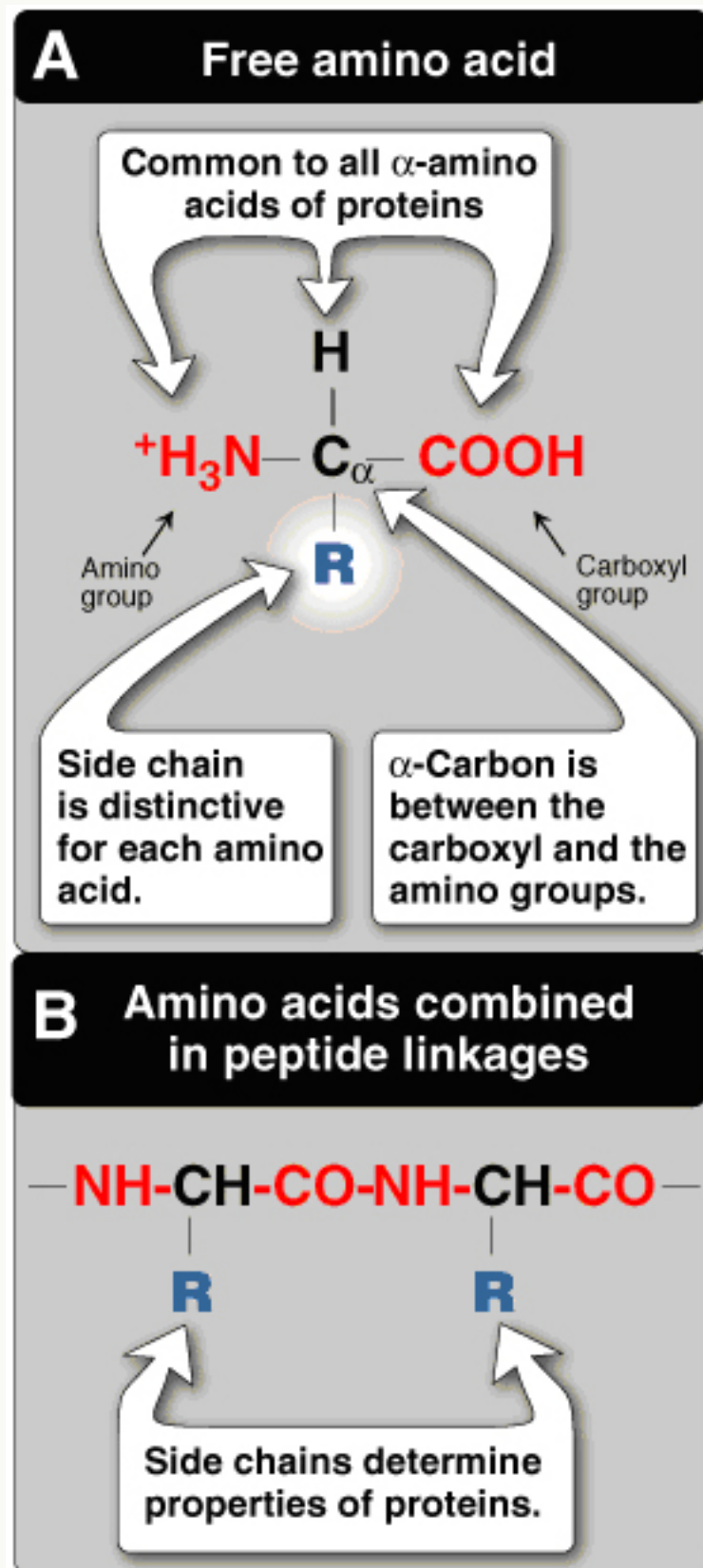
- Carboxyl group (COOH)
- Hydrogen (H)
- Side chain R group (R)

R group determines identity of particular amino acid

There are 9 essential amino acids that must be consumed in the diet because they cannot be synthesized by the body.

The 11 non-essential amino acids can be synthesized by the body from carbohydrates and/or other essential amino acids.

Each protein in the body contains a specific number and combination of amino acids. If we don't get enough essential amino acids through the diet, the limited supply of amino acids can result in a decreased synthesis of new proteins.



The nine essential amino acids for human adults that must be obtained from the diet:

histidine	phenylalanine
isoleucine	threonine
leucine	tryptophan
lysine	valine
methionine	

The nonessential amino acids - also important in nutrition:

alanine	glutamine
arginine	glycine
asparagine	proline
aspartic acid	serine
cysteine	tyrosine
glutamic acid	

Protein as Energy Source

1. If inadequate kcal from CHO and fat, protein can be used as a third energy source
2. C, O, and H components of amino acid used for energy. Nitrogen component is made into urea by liver and sent to kidney for excretion in urine
3. Excess protein is not stored!
4. Protein deficiency causes protein-containing tissues to be broken down to support vital organs (heart, lungs, and brain)

So now to the issue of consuming high levels of protein – in excess of the body’s needs: Bottom line - excess protein is not stored! The nitrogen group is removed/excreted and the remaining fragments (carbon, oxygen, and hydrogen) from the amino acids are converted to glucose, glycogen, or fat.

If we consume inadequate kcal from carbohydrate and fat, protein can be used as a third energy source. As mentioned, the carbon, oxygen, and hydrogen components of the amino acid can be used for energy. Nitrogen is not used to produce energy – instead it is made into urea by liver and sent to kidney for excretion in urine

Amino Acids in the Diet

We get dietary protein from both animal and plant-based foods. Animal tissues typically contain all of the human essential amino acids (EAA), because those tissues are most like us. In general, plant tissues lack some human EAA, but we can combine plant sources to give the total combination of EAA needed. These are called “complementary proteins.”

Protein in Food

1. Complete proteins contain correct proportions of 9 essential amino acids (EAA)
 - a. Meat, fish, poultry, eggs, milk soybean products
3. Incomplete proteins are missing one or more of the EAAs (limiting amino acid)
 - a. Legumes, grains, vegetables
5. Goal is to combine incomplete protein source with a “complimentary” protein source

You don’t have to eat all of your complimentary proteins in one meal – just so you consume all of the needed EAA within a 24 -hour period.

	Lysine	Methionine
	High	Low
	Low	High



Complementary Proteins

1. Beans + rice
2. Peanut butter + bread
3. Split pea soup + croutons
4. Bean burrito (beans + grain)

As mentioned, we cannot store excess dietary protein like we do excess dietary carbohydrates and fat. Instead, excess dietary protein is broken down to its amino acid units and whatever amino acids that aren't used to replace proteins lost by the body are converted to fat or glucose.

If excess dietary protein is not stored by the body, what happens when an individual eats a high protein/low carbohydrate diet?

Typically, there will be a dramatic weight loss the first few days of the diet due to the loss of body glucogen, water, and important minerals. Because protein can be used as an energy source if needed, the body responds to a low carbohydrate diet as it would if you were fasting, by turning to protein to make glucose required by the brain.

Another reason why these diets work is that your appetite is suppressed due to the high protein intake (high protein consumption actually decreases one's appetite) and ketosis – thus you consume less food!

The bottom line why these diets are effective is that you are eating less calories – not because of the high protein and low carbohydrate levels.

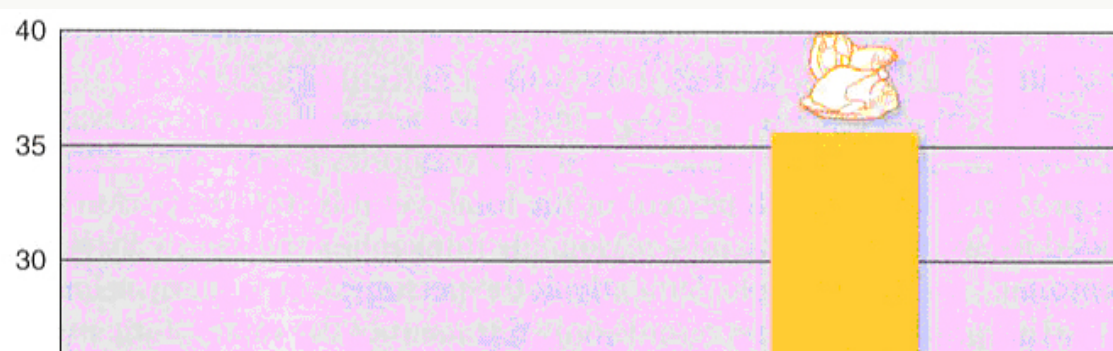
High Protein vs. Low Calorie Diets

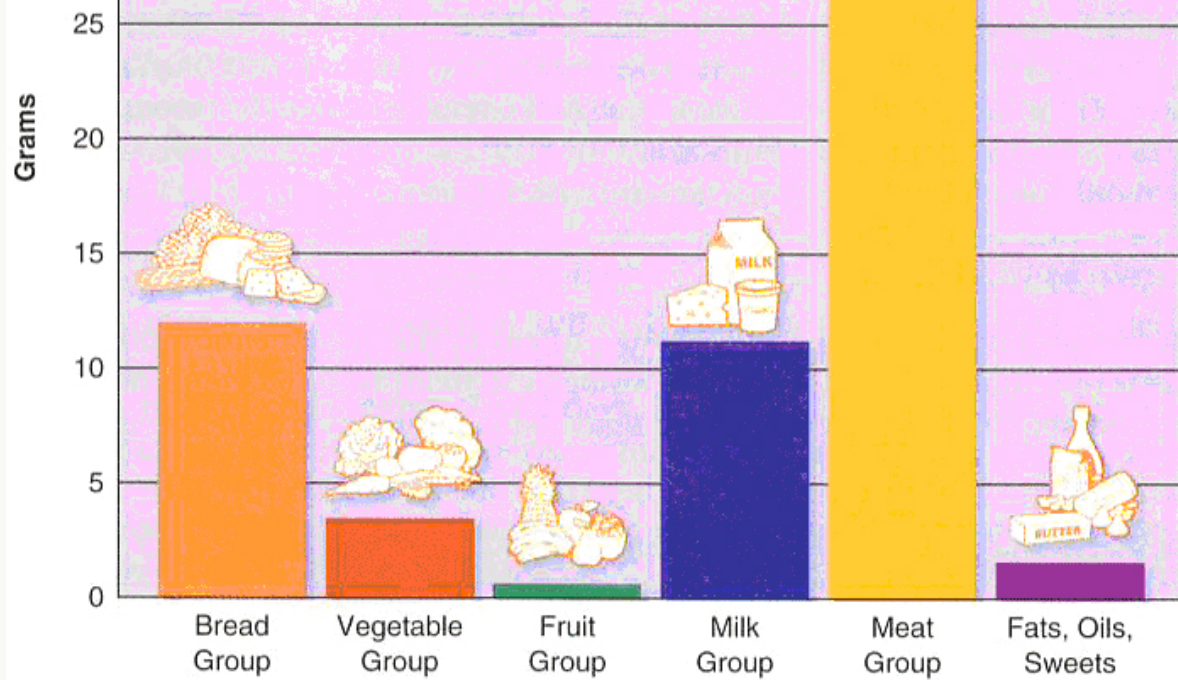
Energy restriction is responsible for the weight loss observed with any diet. Low-carbohydrates, high-protein/fat diets do not have specific metabolic effects that induce weight loss independent of calorie reduction. This study below showed the effect of altering the carbohydrate content while maintaining the same total energy content (1200 kcal/d) on short-term weight loss. Weight loss was similar in both groups, demonstrating that the proportions of macronutrients do not have an important effect weight loss, when the same number of total calories are ingested.

Source: Golay A, Eigenheer C, Morel Y, et al. Weight-loss with low or high carbohydrate diet? Int J Obes Relat Metab Disord. 1996 Dec;20(12):1067-72.

Making Smart Protein Choices

- Dairy – low or nonfat (<5 g fat/oz). Dairy fat is often high in saturated fat.
- Fish/shellfish – all varieties (min 2x/week)
- Meat/chicken – lean varieties
- Deli meats – <1 g fat/oz (Deli meat is often very high in sodium)
- Legumes – ½ cup = 1 oz meat. A "green" and healthy choice
- Eggs – an inexpensive source of protein and other nutrients but d/t chol aim for 3-5 yolks per week
- Nuts – excellent source protein but high in fat (2 tbsp = 1 oz meat). Also a healthy "green" choice.





Choosing healthy protein food sources is simple – focus on the lower fat dairy products, lean meats, poultry without the skin, seafood, legumes, eggs, and nuts.

Below is a research article suggesting that higher protein intakes may reduce hunger and promote weight management.

Protein Triggers Weight Loss Hormone

High-Protein Foods Sate Hunger Best – by Setting Off Antiobesity Hormone

By [Daniel J. DeNoon](#)

WebMD Health News

Reviewed by [Louise Chang, MD](#)

Sept. 5, 2006 -- Eating protein triggers a natural [weight](#)-loss hormone, British researchers say.

When released in the gut, the hormone known as PYY reduces [hunger](#). And high-protein foods set off PYY better than other foods, according to Rachel L. Batterham, MD, of University College London, and colleagues.

Recent studies suggest PYY is part of the solution to obesity. Compared with a normal-weight person, for example, an [obese](#) person has to eat twice as many calories to trigger PYY.

"We've now found that increasing the protein content of the diet augments the body's own PYY, helping to reduce hunger and aid [weight loss](#)," Batterham says, in a news release.

If this sounds like [the Atkins Diet](#), Batterham and colleagues say it's not. They note that many people on the Atkins Diet eat a lot of saturated fat as well as a lot of protein.

Obesity, Men, and Mice

Is PYY really the key to obesity? Batterham's team first looked at what kind of food best satisfies hunger. They studied nine obese men and 10 normal-weight men. After brief fasts, the men ate different meals. Each of the meals -- a high-protein meal, a high-fat meal, and a high-carbohydrate meal -- had the same number of calories.

All the men said the high-protein meal best satisfied their hunger. Interestingly, the normal-weight men found the high-fat meal more satisfying than the high-carb meal, while the obese men did not.

Measurements showed the high-protein meal triggered the most PYY in all of the men. In the normal-weight men -- but not the obese men -- the high-fat meal triggered more PYY than the high-carb meal.

Batterham's team genetically engineered a mouse strain that did not have the PYY gene. These mice ate huge amounts of food, and quickly became obese.

Normally, obese mice fed a high-protein diet will eat less and lose weight. But a high-

protein diet didn't help the PYY-defective mice lose weight -- unless they also got PYY treatments.

Hunters vs. Farmers

Why does protein trigger PYY and satisfy hunger so well? It's not entirely clear. But Batterham and colleagues suggest we blame our ancestors.

The prehistoric humans whose genes we inherit had a different diet than we do. They got 19% to 35% of their energy from protein and 22% to 40% from carbs. Our modern diet gets 49% of its energy from carbs and only 16% protein.

"One potential weight loss strategy is therefore to increase the satiating power of the diet and promote weight loss through the addition of dietary protein -- harnessing our own satiety system," Batterham says. "Such a diet is perhaps more typical to that of our hunter-gatherer ancestors."

The findings appear in the September issue of the journal *Cell Metabolism*.

Protein and Weight Management

This research as well as others do support the idea that, if weight loss is your goal, increasing protein intake may help you tame your hunger. It may also help you maintain lean body mass while losing fat mass. Note that I do not recommend going on a steak and vegetable diet but rather to include some protein in every meal and snack. Also, consider that animal protein tends to be high in saturated fat so including some animal protein and plenty of plant sources of protein is likely the best advice.

Healthy Eating Summary for Weight Maintenance

In summary, a healthy eating plan for weight loss and/or maintenance includes:

- Complex carbohydrates including fruits, vegetables, whole grains, nuts, seeds, and legumes
- Healthy fats (monounsaturated and polyunsaturated), minimizing saturated and trans fat intakes
- Target plant-based protein sources and lower fat and lean sources of animal protein. Include some protein in every meal to promote satiety.
- Consume lower energy density and higher nutrient density foods, i.e., fruits, vegetables, legumes, lean animal proteins (unless vegetarian), low-fat dairy products, and whole grains

