Middle and High School Curriculum

NUTRITION 101

student notes

LESSON THREE

PROTEINS, CARBOHYDRATES AND FATS

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NUTRITION 101

LESSON 3
Proteins, Carbohydrates and Fats

STUDENT-FRIENDLY OBJECTIVE

I will have a working knowledge of protein, carbohydrate and fats.

Proteins

• Proteins are the building blocks of any living organism. They are composed of chains of 20 different kinds of amino acids which will form enzymes, antibodies, hormones, hair, nail, bone, teeth, hemoglobin (blood protein), neurotransmitters, skin - really all basic components of any cell in the body.

DIFFERENT KINDS OF PROTEINS

Protein from animal sources, such as meat and milk, are called complete, because they contain all nine of the essential amino acids. Most vegetable protein is considered incomplete because it lacks one or more of the essential amino acids. This can be a concern for someone who doesn't eat meat or milk products; people who eat a vegetarian diet can still get all their essential amino acids by eating a wide variety of protein-rich vegetable foods.

Essential amino acids:

Essential amino acids are amino acids the human body cannot synthesize and therefore needs to be from the diet. Essential amino acids include: valine, threonine, leucine, lysine, isoleucine, methionine, phenyalanine, and tryptophan.

Non-essential amino acids:

Non-essential amino acids can be produced in the body and must not to be thought as unimportant. The body is simply capable of making them on their own. Non-essential amino acids include: Alanine, cysteine, glycine, serine, histidine, tyrosine, cystine, proline, arginine, aspartic acid, glutamic acid, and glutamine.

Eat beans & rice together for a complete protein.

• Proteins are very important and basically, indispensable for growth and maintenance of virtually all cell functions. A few protein forms examples include;

- **Muscle development and movement:** Protein that helps our muscles contract.
- **Antibodies:** A type of protein that defends the body from antigens.
- **Enzymes:** Enzymes speed up all chemical reactions (the enzyme lastase breaks down sugar lactose found in milk).

Carbohydrates

Carbohydrates are built of sugar molecules. A synomyn for carbohydrate is saccarides which is further broken down into 3 main groups: monosaccarides, disaccarides and polysaccarides.

- Basically everything ending in "ose" is a sugar.
- All sugar chemical make up is of carbon, hydrogen, and oxygen. Their configuration and amounts of each will differ slightly.

Carbohydrates are the primary source of energy for the body. Fat is the second source.

1) **Monosaccharides** are simple sugars. The monosaccharides include glucose, galactose, and fructose. The primary difference between them is how your body metabolizes them.

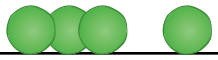
- Glucose is the most basic form of sugar. Glucose is required by all cells in the body for energy. Both the brain needs and red blood cells need it. Glucose is the only form in which sugar can be transported directly into the bloodstream.

- Galactose is a sugar found in lactose or milk. The chemical structures of glucose and galactose are very similar yet due to a slight structural difference, galactose first needs to go to the liver and not directly into the bloodstream like glucose. In the liver, it will convert into glucose to be utilized in the body.

- Fructose is a fruit sugar. Again, the chemical make up is different and therefore the body - digestive system - will need to treat and absorb it differently. Similar to galactose, fructose will need to travel to the liver where it will be converted into glucose and then used by our body's cells.

2) **Disaccharides** are double sugars in which 2 monosaccarides are bound together. This is what we will normally find in our foods.

- Sucrose, table sugar, is the meeting of glucose and fructose.
- Lactose is the joining of glucose and galactose.
- Maltose is the joining of 2 glucoses.



3) Polysaccharides are mostly plant and our complex carbohydrates sugars . They are chains of many monosaccarides.

CARBOHYDRATE FUNCTIONS

1 The primary function of carbohydrates is to provide energy for the body.
2. Amylase is the main enzyme to help break carbohydrates down into glucose.
3. The body prefers to use glucose as the main source of fuel for daily activity.
4. Muscles need glucose to move and organs need glucose to function, including your brain.
5. The key is to eat the right type of carbohydrate, which we will be discussed later.

Carbohydrate Digestive Overview:

Once a carbohydrate enters the mouth, with the help of amylase in the saliva, the digestion and absorption will begin. Amylase is the chemical enzyme that travels from the pancreas that aids in the breakdown. Once the carbohydrate breaks down it is called chyme and a ball of chyme is a bolus. The bolus, with the aid of the muscular rhythmic wave of peristalsis, will journey down the esophagus and into the stomach. Carbohydrates will spend approximately half an hour in the stomach. With more wave like pushes from peristalsis, the carbohydrate bolus will continue in the small intestine where more amylase is secreted to allow further breakdown. Specific enzymes - sucrase, lactase, maltase - will help out to allow for absorption through the lining of the small intestine. The carbohydrate bolus will spend approximately 2 to 6 hours here. Once in the bloodstream, there are a few options that may occur depending on the type of saccaride.

- Absorbed immediately into the bloodstream (like monosaccaride glucose)
- Travel to the liver to be converted into glucose for cell energy (including muscles)
- Stored in the liver for later use
- Excess glucose will be stored in fat cells

TWO CLASSIFICATIONS OF CARBOHYDRATES

The classification depends on the chemical structure of the carbohydrate food and how quickly it is digested and absorbed in the body.

Simple

Simple carbohydrates are broken down quickly. Some simple carbohydrates - like fruits, milks - have beneficial nutrients in them. However, others like processed and refined sugars - store bought baked goods, candy, table sugar, syrups, and soft drinks - are void of any nutrients (vitamins, minerals, and fiber) and actually create more work for the body to digest it.

A sugar fact: In general, the sweeter a sugar the simpler it is.

Complex carbohydrate

Complex carbohydrates are chains of 3 or more single sugar molecules and are called our polysaccharides. These long chains of sugar molecules are storage forms of energy and nutrients. Cellulose, another type of complex carbohydrate, is the main component of fiber (fiber slows the digestion and absorption of sugar).

Food sources: Think color and whole grain: broccoli, legumes, whole wheat, leafy greens.

Fats

FAT FUNCTIONS

- fats from animal & vegetable sources provide energy in the body
- building blocks for cell membranes
- building blocks for a variety of hormones
- fats as part of a meal will slow down absorption therefore making us feel full longer
- act as carriers for fat-soluble vitamins (A,D,E, and K)
- every single living cell in our body requires fatty acids for construction and maintenance
- fats store and carry nutrients around the body
- they provide physical insulation for our body organs
- they help maintain body temperatures and they play myriad of roles in metabolism
- important factor of fats in our diet is that it leaves us feeling sated
- helps maintain our blood sugar

SATURATED FATS

- Saturated fats are formed within the body from carbohydrates and are found in animal fat and tropical oils. At room temperature they are solid or semi solid. Saturated fats are stable.

UNSATURATED FATS

1) Mono unsaturated fats

- Monounsaturated fats are liquid at room temperature, stable, do not readily go rancid (therefore good for cooking). Olive oil, olives, sesame oil, certain nuts, avocados are great examples.
- MOFA is an acronym for monounsaturated fatty acid.
- A short chain MOFA can be found in small quantities in milk.
- A medium chain MOFA can be found in coconut and palm oils.
- Long chain MOFA are found in olive, almond, peanut, pistachio, pecan, and other nut oils as well as in the membranes of plants and animal cells.
- Monounsaturated fatty acids functions to keep arteries supple and skin healthy.

Side note

Canola oil is mostly monounsaturated. It's predominantly made from the seed of genetically modified rape plants which are a member of the mustard family.

2) Poly unsaturated fats

There are two types: **omega-3 alpha linolenic acid** (ALA) and **omega-6 linoleic acid**. They are liquid even when refrigerated. They are unstable and easily become rancid or spoil which is why we store them in the refrigerator.

These fats are defined as essential for several important reasons. They are essential because the body cannot make them, therefore they must be provided from either food or supplements. They are required for normal cell, tissue, gland, and organ function.

1) Omega-3 or alpha linolenic acid (ALA) fatty acids:

- Omega-3 s are polyunsaturated fatty acids.
- Alpha linolenic acid (ALA) which will be converted in the body to eicosapentaenoic (EPA), and docosahexaenoic (DHA). These are important for their anti inflammatory properties, building blocks for hormones, blood clotting, cell growth, and their effect on soothing the nervous system.
- Food sources of omega 3 s include: cold water fish, eggs, and grass fed animals.

2) Omega-6 or linoleic acid fatty acids:

- Omega-6's are also polyunsaturated fatty acids.
- Excess levels of these fats may induce depression, inflammation, and a number of diseases.
- These fats are found in flax seeds, nuts, many processed foods (actually hidden in baked goods and fast food as oils – palm, soybean, rapeseed and sunflower).
- Due to the high intake of processed foods, many people consume more omega 6 fatty acids than omega 3s.

HYDROGENATED FATS

- Hydrogenated fats result from high-heat commercial processing (referred to as trans fatty acids).
- Sources of hydrogenated fats include refined oils, partially hydrogenated oils, shortening, and deep-fried foods.
- These fats are used in processed and store baked foods.

FAT/LIPID REVIEW

- The right fats protect you from disease; however, the wrong fats may create disease by compromising the integrity of the cell membrane.
- Saturated fat is not all that good, but its not particularly bad either, as long as you do not eat too much of it. Your body knows how to burn it for energy.

Good fats

seeds, olives, olive oil, coconut oil, cold- water fish, nuts – walnuts, almonds.

Okay fats

(eaten in moderation): avocados, butter, meats, eggs.

Fats to avoid:

Trans fats mostly present in processed baked foods – cookies and crackers.

Remember!

One of the main differences between simple carbs and complex carbs is how they were processed.