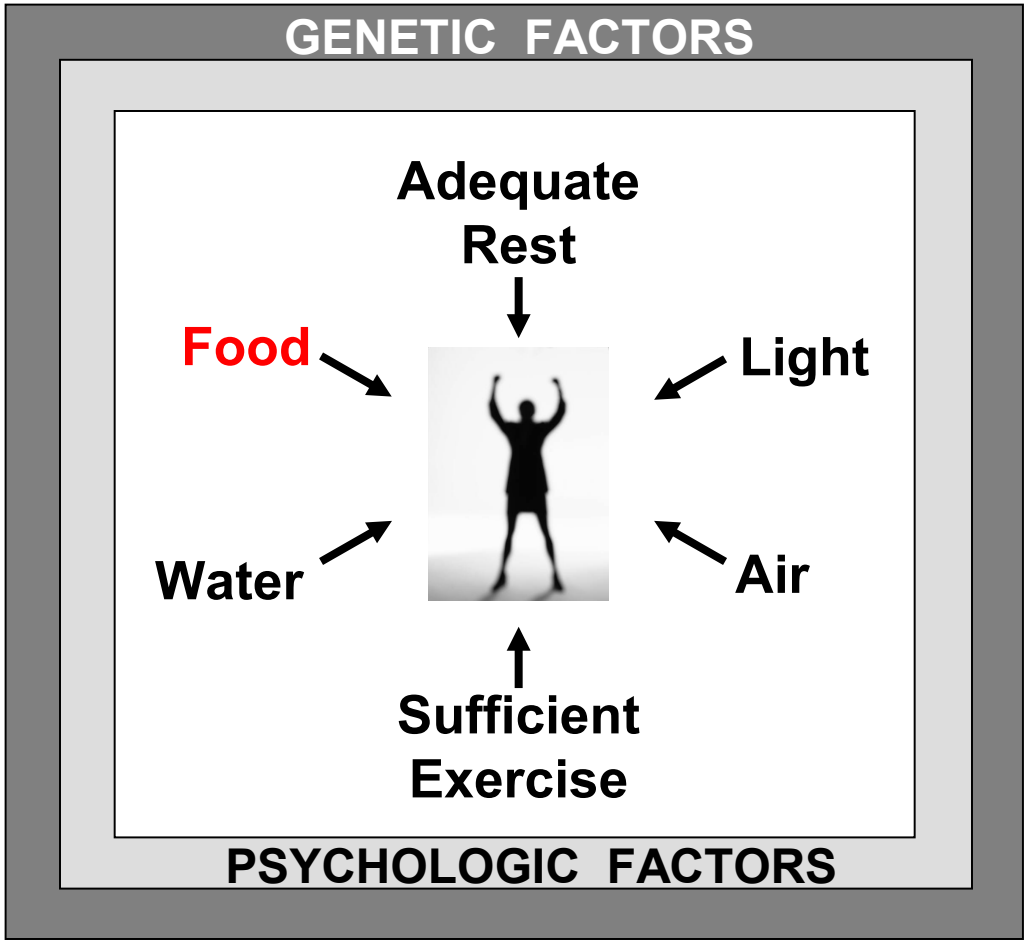
To Your Health

Today's Topic: Proteins

- Disorders and conditions related to protein
- Essential Amino Acids we must eat daily
- Easy to digest and hard to digest proteins
- Protein cautions for vegetarians
- Sleep cycles and ability to function
- Excess protein & kidney health
- Allergies and protein
- Altered proteins
- Basic principles for protein

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



Degeneration is caused by:

- Malnutrition (deficiencies)
- Excesses
- Internal Pollution

(more controllable)

- Genetic Disorders

(less controllable)

- Aging

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

Protein and Degeneration Factors

Most common deficiency in our diets relative to proteins is the inadequate intake of methionine. Dr. Williams, Harvard University, did a study with monkeys. When he gave them a diet deficient ONLY in methionine, they ALL developed athersclerosis.

The most common excess is a high consumption of proteins, especially associated with low-carbohydrate diets. Also, the artificial sweetener called aspartame, which is really two amino acids, can be consumed in excess of the body's requirement.

The most common altered substances associated with proteins are the hydrolyzed proteins, also known as MSG, sodium caseinate, calcium caseinate, etc, and artificial sweetener.

Some Disorder and Condition Associated With Proteins

Genetic, dna related disorders – these are nearly always related to some protein abnormalities with blood, or tissues. (e.g. hemophilia, etc)

Kidney disease – the kidneys are not able to filter the blood properly resulting in waste products and fluid increasing to dangerous levels. Continuous excessive protein can potentially exhaust the kidneys.

Endocrine disorders – hormones are out of balance.

Amyloid diseases (insoluble fibrous protein aggregations sharing specific structural traits), the most significant class of neurodegenerative disorders associated with protein misfolding, are underscored by the aggregation of a specific protein together with a range of other components, such as additional proteins and carbohydrates, which become incorporated into amyloid deposits. (Alzheimers, Parkinsons, Huntingtons, etc)

Allergies – most allergies are associated with proteins and not fats or carbohydrates.

What is Protein?

- Compounds of carbon, hydrogen, oxygen and nitrogen. High quantities are found in meats, dairy, vegetables and grains.

- Protein molecules must be digested and broken down into smaller components called **amino acids** (about 20 types) which the body can then use. The body uses **enzymes** to break protein down**.**

- There are **8 amino acids that are essential** (9 for children) to human health and must be consumed in our daily food intake**.**

- Protein is used for growth and repair of the body. There are over 50,000 life support components made from amino acids. **Within one year about 98% of body protein (tissue) is replaced – therefore your body is made up of what you ate over the last year.** Turnover of tissue proteins varies based on the type of tissues. Here are some of the half-life values: kidney, pancreas, intestinal mucosa and blood plasma - 3 days, liver - 10 days, lung, brain, bone, skin and muscle - 158 days. (A few proteins such as collagen are stable indefinitely)

- There is more protein in your body than anything else except water. (protein is 70-75% of your dry body weight)

- **Excess protein can be used as energy, but is not stored** (when it cannot be used for energy, it puts a load on the kidney for excretion).

Essential Amino Acids

Amino acids are divided into two types, ***essential (8-9)***-which cannot be made in the body, and ***non essential (12-13)***-can be produced in the body from the essential ones.

ESSENTIAL AMMINO ACID	SOME USES IN THE BODY
ISOLEUCINE	proper hemoglobin formation, muscle functions, deficiency in mentally ill, used almost exclusively in protein and enzyme construction.
(HISTADINE) ***- essential for children***	used in red and white blood cells, removes metals, maintains myalin sheaths (nerves), affects digestion
LEUCINE	lowers blood sugar, helps skin & bone healing, corrects congested liver or damaged kidneys, almost exclusively in protein and enzyme construction.
LYSINE	alleviates fatigue, nausea, dizziness, tissue repair, anti-viral, corrects hypoglycemia, helps in absorption of calcium and formation of collagen.
METHIONINE	member of liptropic team (choline & inositol) to produce lecithin, is an antioxidant, neutralizes toxins, deactivates free radicals, removes metals.
PHENYLALANINE	improves learning and memory, inhibits appetite, has been known to increase blood pressure in some people, anti-pain, anti-depressant.
TRYPTOPHAN	induces sleep, lifts depression and anxiety, can reduce headaches, counteracts nicotine, reduces blood pressure & blood fats, raises histamine.
VALINE	works with leucine and isoleucine for oxidations of glucose, strengthens muscle and supports mental and emotional well being
THREONINE	prevents fatty build-up in the liver, constituent of collagen, elastin and enamel protein (deficiency results in irritability)

Essential Amino Acid Requirements Chart

The required amount of essential amino acid is a topic for much debate. The amount you need really depends on what and how much physical exercise you perform and if the body is recovering from injury.

USDA Total protein Recommended Daily Allowance is .8 g/kg/day or .36 g/lb/day, or **for the average male, this works out to roughly 55 grams of protein per day, for the average female 44 grams of protein per day**. **The essential amino acid requirements within that total amount are:**

Amino Acid Requirement Calculator

Enter your weight in lbs		100
Essential Amino Acid	**RDA milligrams /lb**	**Total daily requirement in milligrams**
Histidine	6.4	640
Isoleucine	8.6	860
Leucine	19.1	1910
Lysine	17.3	1730
Methionine	8.6	860
Phenylalanine	15	1500
Threonine	9.1	910
Tryptophan	2.3	230
Valine	10.9	1090

If you have this file digitally, you may enter your weight in lbs. here (not while in PowerPoint show mode) and it will recalculate the amino acids amounts.

A 100 lb person requires a minimum of 36 grams or approx. 1.3 ounces of protein of which about 10 grams or one third is the sum of essential amino acids.

1 Kg = 2.2 lbs
28.4 gms = 1 oz.
1 gm = 1000 mg

RDA sources: http://fnic.nal.usda.gov/nal_display/index.php?info_center=4&tax_level=3&tax_subject=256&topic_id=1342&level3_id=5140

http://www.ifafitness.com/book1/USDA-RDA.htm

Essential Amino Acid – Amounts in Some Typical Foods

	Lentils	White Rice cooked	Peanuts	Soy Nuts	Oatmeal	Tofu	Beef round steak	Chicken	Pork - Ham	Tuna in water	Egg	Skim Milk	Protein Drink
acids shown in mg	1 cup 198 gms	1 cup 186 gms	1 oz 28 gms	1 oz 28 gms	1 cup dry 81 gms	1/2 cup 126 gms	6.5 oz 184 gms	1/2 breast 184 gms	6.5 oz 184 gms	3 oz 85 gms	1 large 50 gms	8 oz. 226 gms	8 oz. water 58.6 g powder
Histidine	503	104	170	125	310	300	1219	906	1168	580	147	227	703
Isoleucine	772	192	236	228	532	500	1543	1540	1430	1125	380	505	2832
Leucine	1295	366	435	375	985	770	2715	2220	2591	1985	533	818	4767
Lysine	1247	160	241	326	538	670	2859	2500	2767	2240	410	663	4625
Methionine	386	195	168	138	552	270	878	816	1394	725	240	210	944
Phenylalanine	1358	385	621	423	1126	840	1340	1180	2460	950	600	403	1463
Threonine	640	158	230	202	441	400	1500	1260	1451	1070	298	377	3162
Tryptophan	160	52	65	68	180	160	384	344	392	273	97	118	852
Valine	887	270	282	228	719	500	1668	1480	1414	1260	437	559	2629
Proteing grams	17.9	4.4	7.3	10	13	10	36	38.3	32.6	21	6	8.4	40
Fat grams	0.75	1.5	13.6	4	5	5.6	31	13.4	19.6	0.7	5.6	0.4	0
Saturated Fat	0.1	0.3	2	0.5	0.9	0.8	13	3.9	8.8	0.1	1.7	0.3	0
Carbohydrate	38.6	53	5.8	5	52	3.7	0	0	5.7	0	0.6	11.8	7
Fiber	15	0.5	2.3	6	8.5	0.5	0	0	0	0	0	0	2
Total Calories	**212**	**240**	**163**	**120**	**300**	**96**	**443**	**317**	**339**	**108**	**79**	**86**	**200**

Note: High quality proteins are those that have low fat, low carbohydrate levels and all essential amino acids. Example from the above chart: soy nuts vs peanuts (higher protein, lower fat), tuna or tofu vs beef (lower calories and lower, healthier fat), etc.

"Complete protein" foods are those that have a complete balance of all the essential amino acids – typically meats and dairy products. Vegetable proteins are not typically complete. Grains are usually very low in lysine but high in methionine while legumes are low in methionine but high in lysine. Combining vegetable proteins is essential to obtaining the complete set of amino acids necessary for the catabolic (breaking down processes) and anabolic (building larger molecules from smaller ones) that goes on in our bodies. An enzyme is a protein which catalyzes biochemical reactions, breaking proteins down into amino acids. Amino acids act like the alphabet for messages in our body. We need all of them.

(It has been determined through research that combination proteins must be eaten within 3 hours)

Protein – Types of Protein

* Stress here is defined as the amount of work the body must do to break down the protein into amino acids.

LOW STRESS PROTEIN FOODS - examples

Sprouts	Eggs	Fermented soy (miso, tempe, tofu)
Coconut milk	Deep ocean fish	Chicken
Cottage Cheese*	Soaked nuts	Yogurt *

* The bacteria that clabber the milk in cheese and yogurt, pre-digest it and make it easier to assimilate

MEDIUM STRESS PROTEIN FOODS - examples

Avocado	Turkey	Cheese*

HIGH STRESS PROTEIN FOODS - examples

Beef	Raw nuts	Cow's Milk
Pork	Peanuts	

Breast milk = 30 minutes stomach digestion time.
Goat's milk = 90 minutes.
Cow's milk = 180-240 minutes

Generally, dairy products from goats and sheep are superior for human nutrition to products from cows because goat milk is more similar to human milk. The fat in cow's milk is a larger molecule, but in goats it is more human-milk sized. This means better digestion.

Some proteins such as soybeans and eggs must be heated before our body can use the protein. Heating helps to break down the proteins.

Protein and Vegetarians

Vegetarians use mostly vegetable and grain sources for their diet.

- It is important for vegetarians to combine grains, beans and other vegetable sources to obtain **complete protein** in their diet. These are preferably combined in the same meal or eaten within a few hours. Withholding an essential amino acid even for a few hours affects synthesis and creates a negative nitrogen balance.
- Vegetarians are **susceptible B12 and folic acid deficiency** because B12 (also known as cobalamin or cyanocobalamin) is found mainly in animal protein. Their adequate intake of folic acid can mask this deficiency. (some symptoms of deficiency are: gastrointestinal weakness, sore tongue, yellow skin and tingling extremities, unusual fatigue, loss of appetite, nausea, loss of menstruation and neurological symptoms)

Some benefits of consuming beans and lentils:

- Low in fat , low in glycemic index.
- Reduces blood cholesterol.
- Contains chemicals the inhibit cancer
- Controls insulin and blood sugar
- Lowers blood pressure
- High fiber for colon health

Vitamin B12 and B6

B-12 also known as methylocobalamin is used by the enzyme methionine synthase to change homocysteine into methionine. When this enzyme is not working, we increase the homocysteine in our system, which recent research has associated with the increased potentiality of heart disease and deterioration of the arteries and nerves. When the homocysteine is high, it appears to be a nerve toxin, as well as a blood vessel toxin.

Elevated homocysteine also happens with deficiencies in B-6 or folic acid. One of the major symptoms of B-12 or folic acid deficiency is macrocytic anemia. Folate, also called folic acid, is needed to turn the uracil into thymidine, an essential building block of DNA. This DNA is needed for production of new red blood cells and for red blood cell division. B-12 is involved because it is involved in the pathway that creates methyl cobalamin. This B-12 also produces a form of folate needed to make DNA. So, **if there is no B-12, folate can become depleted and DNA production slows down.**

Protein – Sleep and Body Repair

The amino acids are distributed in our body via the lymph system, The lymph is a passive system and works better with movement. So **exercise can facilitate all the functions in our body associated with amino acids**.

Tissue repair and amino acid activity is highest during the REM (Rapid Eye Movement) phase of our sleep cycles. We sleep in 90 minute cycles with the middle 30 minutes of deep sleep or(delta or "slow wave activity". Taking substances (e.g. tricyclic antidepressants) that interfere with REM can reduce the body's ability to rejuvenate. Also, if we force ourselves awake in the middle of a cycle, it can slightly impair our cognitive abilities for the whole day.

During times of illness or injury, it is especially important to consume higher levels of quality low stress proteins, and rest adequately.

Excess Protein

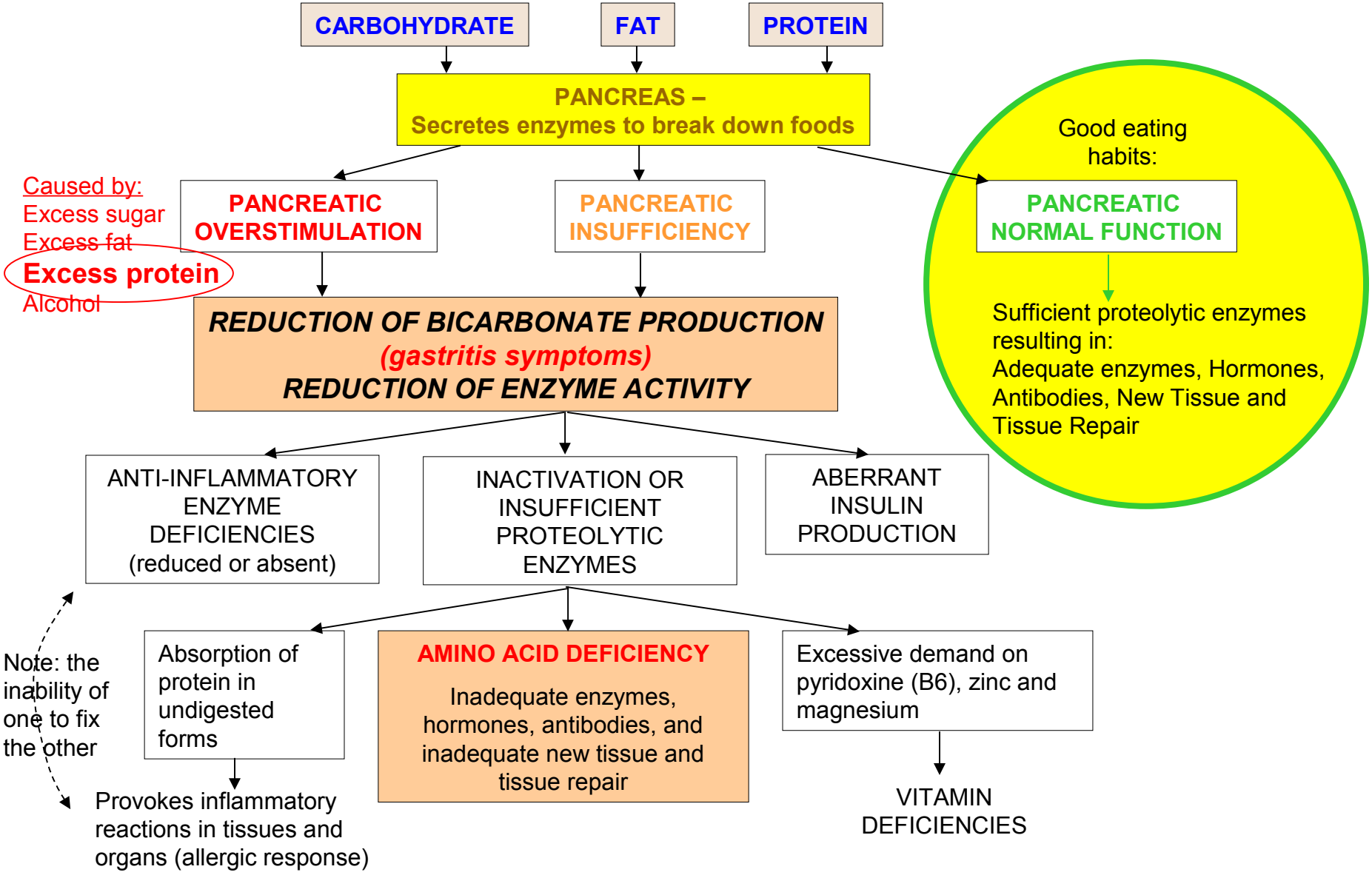
- There is no value in eating excess protein, as much of the **excess is eliminated** in urine and feces. There is no efficient way for the body to keep protein storage. The excess water required to wash out protein by products in a high protein diet can leave a person **dehydrated and constipated**.

- When people start consuming too much protein (over 2.0 g/kg/d), the extra protein can become a stressful stimulus for the kidney. This is even more of a concern **as we get older and our organs are less efficient and effective**.

- Very high levels of dietary protein have also been correlated with increased urinary calcium excretion. The loss of calcium through urine could potentially be harmful for bone turnover, with the added **risk of osteoporosis and kidney stones***. Feb 2004 Reader's Digest reports kidney stone increase in men (29%) and women (46%). Compared with animal protein, vegetable protein, such as is found in soy, causes a much smaller amount of calcium to be lost, leaving more available to strengthen bone (Breslau et al., 1988). Soy may also help prevent further kidney damage by inhibiting oxidation of LDL-cholesterol.

- Protein requires vitamin B6 in order to be metabolized and ultimately utilized in the body. Very high levels of dietary protein **increase the requirement for this B vitamin**.

Excess Protein – Pancreatic Pathway of Amino Acid Metabolism



Protein and Allergies

There are eight types of foods that are accountable for 90% of all food-allergic reactions Some of these foods can cause anaphylaxis. These are called *allergenic foods*:

Peanuts	**Tree nuts (walnuts, pecans, etc.)**	
Shellfish	**Fish**	**Eggs**
Milk	**Soy**	**Wheat**

The most common symptoms of food allergies are:

Hives	Diarrhea
Vomiting	Abdominal cramping

Food allergy and intolerance are often mistaken for one another. While they may share similar symptoms, including diarrhea and vomiting, food allergy is an immune system response while food intolerance occurs when another system of the body (usually the digestive tract) reacts adversely to a food.

For example, one of the most common food intolerances arises in response to lactose, the sugar in milk. Lactose intolerance occurs when a person lacks an enzyme needed to digest this sugar, and the body reacts with gas, bloating, diarrhea, and abdominal pain when milk products containing lactose are consumed. These symptoms occur as a result of intolerance rather than allergy. Other intolerances exist for artificial sweeteners and altered proteins. Often there are supplements that can be taken to offset some intolerances (e.g. lactaids, "BeanO"- for intolerance to beans, etc.)

Protein – Altered Proteins

HYDROLYZED PROTEINS: The most common food additive that is an altered protein is hydrolyzed protein, also known as MSG (Monosodium Glutamate), calcium caseinate, sodium caseinate, textured protein, autolyzed yeast, and other similar names, including 'natural flavorings'. It is added to foods to enhance flavor.
MSG-sensitive people have reported numerous reactions, including simple skin rash, bloating, fatigue, joint pain, shortness or breath, chest pain, severe gastric distress, diarrhea, asthma type symptoms, exercise induced asthma, headache, migraine headache, irregular heart beat, atrial fibrillation, rapid heart beat (called tachycardia), nausea and vomiting, anxiety attacks, depression, hyperactivity in children, mood swings, mouth lesions, flushing, and tremors.

ASPARTAME: Another common substance is Aspartame, a non-calorie artificial sweetener which is really two amino acids, aspartic acid and phenylalanine with methanol. According to the aspartame.org site, a 12 oz. Diet soda provides about 70 mg. of phenylalanine and 50 mg of aspartic acid.
The following symptoms are listed on the Aspartame Consumer Safety Network Fact Sheet: headaches, nausea, vertigo, insomnia, numbness, blurred vision, blindness and other eye problems, memory loss, slurred speech, depression, personality changes, hyperactivity, stomach disorders, seizures, skin lesions, rashes, anxiety attacks, muscle cramping and joint pain, loss of energy, symptoms mimicking heart attacks, hearing loss and ear ringing, and loss or change of taste.

There are many articles, both for and against the use of these substances. Just be aware of the controversy and stay informed. **Most importantly, if you think you are having symptoms from these substances, then eliminate them from your diet and notice if you improve.**

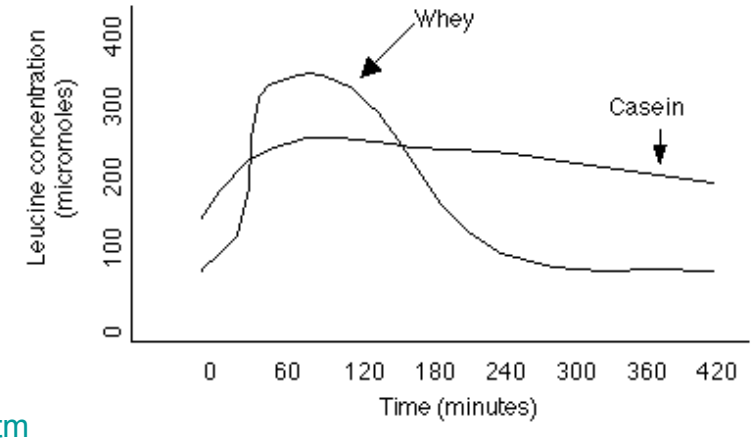
Pro-Aspartame: http://www.aspartame.org
Con-Aspartame: http://www.mercola.com/article/aspartame

Protein - Casein and Whey

- Casein and Whey are proteins extracted from milk and cheese by products. They each have characteristics that can be compared to the high and low glycemic index which is applied to carbohydrates, and represents the speed at which they digest and affect blood glucose and insulin levels. In this study, healthy subjects with a normal protein intake (16% of total calories) were fasted for 10 hours and then given either 30 grams of whey protein or 30 grams of casein (milk) protein. The primary finding of the study was that whey protein caused blood leucine levels (which are used as a marker of a variety of metabolic processes in the body) to increase rapidly, hitting a peak in 1 hour. However leucine levels decreased equally rapidly returning to normal by 4 hours. In contrast, casein caused a much slower rise in blood leucine levels, reaching a lower peak around 1 hour, but maintained that level for almost 7 hours (see figure below)
- Casein is structured in voluminous globules. These globules are mainly responsible for the white color of the milk. According to various species, the casein amount within the total proteins of the milk varies.
- Casein is the most abundant protein present in milk. It is considered a high quality protein because it is easily assimilated and it supplies sufficient quantities of amino acids that cannot be synthesized by the body.
  Another benefit is increased satiety (feeling of fullness or satisfaction). Casein exerts a slight pressure on the stomach walls. In effect, this pressure signals to the brain to stop eating because the stomach is full.
- Casein is the most slowly digested and absorbed type of protein. This helps create a "timed-release" effect, providing a steady stream of amino acids to your muscles over a long period of time. The net result is a greatly enhanced anti-catabolic environment which is much more friendly to growth and recovery.

Note: Casein, Whey and also Soy Isolates are used in protein supplements and powders for body builders, athletes and sometimes for the elderly or for healing injuries. <u>These are highly concentrated forms of protein to be used with careful understanding.</u>

Figure 1: Time course for whey vs. casein



http://www.thinkmuscle.com/articles/mcdonald/protein-01.htm

Proteins – Simple Principles

- **Eat proteins during the day and not late at night. Include protein in your breakfast.**
- **Eat appropriate amounts of complete high quality, low stress protein foods - those that are low in carbohydrates and fats, especially saturated fats .**
- **Get plenty of good rest. Sleep in full cycles.**
- **Exercise regularly.**
- **Avoid altered proteins or proteins that you are intolerant or allergic to.**

Book and Web Sites

A book on **Food compositions** (protein, fat, carbohydrate)
Nutrition Almanac by Lavon J. Dunne (McGraw Hill)
ISBN: ISBN-13: 9780071373388

Good Websites:

How protein is changed by heat (frying an egg)- fun for children to see:
http://www.sumanasinc.com/webcontent/anisamples/nonmajorsbiology/proteinstructure.html
(be sure to click on the "narrated" icon, then press the play button) This may only work on your home computer.

RDA sources: for total protein http://www.ifafitness.com/book/USDA-RDA.htm

For calculating essential amino acids (also a vegan site): (remember 1 kg = 2.2 lbs)
http://www.vegtalk.org/vegan-nutrients/essential-amino-acids-vegan-diet-t2558.html

For body builders and those interested in protein supplements:
http://www.thinkmuscle.com/articles/mcdonald/protein-01.htm

Amazing website on everything about cells, amino acids, etc. (this is an animation website):
http://www.johnkyrk.com