Protein - Complete and Incomplete

Summary

The relationship between how an individual looks and feels and the nutrients he or she eats.

Main Core Tie

Food And Nutrition I

Strand 4 Standard 1

Background for Teachers

Protein is one of the most important nutrients in our food because it is the chief constituent of the body cells, of body tissues and of body fluids.

Protein has multiple functions:

- build and repair body tissue.
- maintain cell growth in the formation of new body tissue. This is especially important if the body is growing rapidly, injured, or under stress.
- aid in the formation of enzymes, some hormones and antibodies.
- provide as energy if sufficient carbohydrates and fats are not supplied by the diet.

Individuals must supply themselves with fresh protein daily, since proteins are constantly needed to replace the wear and tear of the tissues and keep up the protein concentration in the blood serum. Protein can take the place of some fat and carbohydrate, but fat and carbohydrate cannot serve in place of the body's need for protein. That is why the minimum amount of protein, from a good source, must be consumed daily.

The best animal sources of protein for optimum health are milk, eggs, cheese and lean meat. It is not necessary, however, to devour pounds of steak, dozens of eggs or gallons of milk daily for that purpose. In fact, excessive amounts of these foods may do more harm than good.

Amino acids are the chemical building blocks from which new proteins are made. The value of proteins is dependent upon combinations of amino acids that build the protein. There are nine amino acids that are essential to human health and nutrition. A food that has all the essential amino acids an individual needs is called a complete protein. Complete proteins support growth and normal maintenance of body tissues. All animal proteins are complete proteins: i.e. milk, eggs, cheese, fish and meat have all 9 amino acids. Proteins from some plant sources, such as brewer's yeast, certain nuts, soybeans (tofu is made from soybeans), cottonseed, and the germ of grains are also complete proteins.

Partially complete proteins do not contain all 9 of the essential amino acids but a limited amount of one or more of them. Partially complete amino acids provide normal maintenance but will not support growth.

Some plant foods contain protein, but do not have all the essential amino acids the human body needs. They are called incomplete proteins. Incomplete proteins lack one or more essential amino acids but will neither support growth or provide normal maintenance of body tissues. We can obtain some protein from nuts, legumes, beans (navy and lima), grains/cereals, lentils and peas, but the proteins from these sources do not contain all the essential amino acids and are not as easily absorbed as the animal proteins. Other vegetables contain some protein but not all the essential amino acids. Rice, wheat and corn, for example, are missing some of the nine essential amino acids, but grains combined with other foods are major protein sources in many countries. Some vegetables are only missing a few essential amino acids while others are so deficient that they can't repair tissue. It is important to have a variety of foods to make certain the body gets all of the essential amino acids. There are various ways to make protein complete:

by combining plant and animal foods
by combining plant proteins from a variety of cereals and grains

For example: peanut butter lacks 3 amino acids. By spreading it on buttered whole wheat (not white) bread and serving it with a glass of milk or some yogurt it becomes a complete protein. NOTE TO TEACHER: Display example using real food or food models.

Protein needs are influenced by:

age
body size
quality of the proteins
physical state of the person

Proteins are needed at all meals but especially at breakfast to replenish amino acids used for growth and maintenance during the night. Excess protein not immediately needed by the body is converted to fat and stored in adipose tissues to be used as energy. Unfortunately it cannot be converted back to amino acids.

Deficiencies of protein can cause tiredness, loss of weight, lack of energy. In children growth can be stunted. Lack of sufficient protein can lower the body's resistance to disease. Prolonged lack of protein can result in liver damage and eventual death may result.

Americans had long thought that the best source of protein was meat--any kind, anywhere. It has since been determined that we don't need to consume as much meat as we have been to meet the daily protein requirement. Additionally, meat is usually high in saturated fat. Therefore, MyPyramid's daily recommendations for its Meat and Beans Group is smaller than in the previous Food Pyramid. It also suggests that when we do consume meat, we prepare it using low-fat methods (grilling, baking, broiling). Other suggested protein sources in MyPyramid's purple band are beans, eggs, and nuts. So, when you look at that purple band on MyPyramid, foods in the wide base (more recommended) would be baked chicken breast, tofu, or black beans. At the apex (eat sparingly) would be fried chicken and cheeseburgers.

Vegetarians have long argued that it is possible, with careful planning, to meet daily protein requirements without consuming animal sources. Vegetarians fall into the following groups:

Vegans: consume foods only from plant sources
Lacto-vegetarians: eat foods from plant sources and dairy products
Ovo-vegetarians: eat foods from plant sources and eggs
Lacto-ovo vegetarians: eat foods from plant sources, dairy products, and eggs
Semi-vegetarians: eat no red meat, but eat poultry and seafood

Most vegetarians enjoy health benefits from eating a diet that is generally high in fiber and low in saturated fats and cholesterol. Vegetarianism doesn't guarantee proper nutrition. Just as every other population, vegetarians need to be mindful of fat intake and calorie intake. They also need to take special care to ensure adequate consumption of certain vitamins and minerals that are not supplied by a diet rich in plant sources. These nutrients include: zinc, calcium, iron, Vitamin D, and Vitamin B12. (*Food For Today*, Kowtaluk, 2006).

ILLUSTRATED LECTURES TO AID IN UNDERSTANDING AMINO ACIDS

Make a model of an amino acid chain using construction paper. Each amino acid on the chain should be a different color. If one color is missing the next link cannot connect, and the chain is broken. Point out to the students that some foods contain complete as well as incomplete chains, and some foods contain incomplete chains only. Guide the students to the understanding that whenever incomplete chains are present, the missing links (amino acids) need to be provided by other foods or the chains will go unused and be excreted by the body. Break the paper amino acid chain by removing one link. Pose the question, "How can you correct for a missing link?"

Hold up food models or pictures that are complete and incomplete proteins. Then put several

foods together to supplement the missing amino acids and simulate a complete protein.

- peas and pasta
- beans and bread
- peanut butter and wheat bread or peanuts and wheat
- red beans and rice

Extend plant proteins with small amounts of animal proteins:

- chicken and rice
- chili con carne
- macaroni and cheese
- tuna noodle casserole

On chalkboard draw a ladder with broken and missing rungs to represent incomplete proteins. Show how the ladder can be repaired.

PROTEIN SPARING

Animal foods such as red meats have traditionally been plentiful and over-used in the U.S. diet, and historically U.S. people have consumed more of these foods than are needed. Animal foods are expensive in terms of resources. Animal proteins can be extended and resources spared by combining them with plant proteins or carbohydrate foods that extend or "spare" proteins.

Define and discuss the concept of protein sparing using the following questions as a guide.

- How does the body use protein when there are insufficient carbohydrates and fats in the diet?
- What are the side effects of using protein in this way?
- What are the disadvantages of consuming a high protein diet?
- Is it possible to have too much protein?
- How much protein is required each day?
- What foods could be eaten to meet this requirement?

NOTE TO TEACHER: Milk is often thought of as a protein product. The discussion of milk has been put into Unit IV as a skill supplement to minerals. Please refer back to that unit as a reference.

Instructional Procedures

LEARNING ACTIVITIES AND TEACHING STRATEGIES

OPTION #1

As an introduction use the PROTEIN STUDY GUIDE as a basis for lecture or discussion on the importance of proteins.

Have students take notes on protein or continue using the SIX ESSENTIAL NUTRIENTS worksheet found in the MyPyramid discussion section. Add to the bulletin board display.

As students take notes, list the functions of protein on the chalkboard. Ask the students to rank them in order of importance to the body. Functions could also be listed on word strips so they could be rearranged in order of importance. Ask the question "Why do nutritionists state that protein is a non-preferred energy source?"

Possible answers to above question - The heart is made of muscle and that's why protein should be the body's last energy source. Eating disorders affect the body's use of protein as energy (anorexia).

OPTION #2

Have the students complete PROTEIN HUNT. Discuss the results and guide students to the following conclusions:

- Protein does not always equal red meat.
- Patterns of protein consumption are changing.
- Patterns of protein consumption are related to culture.
- Protein is essential to good health.

VARIATION: Find pictures of food showing either complete or incomplete protein. Fill out PROTEIN HUNT according to the pictures they find.

VARIATION: Complete a poultry hunt, seafood hunt, lentils hunt, etc. using the same procedures of finding pictures as instructed in variation #1.

OPTION #3

Have the students determine their daily protein requirement and the formula found on the worksheet GETTING YOUR SHARE OF PROTEIN. Have the students use the formula results to analyze their daily intake OR have students pull from HEALTH HABIT DIARY for their daily intake. Put the formula on the board so they can check the protein in their own diet.

VARIATION: Use the protein range for a 2,000 calorie/day diet as a basis for students to enter a "Make a Recipe" contest. Have students develop a recipe that provides the amount of protein the student needs each day. Give prizes to the best recipes. If time allows, have students prepare the prize winning recipe.

OPTION #4

Provide a sample of tofu as a feeling and tasting experience by demonstration or by student lab using the recipe ORIENTAL STIR FRY and/or ORIENTAL NOODLE SOUP.

BACKGROUND INFORMATION ON TOFU: Soybeans are the best source of protein among the wide variety of beans. Tofu is a high protein food made from soybean milk. The Oriental people have used it for centuries. It is also known as bean curd. Because it is high-quality protein it is a good substitute for meat and dairy products. Tofu has a bland flavor and a porous and creamy texture. It can be eaten raw in salads, cooked alone or combined with other foods in casseroles, soups and stir-frys. Tofu is easily digested and contains many vitamins and minerals, especially the B vitamins, vitamin E, iron and potassium, as well as protein. Tofu is low in fat and calories, containing no saturated fat or cholesterol. It is being used in the manufacturing of imitation dairy, egg, and meat products.

OPTION #5

As a protein lab experience, have students prepare a variety of snacks using recipes high in protein. Do a round robin tasting experience.

Discuss the advantages of eating nutritious snacks rather than all sweets. See HIGH PROTEIN SNACK RECIPES.

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