EVALUATING ACADEMIC READINESS

Revised for

FOR APPRENTICESHIP TRAINING

SCIENCE SKILLS
BASIC FOOD GROUPS AND NUTRITION

AN ACADEMIC SKILLS MANUAL
for
The Food Preparation Trades

This trade group includes the following trades:
Baker & Cook and
Retail Meat Cutter

Workplace Support Services Branch
Ontario Ministry of Training, Colleges and Universities

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In preparing these Academic Skills Manuals we have used passages, diagrams and questions similar to those an apprentice might find in a text, guide or trade manual.

This trade related material is not intended to instruct you in your trade. It is used only to demonstrate how understanding an academic skill will help you find and use the information you need.

SCIENCE SKILLS
BASIC FOOD GROUPS AND NUTRITION

An academic skill required for the study of the Food Preparation Trades

INTRODUCTION

Because humans can't capture energy from the sun in the way that plants can, we depend on a regular supply of food. Our food provides the energy our bodies need to carry out all the metabolic functions that keep us alive. We also need to eat different nutrients that provide the raw materials that our cells need to maintain growth and repair. All the energy and nutrients we need to stay healthy come from the food we eat.

We use the energy from food to stay active. Some foods provide lots of calories for energy but not many nutrients. Other foods are rich in nutrients but don't offer much energy. We need lots of different types of food to meet all our requirements. Once food is eaten and digested, our body uses the energy and nutrients as the basic resources needed to grow and develop, to respond to the environment and to send messages between the different body systems.

Our cells need the basic molecules obtained from food as building blocks to construct new molecules used for cell maintenance and repair. For example, bone marrow makes new blood cells using iron we get from eating meat. Our DNA is replicated from molecules floating in the cytoplasm every time our cells divide.

We need to eat a wide range of foods in order to get all the resources our body requires. The different types of foods are classified into basic groups. The main food groups are carbohydrates, proteins and fats. We also need vitamins and minerals.

Although we need a certain amount of food from each of the food groups, a growing concern in the food industry today is the amount of fat, sugar and salt present in prepared food. If you know the basic types and relative amounts of the different foods and nutrients required, you can interpret the ingredients in prepared foods. You will also be able to explain to a client the nutritional value of the foods you prepare.

The food preparation trades deal with many different types of foods. A basic knowledge of food groups and nutrition will give you a better understanding of the materials you work with. In this skills manual, we will look at the main food groups, the need for vitamins and minerals and what is required for a balanced diet. This skills manual describes the following:

- Basic food groups
- Vitamins and minerals
- Nutritional requirements

BASIC FOOD GROUPS

Food is classified into three basic groups. This classification is based on the nutritional properties of various foods and their importance in human nutrition. The major food groups are:

- carbohydrates
- proteins
- fats

Other nutrients that the body needs to maintain a healthy state are:

- vitamins,
- fibre,
- water and
- minerals.

The Canada Food Guide recommends the types and proportions of foods from the different groups that should be eaten to maintain a healthy lifestyle.

Carbohydrates

Carbohydrates are an important food group that provides the body with much of its ***energy*** or calorie requirements. Carbohydrate molecules are combinations of carbon, hydrogen and oxygen. The ratio of hydrogen to oxygen is two to one, the same ratio as in a water molecule.

Carbohydrate molecules are classified into different categories. The two main categories are simple carbohydrates and complex carbohydrates.

Simple sugars

The simple carbohydrate molecules are called sugars:

- Some common sugars are glucose, sucrose, fructose and lactose.
- The simplest sugar is called glucose.
- Two molecules of glucose can join together to form sugars such as sucrose and lactose.

Glucose is the sugar transported by the blood system throughout the body. The amount of glucose in the blood is closely regulated so that the level remains fairly constant. When a person's sugar regulatory system doesn't work correctly, the person has diabetes.

Sucrose is common table sugar. It is used as a sweetener in many different food preparations, including baking, snacks and drinks. It is usually obtained from sugar cane plants.

Lactose is the sugar found in milk. Because milk sugars were only consumed by children until agriculture became established, some people lack the enzyme to digest lactose when they become adults. Milk products with most of the lactose removed are now available.

High fructose corn syrup is replacing sucrose as a sweetener in the food industry. The glucose in corn syrup is treated by enzymes to change it into fructose, which is sweeter tasting than glucose. High fructose syrup is becoming popular because subsidies on corn production and tariffs on cane sugar make it cheaper to use as a sweetener. It is easier to transport and blend into food preparations because it comes in a liquid form. There is some controversy over its use because it doesn't trigger the insulin reaction that the body uses to regulate the amount of sugar in the blood.

Complex sugars

When larger numbers of sugar molecules are joined together, ***polysaccharide***s are formed.

- Polysaccharides are used to store carbohydrates for future use by plants and animals.
- In plants, the most common polysaccharide is called ***starch***.
- In animals, it is called ***glycogen***.

Because plants store carbohydrates as starch, many grains, fruits and vegetables contain ***starch,*** which is considered a complex carbohydrate when it is not refined. White flour and rice are processed so that they are lighter in texture and colour. However, the refining process removes the germ, which is a source of nutrients, and the outer coating or bran, which is a source of fibre. Complex carbohydrates are found in many other foods such as fruits, vegetables and milk products. These foods provide the body with different nutrients along with energy from their carbohydrate components.

Proteins

Proteins are an important food group. The human body has thousands of different proteins, each with a specific structure and function.

- Proteins are used for structural support, movement of muscles, transportation of other substances, hormonal signaling between different areas of the body and defense against invaders.
- As ***enzymes,*** proteins play a vital role in cell functions. Enzymes increase the rate of chemical reactions in the cell and regulate much of the cell's activities.

Proteins are made of chains of amino acids. **Amino acids** are molecules that have carbon, hydrogen, oxygen and nitrogen as their basic components.

Amino acids are divided into essential amino acids and non-essential.

- There are nine essential amino acids.
- Essential amino acids must be obtained from food sources.
- There are eleven non-essential amino acids.
- Non-essential amino acids can be made by the body from other amino acids.

Most meats and some vegetable sources are called complete proteins because they contain all the essential amino acids the body needs in the correct proportion. However, not all the essential amino acids need to be eaten at the same time or from a single source. As long as the diet includes a variety of protein foods, the body will usually get all the amino acids it needs.

Fats

Fats are a diverse group of nutrients that do not dissolve in water. They are also called lipids. Fats provide a high amount of calories or energy. They are also used by the body for both structural and maintenance functions.

In the food industry, fats are divided into the categories *Fats* and *Oils* depending on whether they are solid or liquid at room temperature.

- Fats are solids at room temperature.
- Many fats in the diet come from animal sources.
- Animal sources of fats include butter, lard, suet and the fat in meat.
- Fat is obtained from milk, within meat muscle tissue and under the skin of meats.
- Oils are liquids at room temperature.
- Many edible oils come from plant sources. Oil is also obtained from fish.
- Plant sources of oils include the seeds of corn, soybean, olive, sesame, coconut, sunflower and peanut plants.
- These oils can be made into margarine and shortening.

Fats are also divided into ***saturated fats*** and ***unsaturated fats***.

- Saturated fats have more hydrogen atoms bonded to the carbon chain, so it is saturated with hydrogen.
- Unsaturated fats have fewer hydrogen atoms. The carbon atom forms a double bond with a neighbouring carbon atom instead of adding another hydrogen.

Most animal fats are saturated while fish and plant fats (oils) are unsaturated. Oils are described as monounsaturated and polyunsaturated.

- Monounsaturated oils have one double carbon bond.
- Polyunsaturated oils have many double carbon bonds.
- When oils are made into margarine and shortening to make them easier to handle and more palatable in the consumer market, hydrogen is synthetically added, changing the oil to a saturated fat called a trans-fat.

Because there is some concern that trans-fats increase the occurrence of heart disease, their use is being regulated in the food industry.

Although too much fat in the diet can cause obesity and other health issues, a certain amount of fat is necessary in maintaining good health.

- Fats are an important energy source for the body. Stored fat can provide energy when it is needed.
- Fat forms an important part of skin, hair and cell membranes,
- Fat insulates body organs and it helps maintain body temperature.
- Fat soluble vitamins such as vitamin A, D, E and K must be digested, absorbed and transported along with fats from the diet.
- Consumed fats also provide essential fatty acids, which the body needs in small amounts but can’t make.

- Fats act as a buffer by storing harmful substances in fat tissue until the body can get rid of them by other methods.

VITAMINS AND MINERALS

There are certain nutritional requirements our body needs in small amounts but can't manufacture (*synthesize*) from basic food building blocks. Most of these nutrients are called vitamins and minerals. For example, unlike most animals, we can't make vitamin C, even though our cells have access to the basic materials. We need to get vitamin C by eating fruits and vegetables.

Vitamins

Vitamins are organic compounds that are required in tiny amounts compared to carbohydrates, proteins and fats, which are required in relatively large amounts. Vitamins are considered essential nutrients because they can't be synthesized by the body. They must be obtained through the food that is eaten. Recently, vitamins have become available in supplemental form and they are added to many food products.

The different vitamins have quite diverse roles in the body. Thirteen vitamins have been identified so far. They are divided into two categories:

- Water soluble vitamins include the B complex and vitamin C.
    - B complex vitamins function as enzymes in key metabolic processes. These are the processes the cell uses to maintain life and to grow and develop.
    - Vitamin C is required for the production of connective tissue throughout the body and it acts as an antioxidant.

- Excess water soluble vitamins are excreted and overdoses are usually harmless.

- Fat soluble vitamins include A, D, E and K.
    - Vitamin A is a component of the visual pigments of the eye. It is needed for maintenance of skin and helps prevent damage to cell membranes.
    - Vitamin D promotes bone growth and aids in the absorption of calcium and phosphorus.
    - Vitamin E is an antioxidant and helps prevent damage to cell membranes.
    - Vitamin K is important in blood clotting.

- Because fat soluble vitamins are deposited in fat tissue, excess amounts can result in the accumulation of toxic levels.

Although vitamins are only required in small amounts, vitamin deficiencies can cause severe problems, ranging from scurvy to bone deformities. A growing child needs certain vitamins as it develops to make healthy skin, bones and muscles.

Vitamins are obtained from many different food sources. Meat, dairy products, whole grains, nuts, vegetables, fruits eggs, oils and seeds all contain differing amounts of vitamins. When foods are over-refined or overcooked, they lose many of their vitamins. Maintaining a reasonable

amount of vitamins in processed foods is a challenge to the food preparation trades. Fortifying foods with added vitamins is one way to address deficiencies.

Minerals

Minerals are naturally occurring solid substances that come from the ground. The minerals we get in our food come from material absorbed from the ground by plants through their roots. When animals eat the plants, the minerals enter their systems. Some animals get minerals directly when they lick salt or ingest soil along with their food.

There is a long list of minerals required by the body in differing amounts. However, the amount of mineral nutrients required is much less than the amounts of carbohydrates, proteins and fats needed. The following minerals are required by the body:

- Calcium is the mineral required in the largest amount. It is the primary component of our bones and teeth. It is also important in nerve and muscle function. Dairy products are the major source of calcium, along with nuts and legumes.
- Phosphorus is also a part of the construction and maintenance of bones and teeth. It is an important part of the cycle involved with respiration. Phosphorus comes from meats, dairy and grains.
- Sulfur is a part of certain amino acids which are used to make proteins. It is found in the broccoli family of plants and in most protein sources.
- Sodium and chlorine are part of the function of nerves and they play a major role in maintaining the balance of water inside and outside of cells. We get both of these minerals, in overly large amounts, from the salt added to food.
- Iron is an important component of red blood cells. It is mostly obtained from red meat and eggs. A lack of iron leads to anemia.
- Trace minerals such as magnesium, manganese, copper and iodine are part of different enzymes and proteins. A balanced diet usually provides the needed amounts of these minerals.

NUTRITIONAL REQUIREMENTS

Scientists working with the food preparation trades have studied the variety and amount of food needed for maintaining a healthy body. In Canada, the recommendations are listed in the Canada Food Guide. As new information is discovered, the guide is revised and updated.

Foods are divided into different categories. Some highlights from the main groups include:

- ***Fruits and vegetables:*** An average adult needs around seven serving of fruits and vegetables every day. One serving of vegetables is about half a cup. Eat a variety of types with different colours, textures and tastes.

- ***Grain products:*** Grains include wheat, rice, oats, barley and rye. Most grains are high in fibre and low in fat. Fibre isn't really a nutrient but it is important for digestion and regulating appetite. The guide recommends that an adult eat around 6 servings of grain products a day. One slice of bread, half a cup of cereal and half a cup of pasta makes one serving of grains. Whole grains contain more nutrients than refined grains

- ***Milk and milk alternatives:*** This group includes milk, yogurt, cheese and fortified soy beverage. Adults and children need two to three servings while teenagers need three to four. One cup of milk, ¾ cups of yogurt and 50 grams of cheese makes one serving, milk is the best source of dietary calcium, needed for strong teeth and bones.

- ***Meat and alternatives:*** Meat includes chicken, turkey, beef, pork and wild meats. Fish and seafood are good alternatives to meat. The group also includes beans, eggs, lentils, nuts – all foods that contain protein and other nutrients such as iron, magnesium and B vitamins. Adults need two to three servings of meat or an alternative. One serving of meat, fish and seafood is about 75 grams or half a cup. Two eggs, ¾ cups of baked beans and two tablespoons of peanut butter make a serving of a meat alternative.

- ***Oils and fats***: Only small amounts of oils and fats are needed. The guide recommends two to three tablespoons of mostly unsaturated oil each day.

- ***Beverages:*** Water is needed by the body every day for many different functions. Although we get water from many different drinks, the guide recommends plain water as the ideal beverage. More water should be drunk when exercising and when it is hot.

The guide also recommends limiting the amounts of food high in calories, fats, sugar and salt. There are many health benefits to be gained from following the food guide. These include a healthy body weight, better overall health, more energy and stronger muscles and bones. Good eating habits promote lower risk of f heart disease, diabetes, osteoporosis, and certain cancers.

CONCLUSION

The human body is made from many different elements. Only plants can harvest the energy from the sun, so we have to eat plants and animals, in order to obtain the materials we need for growth and development. We need to consume a certain amount of calories every day to provide the body with energy to run all its basic functions. These calories come from the three food groups, carbohydrates, proteins and fats.

These food groups also provide the body with certain food requirements that the body needs but can't make on its own. Many of these nutrients are called vitamins and minerals. Small amounts of all the vitamins are essential to maintain a healthy body. Minerals such as calcium and iron are also required. The best source of information on what kinds of food to eat and how much is provided by Canada's Food Guide.

Workers involved in the food preparation trades have a strong influence on the food that people eat. It is important for you to be aware of the nutritional value of different foods. It is also helpful to know the different categories that food groups are divided into and what each group contributes to good health. Most people depend on the food preparation trades to provide the food they eat. Knowing what is required for a balanced diet can broaden your understanding of the role food plays in a healthy lifestyle.

Answer the following questions by putting the correct word in the blank space. The answers are on the next page.

Carbohydrates	bones	liquid	enzymes	vitamins	seven
food	trans-fats	starch	Food Guide	glucose	amino acids

1. Humans can't make their own energy from the sun but must get it from the _____ they eat.
2. _____ are an important food group that provides the body with much of its energy or calorie requirements.
3. The simple sugar that is carried in the blood stream is called _____ .
4. Complex carbohydrates are stored in plants in the form of _____ .
5. Proteins play an important role in cell functions when they act as _____, increasing the rate of chemical reactions and regulating the cell's activities.
6. Proteins are made of chains of _____ _____.
7. Oils are _____ at room temperature. Most come from plant sources.
8. When oils are made into margarine and shortening, hydrogen is synthetically added, changing the oil to a saturated fat called a _____.
9. Nutrients that can't be made by the body but which must be ingested in small quantities are called _____ and minerals.
10. Calcium is required for strong teeth and _____.
11. The average adult needs around _____ servings of fruits and vegetables every day.
12. There are many health benefits to be gained from following Canada's _____ _____ ..

ANSWER PAGE

1. food
2. Carbohydrates
3. glucose
4. starch
5. enzymes
6. amino acids
7. liquid
8. trans-fat
9. vitamins
10. bones
11. seven
12. Food Guide