

# Nutrition

**Nutrition:** (1) the act or process of nourishing or being nourished; (2) the sum of the processes by which an animal or plant takes in and uses food substances; (3) the scientific study of food and drink



## What is nutrition?

If we look back over generations and generations, as far back as the beginning of all the stories, we would see that until very recently, the vast majority of human activity everywhere in the world focused on gathering, hunting, growing and preparing food. Even today, we spend lots of time focused on food. If we don't hunt, gather or grow the food ourselves, we still spend time going to the grocery store, preparing meals and eating.

*Have you ever spent a long time watching a small bird or animal?  
How do they spend most of their time?*

Scientists believe this huge effort to get food, is programmed into us (and all animals) at the most basic level. We need food to grow, to move and to think; without food we die. They actually believe that our natural state is to be hungry - by eating we only "turn off" hunger for a limited period of time: it always comes back.

For scientists, nutrition is the study of how food and eating habits impact health.

*What do you eat every day?  
Do you know how it impacts your health?*



## The importance of food

We need to eat in order to stay healthy, but the importance of food goes beyond physical health. Food plays a central role in our spiritual and emotional lives too.

We come together through food: eating family meals, going on hunting trips, or gathering plants and herbs. We celebrate with food: feasting for holidays and significant life events such as baby namings and weddings. We also honour, worship and give thanks with food. In some cultures, a traditional feast is held to help a recently deceased relative enter the spirit world.

*What role does food play in your life?*

As you learn about the science of nutrition, it is important to remember the others ways in which food nourishes your life.



## Nutrients

At the simplest level, all of the food we eat or drink is made up of molecules. If we could look at soda, cloud berries, caribou, hamburger or salmon under a very powerful microscope we could see how those molecules join together to make up the nutrients we need for good health.

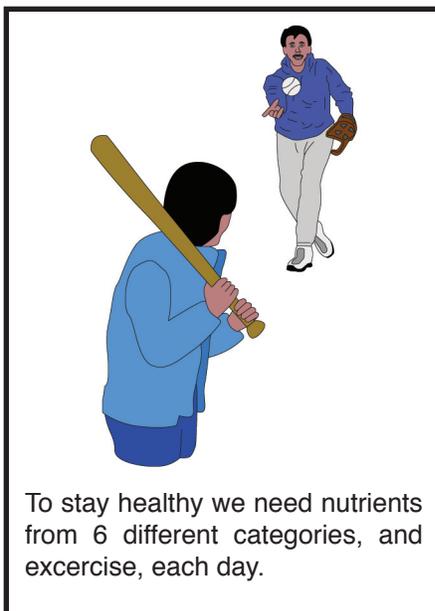


*If you looked at a drop of soda under a very powerful microscope, what do you think you would see?*

When people are hungry enough, they'll eat just about anything. But not all food is created equal. Some foods are a good source of nutrients, others are not. And nutrients are the key to good health. In fact, food engineers and scientists are now beginning to believe that "there are no essential foods – only essential nutrients." (Harold Draper in Gadsby p.50)



*Think about the foods you eat.  
Which ones do you think are a good source of nutrients?  
Which ones have little nutritional value?*



To stay healthy we need nutrients from 6 different categories, and exercise, each day.

Nutrients are the vitamins, minerals etc. in the food we eat. There are more than 50 nutrients we need for growth, development and health maintenance. Our bodies take in nutrients, and break them down into smaller, useable parts like sugars and amino acids. Some recombine and contribute to tissue growth or the maintenance of body processes like digestion. Others are converted directly into energy to help us walk, run and think.

Nutrients fall into 6 main categories: carbohydrates, fats, proteins, vitamins, minerals and water. Despite what you may hear about the latest diet fashions, we need nutrients from each of these categories in order to remain healthy. The first three categories – carbohydrates, fats and proteins – are known as the macronutrients because we need relatively large quantities of these nutrients to ensure growth and health.

*How do you think scientists refer to the other three categories of nutrients?*

## Macronutrients

The main job of macronutrients is to provide the body with energy – both instant energy and stored energy. As a general rule, doctors and dieticians suggest our diets should consist of 45-65% carbohydrates, 10-35% fat and 10-35% protein. However, because all macronutrients can supply energy to the body, these percentages can vary widely from one population to another.

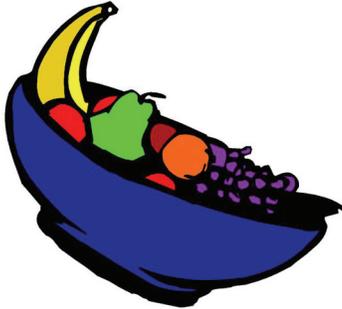
*Why might some populations have different diets than others?*

## Carbohydrates

In most diets, carbohydrates are the primary source of instant (and almost instant) energy. In the form of glucose ( $C_6H_{12}O_6$ ), they supply 70-80% of our bodies' energy needs, and 100% of energy needed by the brain.

*Can you think of geographical areas where people may have a hard time getting carbohydrates?*

Carbohydrates are made when carbon (C) and oxygen (O) and hydrogen (H), in the form of water ( $H_2O$ ), combine to make sugar molecules. They come in two types, simple sugars and complex carbohydrates.

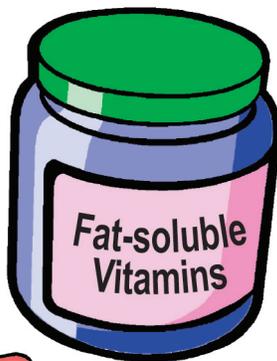


Simple sugars are a combination of one or two sugar molecules. They are referred to as monosaccharide when they consist of one sugar molecule (like glucose and sucrose), or disaccharides when they consist of two sugar molecules (like fructose and lactose). Complex carbohydrates are long, long chains containing thousands of sugar molecules. Complex carbs are either starches, which humans can digest, or fibres, which humans cannot digest.

*If we can't digest fibre, why do we need it in our diet?*

Carbohydrates are found mostly in grains, fruits and vegetables. The body breaks down both simple sugars and starches into glucose. Simple sugars break down quickly and provide instant energy. Complex carbohydrates break down over a longer period of time. Endurance athletes often eat complex carbohydrate-based meals (pasta, bread, rice, etc.) several hours before an event so that they have lots of energy when they need it most.

Carbohydrates are good for us, but in large quantities they can be bad. When carbs aren't burned off, they are converted to fat and cause weight gain. They also play a role in dental problems. When carbs get stuck around teeth, they start an acid reaction in the mouth and promote tooth decay.



The body needs fat to absorb some vitamins.

## Fats

Fats have a bad reputation, but they are essential to our health and well-being. As with other types of food, there are good fats and bad fats.

*Have you heard of any good fats?*

Fats are made from chemicals known as fatty acids. When put together, these chemicals form the most concentrated source of energy in the body. Dietary fats provide essential elements for growth, skin health and cholesterol management. They carry fat-soluble vitamins (A, D, E and K) and help in their absorption in the intestines. Fats also help the body use carbohydrates and proteins more efficiently.

We store fat in various fatty tissues; most is found in the body's adipose (a fancy name for fat) cells. These deposits act as stored energy, but they also insulate the body and cushion internal organs. When the food supply is low, and the body doesn't have readily available energy from carbohydrates, it converts fat into usable energy.

In our diets we take in unsaturated fats (good), saturated fats (bad) and trans fats (very bad).



Fatty fish (like salmon or char) and vegetable oils are good sources of unsaturated fats.



Animal fats (like beef, poultry, pork, game), shortening, and many processed foods contain saturated fat.

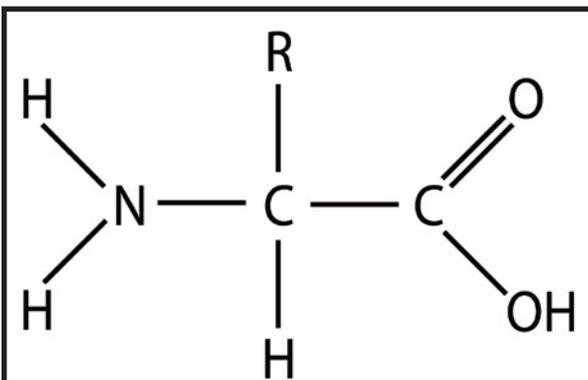


Processed foods also contain trans fats, a man-made type of fat which is extremely bad for health.

Saturated fats are solid at room temperature, and unsaturated fats are not. Saturated fats are very stable - they don't break down and become rancid. Manufacturers like to use them in processed foods, like pizza and chips, because it helps the food last longer. Unfortunately, large amounts of saturated fats lead to high LDL (or bad) cholesterol levels and increased risk of heart disease. Trans fats are made by partially hydrogenating liquid fats. Like saturated fats, trans fats are stable and prolong the shelf life of food. However, trans fats are even worse than saturated fats for our health; they increase levels of LDL cholesterol, and actually deplete levels of HDL (or good) cholesterol which helps prevent heart disease.

*Do you know where unsaturated fats are found in your diet?*

Dieticians and doctors say that while it may be hard to avoid saturated fats, most of the dietary intake should be unsaturated fats. They also suggest choosing foods with lower fat content.



Amino acids are a combination of carbon, hydrogen, oxygen and nitrogen. As far as we know, there are just over 20 amino acids. Each shares the chemical structure above. The difference between them lies in the chemical or chemicals which fill the space marked by the letter R, also known as the side chain. In the simplest amino acid, glycine, this space is filled by one hydrogen atom.

### Proteins

Proteins are the main component of muscles, organs, and glands. Structural proteins make up most of our bulk. Another type of proteins, called functional proteins, do work in our bodies. Hemoglobin is a functional protein.

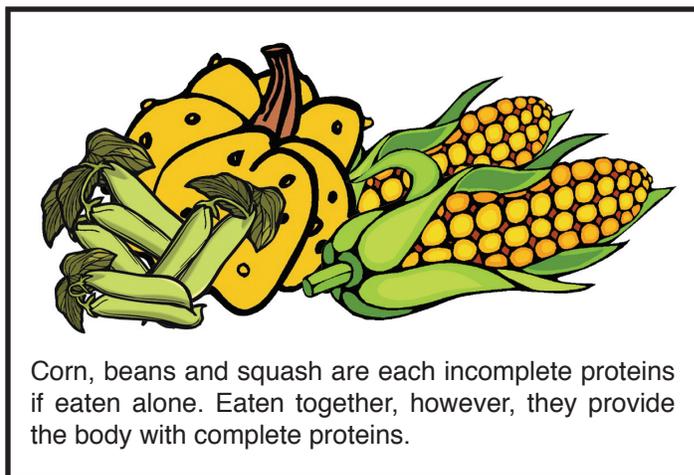
*Do you know what hemoglobin does?*

Proteins are made from amino acids. The 100,000+ types of protein in the body are all made from combinations of only 20 amino acids. Our bodies can make most of the amino acids it needs for protein development, but there are 9 we can only get from food. These nine are called the essential amino acids.

Dietary proteins which supply all the essential amino acids, are called complete proteins. Complete proteins are animal foods like beef, lamb, pork, poultry, fish, shellfish, eggs, milk, and milk products. Dietary proteins which supply some, but not all, of the essential amino acids are called incomplete proteins. Incomplete

proteins are plant foods like grains, fruits and vegetables. Plant foods can be combined to provide complete protein requirements. Corn, beans and squash – a traditional Iroquois diet – combine to produce complete proteins.

In very desperate food situations, the body can convert protein to energy through a process called gluconeogenesis. However, there seems to be a limit to how much protein a body can safely convert, and we appear to have built that limit into our diets. In studying diets from all over the world, food scientists have discovered that even the most protein-rich diets do not have more than 35-40% of dietary intake from protein.



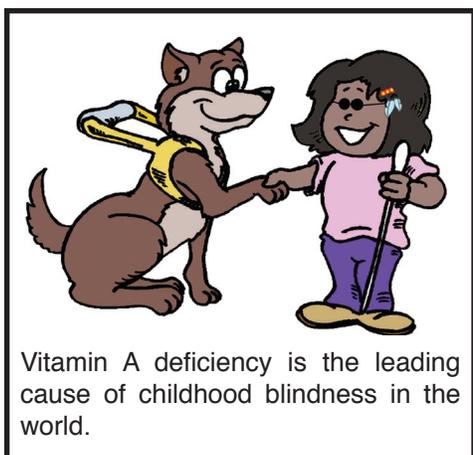
### Micronutrients

Vitamins and minerals are referred to as micronutrients because the body only needs very small quantities of them to ensure growth and good health. The most commonly required micronutrients are listed in the table below.

Common required			
Vitamins		Minerals	
Vitamin A	Thiamin	Calcium	Manganese
Vitamin C	Riboflavin	Chromium	Molybdenum
Vitamin D	Niacin	Copper	Phosphorous
Vitamin E	Folate (Folic Acid)	Fluoride	Selenium
Vitamin K	Pantothenic Acid	Iodine	Zinc
Vitamin B <sub>6</sub>	Biotin	Iron	
Vitamin B <sub>12</sub>	Choline	Magnesium	

The amount of each vitamin you need per day varies with your age, and gender. For instance, adult men require 120 µg (micrograms) of vitamin K (an important vitamin for blood clotting) per day, while women only require 90µg per day. This difference is largely due the difference in size and body mass between men and women.

*How much is a µg?*

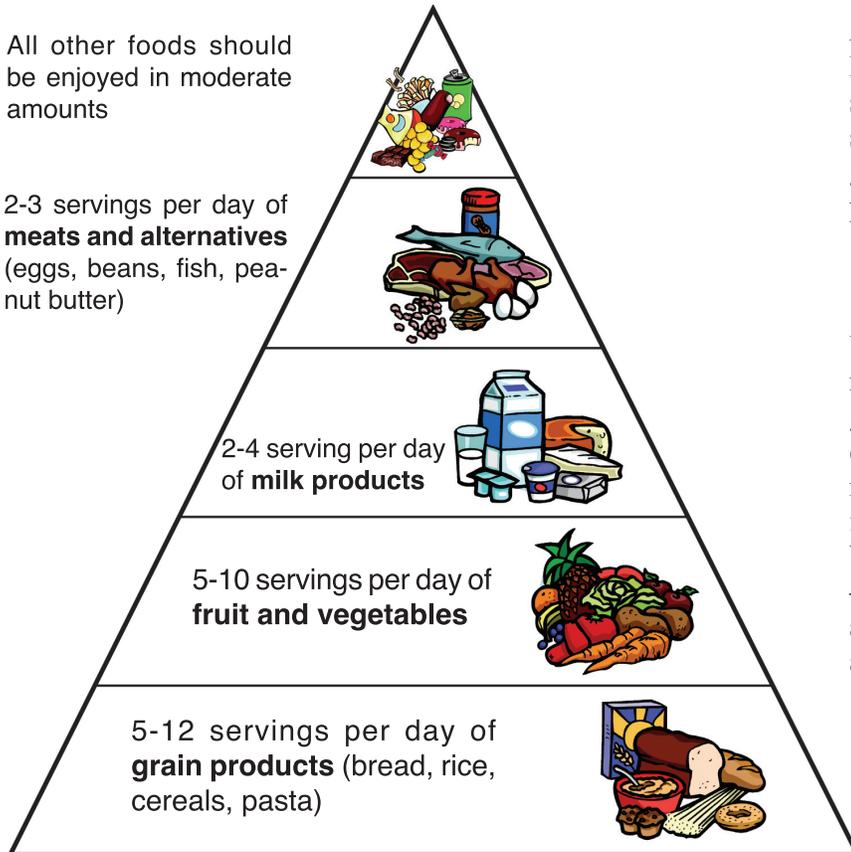


To understand how important micronutrients are to overall health, you just need to know what happens when you don't get enough of them. For instance, Vitamin A deficiencies are the leading cause of childhood blindness in most of the world. A daily dose of 300-600µg could prevent blindness for thousands, if not millions, of people. Iodine deficiency is the world's leading cause of preventable brain damage, but approximately 13% of the world's population suffers from some form of Iodine Deficiency Disease. IDD can be prevented by a daily dose of 90-150µg of iodine - that much can be had from a smattering of iodized salt.

## A balanced diet: The key to good nutrition

### What is a balanced diet?

*Canada's Food Guide to Healthy Eating* makes suggestions about what people should eat in order to maintain a balanced diet. It looks at commonly available foods and suggests how much an average person should eat each day in order to remain healthy. It says that people should eat the foods listed in the pyramid below.



A serving size for each type of food is also provided. For instance, 1 serving of grain products can be 1 slice of bread, or 30 grams of cold cereal, while a serving of meats and alternatives can be 50-100 grams of meat, fish or poultry or 2 tablespoons of peanut butter.

### Why is serving size important?

While it doesn't talk about specific amounts of macronutrients and micronutrients, the mix of foods suggested by *Canada's Food Guide to Healthy Eating* ensures a daily intake of all required vitamins and minerals as well as balanced proportions of carbs, fats, and proteins. At the same time, the guide is based on a certain type of diet and food availability – one that is fairly common in southern and/or urban areas, but less common or accessible in rural, remote and northern areas.

*Do you think it's possible to have a balanced diet without following the Canada Food Guide exactly?*

## Traditional and Country foods

Food scientists are starting to think that the really important part of nutrition is not the particular foods that we eat, but that the foods we eat contain the right combination of nutrients. They have discovered that in most areas of the world, indigenous diets meet nutrient needs through locally available resources. Indigenous diets are those made up mostly of traditional (also called country) foods.

### What are the traditional foods in your community?



The traditional diet of the Inuit and related peoples in the far north is the lowest in carbohydrates and highest in combined fat and protein of any diet in the world. It's not surprising, because carbs are usually provided by fruits, vegetables, cereals and grains – food which don't easily grow in the cold climate and short growing season of the north. What's more surprising is that, despite the scarcity of one of the macronutrient groups, the diet provides a relatively complete spectrum of micronutrients. For every southern source of vitamins and minerals, there is a northern equivalent.

Vitamin/Mineral	Needed for	Primary Southern Source	Primary Northern Source
Vitamin A	Good vision Fighting disease	Orange/red vegetables (carrots)	Oil from cold water fish and sea mammals
Vitamin C	Connective tissue health Fighting scurvy	Citrus Fruit	Fish
Vitamin D	Calcium absorption	Sunlight, fortified dairy products	Oil from cold water fish and sea mammals
Calcium	Strong bones and teeth	Dairy products	Fish skin, shell fish
Iron	Strong blood and muscles	Meat (Beef, pork, lamb, poultry)	Livers from sea food and game (moose, elk, caribou)
Zinc	Healing wounds Immune system health	Meat (Beef, pork, lamb, poultry)	Polar bear, lives from birds wild game

Traditional foods tend to be lower in bad fats than most commercially raised meats and processed foods. Many also provide other health benefits. Blueberries, for instance, contain a substance which helps control cholesterol (the bad kind). According to scientists they may be as good as commercial anti-cholesterol drugs, without any of the side effects.

**Do you know of any other health benefits of traditional food?**

More importantly, traditional foods contribute to the physical, spiritual and mental health of the community. As Patricia Cochran, an Inupiat from northwestern Alaska and Director of the Alaska Native Science Commission explains,

*“How we get our food is intrinsic to our culture, It's how we pass on our values and knowledge to the young. When you go out with your aunts and uncles to hunt or gather, you learn to smell the air, watch the wind, understand the way the ice moves, know the land. You get to know where to pick which plant and what animal to take.*

*It's part, too, of your development as a person, You share food with your community. You show respect for your elders by offering them the first catch. You give thanks to the animal that gave up its life for your sustenance. So you get all the physical activity of harvesting your own food, all the social activity of sharing and preparing it, and all the spiritual aspects as well. You certainly don't get all that, do you, when you buy prepackaged food from a store.”* (Gadsby, p.54)

## References

### Print

- Gadsby, Patricia. (October 2004). “The Inuit Paradox.” *Discover*. Vol. 25. No. 10
- Spears, Tom. (August 24, 2004). “Little berry solves cholesterol blues.” *Montreal Gazette*.

### Online

- Canada's Food Guide to Healthy Eating  
[http://www.hc-sc.gc.ca/hpfb-dgpsa/onpp-bppn/food\\_guide\\_rain-bow\\_e.html](http://www.hc-sc.gc.ca/hpfb-dgpsa/onpp-bppn/food_guide_rain-bow_e.html)  
 Carbohydrates  
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Centre for Indigenous Nutrition and Environment

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<http://arbl.cvmbs.colostate.edu/hbooks/pathphys/digestion/>

## Connecting to Math

1. Kagiwiosa Manomin Inc is operated by the Ojibway Nation at Wabigoon Lake, Ontario. It is a company that specializes in the production of wild rice using traditional methods which date back at least 1,000 years. As the company's food engineer, you are asked to prepare a presentation which compares the nutritional and caloric value of wild rice, with that of white and brown rice.

You decided to present the information in a table. Luckily, you already have the following information for 125ml servings of cooked rice.



Rice Types	Calories	Carbohydrates	Fat	Fibre	Protein
Brown		24.8g	0.8g	2.3g	2.5g
White	112.2	25.6g		0.1g	2g
Wild	91.8		0.2g	2.6g	3.6g

You know that carbs and proteins contain about 4 calories per gram, and that fat contains about 9 calories per gram. Can you fill in the table for your presentation?

2. Wild blueberries are an exceptional source of the vitamins and minerals that are an important part of a balanced diet. The people in your community have always collected blueberries for local use. A few years ago, as an economic development project, they have started a cooperative company to cultivate, collect, package and distribute blueberries. Last year, the co-op collected 6.8 million kg of berries.
- If one acre of land produces about 4000 kg/acre, how many acres does the coop cultivate?
  - The co-op exports 90% of its production to foreign markets in the US, Europe and Asia. How many kg of blueberries does it distribute in Canada?
  - A kg of frozen wild blueberries sells for \$10 in Asia, 8\$ in Europe and \$8 in the US. In Canada, fresh berries sell for \$5 per kg and frozen ones for \$4 per kilo. The coop sells, 40% of its crop to Europe, 20% to Asia and 30% to the US. 60% of Canadian sales are fresh berries. If it costs the company \$2 per kilo for each fresh kg and 2.75 per kg for frozen. How much profit did the company make last year?

