NUTRITION
FOR
PAPUA NEW GUINEA

THIRD EDITION

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NUTRITION SECTION
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FOREWORD

It is my great pleasure to present the third edition of "Nutrition for Papua' New Guinea". Considerable time and effort has gone into updating this manual to ensure that the information and sound advice given is relevant to the changing environment of nutrition in Papua New Guinea.

Not only does this manual provide useful knowledge in understanding the etiology of nutritional problems, but it also provides practical measures to prevent or overcome them.

This manual focuses on the continual high prevalence of Protein Energy Malnutrition seen mostly in young children and women of child-bearing age, in addition to the increasing incidence of non-communicable diseases such as diabetes and heart disease. To assist in the eradication of these major forms of malnutrition, the well established three food group system has been extended to four, separating the staple foods such as kaukau and other root crops from the high energy foods such as fats and oils. Hopefully this will draw attention to the selective usage of the energy dense food additives grouped under the high energy heading.

Having a good understanding of the nutritional content of foods and the appropriate usage in the daily diet is important when trying to improve our eating habits and general health. This manual will benefit nutritionists, health educators, agriculturalists, home economists, researchers, doctors, nurses, health extension officers, and most importantly, the people of Papua New Guinea.

I welcome and invite you all to make full use of this manual.

PAUL B. SONGO CMG
Secretary

What is Nutrition?

In Papua New Guinea, as well as other South Pacific countries, food plays an important part in the cultures and traditions of the people. The types of foods available and how they are prepared and eaten varies from region to region, from village to village, and sometimes from family to family within the same village.

Despite some differences in what and how people eat, the common factor that most people understand is that food is needed to live and carry out all daily activities. Food is not just something that fills you up and stops your hunger. Health workers 1pust be able to explain to people that their health status depends upon what and how much food they consume each day. To ensure proper growth and function, people must eat the right amount of a variety of foods daily.

All foods contain certain substances called *nutrients* that perform various functions in the body. The study of these nutrients and how they function in the body is called **nutrition**.

1.1 Food and Nutrients

Different foods have different nutrients, and every nutrient has an important role in maintaining normal body functions. Therefore, people must eat a variety of foods each day in order to satisfy their bodies' nutrient needs. When these needs are not met, the body can break down and become ill. Health workers should learn the functions of the nutrients in the body as well as the foods that are the best sources for these nutrients.

There are six groups of nutrients:

1. Carbohydrates
2. Fats
3. Proteins
4. Vitamins
5. Minerals
6. Water

The different nutrients need each other to work. Carbohydrates and fats primary provide the body with energy (or the fuel) for work and exercise. Sometimes proteins also provide energy, but only when the body is not getting enough carbohydrates and fats, as in the case of starvation. Proteins provide substances for building and repairing the body, and energy is needed to perform this function. Insufficient food energy will lead to the proteins being wasted and used as an energy source.

Proper tissue growth and repair also depend on some mineral substances. Other minerals, along with the vitamins, help to regulate body processes. For example, some of the B vitamins are needed to release energy from foods, while Vitamin B12, folic acid and iron are all used in making blood.

Water also helps to regulate body processes by preventing dehydration of cells and keeping the body temperature constant. Along with dietary fibre, water also maintains proper bowel

function and helps the body eliminate waste products.

Now that you have a better idea of how the nutrients work together in the body, it is time to examine each nutrient group in more detail.

1.2 Carbohydrates

Carbohydrates are divided into sugars, starches and the "unavailable carbohydrate", dietary fibre. Sugar cane and honey are two examples of foods that contain simple sugars, which are sweet and soluble in water. Starches are a more complex structure and do not dissolve in water. They provide the largest proportion of carbohydrates in the diet and are found in foods such as taro, sweet potato, yam, cassava, sago and cooking banana. These are often called *staple foods* because they are the most abundant carbohydrate food eaten in an area. In most of the Highlands, for example, sweet potato is the staple while in some coastal areas it is taro. Sago is the staple in swampy lowland areas while cooking banana is a staple in drier lowland areas. See Table 1.1 for some common sources of carbohydrates.

Dietary fibre is the indigestible part of plant materials. This unavailable carbohydrate passes through the intestine during digestion, to form the major component of our faeces. Dietary fibre is found mostly on the 'outside of seeds, grains (such as wheat and rice), vegetables. and fruit. When the outer layers of foods are removed, as occurs when white flour is milled or when potatoes are peeled, much of the dietary fibre is lost.

Functions of Carbohydrates

Carbohydrates that are absorbed by the body perform two basic functions:

1. Heat and energy. Carbohydrates supply heat for the body and energy for physical activity and for all other body functions, such as breathing, heartbeat and digestion.

2. Protein-sharing. If there is not enough carbohydrate in the diet, protein is used for energy rather than its proper function of making and repairing body cells. Therefore it is said that carbohydrate has a *protein-sparing* effect because it prevents protein being used for energy.

Dietary fibre, or carbohydrate that is not absorbed by the body, has at least four important functions in the body:

1. Dietary fibre is essential for the movement of food through the body and for preventing constipation and other related problems, such as diverticular disease. .

2. Dietary fibre helps to reduce blood cholesterol and other blood fat levels.

3. For people with diabetes, dietary fibre helps to keep the blood sugar level constant.

4. For overweight people, high fibre diets are generally lower in energy and more filling than low fibre diets and thus, assist in weight reduction.

1.3 Fats

Fats and oils, also known as *lipids,* are made up of compounds called *glycerol* and *fatty acids.* Most fats are triglycerides, which are one unit of glycerol combined with three units of fatty acids. Fats are not soluble in water.

Fats and oils are found in both animal and plant foods. Most animal fats, such as dripping from beef cattle and butter from milk, are solid at room temperature. Plant fats, such as the oils from vegetables, seeds and nuts, tend to be liquid at room temperature. These oils can be hardened to make margarine in a process called hydrogenation. Table 1.1 also lists foods high in fat.

Table 1.1 Sources of Carbohydrates and Fats

Carbohydrates			**Fats**
Starchy foods		**Sugary foods**	**Fats and oils**
Breadfruit	Biscuits (hard)	Honey	Avocado
Cassava	Bread	Jam	Butter
Cooking banana	Flour	Packet sugar	Coconut cream
European potato	Noodles	Sugar cane	Dripping (beef fat)
Sago	Rice		Margarine
Sweet potato		Fruit	Pig fat
Taro		Fruit juice	Peanut butter
Yam			
			Oils - peanut, pandanus, palm, coconut, etc.

Functions of Fats

Like the carbohydrates, fats perform a number of functions:

1. Heat and energy. Fatty foods provide large amounts of heat and energy. They contain more than twice as much energy as either protein or carbohydrate. Therefore, a diet high in fat is also high in energy. Energy is stored as fat in the body.

2. Fat-soluble vitamins. Fats carry the fat-soluble vitamins -- A, D, E and K - which are stored in the fat tissues (body fat). See the section on Vitamins In this Chapter.

3. Insulation. Fats help to support the internal organs in the body, such as the kidneys and heart, and the layer of fat underneath the skin keeps the body warm. However, too much stored fat can cause ill health. When people eat more food than they need, the extra energy is converted to fat and stored in fat tissues. This process often leads to obesity.

4. Tissue structure & body secretions. Fats are essential for the formation of tissues such as nerve sheaths. They are also used to make body secretions such as bile, which is used in the digestion of fat.

1.4 Proteins

During the digestion of food, proteins are broken down into smaller pieces called *amino acids,* which are joined together to make new body proteins in the body. Amino acids are like beads in a necklace. When they are linked together in a long chain, they form a protein. .

There are 22 different amino acids. Our bodies can make some of these, but those it cannot make must be obtained from our food. These are called the *essential* amino acids. Eight out of the 22 different amino acids are essential for adults and 10 of them are essential for children. The protein in the diet must contain all the essential amino acids for our bodies to function properly.

Protein Quality

A good quality protein is one that contains all or nearly all of the essential amino acids in the amounts our body needs for making new proteins. Eggs and human milk contain very good quality protein since they have all the essential amino acids in the right amounts for our body to use. Meat and fish also have quite good quality protein. Plant proteins, however, are short of one or more of the essential amino acids.

A person can get the right combination of amino acids by mixing together two or more food proteins that are deficient in different amino acids to create a quality protein. Proteins combined in this way are called *complementary proteins.* Different plant proteins should always be mixed together to ensure the right amino acid balance, or a small amount of meat or fish may be added to them. Table 1.2 shows animal and plant sources of protein. .

Functions of Proteins

Proteins perform four basic functions in the body:

1. Cell growth. Proteins are needed for the growth and development of tissue cells from birth until growth stops.

2. RepaIr and replacement. Proteins are important for the repair (especially after an injury) and renewal of all tissue cells, which are constantly dying and must be replaced. Some need replacing often, especially the cells of the nails, the hair and the lining of the intestine.

3. Formation of substances. Proteins are needed to help form substances such as enzymes, hormones, antibodies, haemoglobin and antitoxins.

4. Energy source. If insufficient carbohydrates are eaten, proteins can be used for the production of energy. However, this is not a healthy situation.

Table 1.2 Sources of Proteins

Animal Protein Foods	Vegetable Protein Foods
Bush animals (cuscus, cassowary, ete.)	Lentils
Cheese	Matured or dried beans (eg winged, mung, soy, etc)
Chicken	
Eggs	Matured or dried peas (eg split, chickpeas, etc)
Fish (fresh, tinned, smoked)	
Insects (ants, grubs, etc.)	
Meat (fresh, smoked, tinned)	Nuts (peanuts, galip, chestnuts, etc.)
Milk (fresh, dried, UHT)	Seeds (pumpkin, etc.)

1.5 The Energy in Food

When food is broken down in the body energy is released. This energy is needed by all tissues and cells for every activity. Even during sleep, energy is needed to ensure that all the essential processes continue, especially heartbeat, breathing, and maintenance of the blood's temperature.

We use units called *joules* (kJ) and *calories* (kcal) to measure energy, just as we use centimetres and inches to measure length:

1 kcal	=	4.184 kJ	1 kJ	=	0.239 kcal
1000 kcal	=	4184 kJ	1000 kJ	=	239.0 kcal
1000 kcal	=	4.184 MJ	1MJ	=	239.0 kcal

MJ = megajoule; 1000 kJ = 1 MJ

As already mentioned, the nutrients that supply energy are carbohydrates, fats, and sometimes proteins. Alcohol can also provide a large amount of energy. However, due to its adverse effect on health, it obviously is not a preferred choice.

The amounts of energy supplied by the different nutrients and alcohol are measured in terms

of kcal or kJ per gram (g) of the nutrient:

1 g Carbohydrate = approximately 4 kcal or 16 kJ.
1 g Protein = approximately 4 kcal or 17 kJ. .
1 g Fat = approximately 9 kcal or 37 kJ.
1 g Alcohol = approximately 7 kcal or 29 kJ.

Fat contains twice as much energy per gram than protein, or carbohydrate. Foods containing fat, such as lamb flaps or coconut cream, contain a lot of energy in a small amount compared with carbohydrate foods like taro and sweet potato.

Figure 1.1 shows that 2 level teaspoons of dripping contain as much energy as 1 small sweet potato.

Figure 1.1 . Image was removed from the document in order to optimize file size.

To get all the energy that the body needs each day, a lot of staple food has to be eaten. A person may feel full before eating enough of the staple food to meet the body's energy needs. If a small amount of fat like dripping or coconut cream is added to the food, the meal will contain more energy and will taste better. This is especially important for infants and children who have small stomachs and fill up very quickly. However, overweight adults who want to lose weight need to eat less food, especially fats, and increase their activity level.

1.6 The Vitamins

Vitamins are compounds which the body cannot make in sufficient amounts to meet its needs. Eating a balanced diet based on a variety of foods, provides all the vitamins for good health.

Many of the vitamins are named with letters from the alphabet when they were first discovered, before it was known exactly which chemical substance they were. They are usually measured in milligrams (mg) or micrograms (mcg).

The vitamins are classified into two groups according to whether they dissolve (or are soluble) in fat or water.

Fat-Soluble Vitamins

Vitamins A, D, E and K make up this group and are found primarily in fatty foods. They can only be absorbed in the presence of fats. Because they are stored in the fat tissue of the body, fat-soluble vitamins can be toxic in large amounts. Table 1.3 summarizes the sources and

functions of the fat- soluble vitamins, which are also reviewed here.

Vitamin A. The chemical name for Vitamin A is *retinol,* which is a substance found in animal foods such as liver, eggs and dairy products. However, margarine normally has Vitamin A added to it because of the way it is processed. Fish liver oils are the most concentrated and natural sources of Vitamin A. Retinol is the most readily absorbed form of the vitamin.

Less easily absorbed is *carotene,* which can be converted into retinol in the body. Carotene is a deep yellow pigment found in vegetable foods such as pumpkin, carrots, yellow sweet potatoes, pawpaw, and mangoes. Dark green leaves and palm oil are also good sources. In fact, the amount of carotene in green vegetables is proportional to how green they are (the darker, the better).

Retinol and carotene are stable to most cooking methods, but frying may cause some loss to occur. Exposure to sunlight can also cause loss of Vitamin A, such as when drying fruit or other foods.

Vitamin A is necessary for the normal growth of children. It also plays an important part in the way our eyes perceive light, and therefore it is sometimes called the eye-sight vitamin.

Another important function of Vitamin A is for protection of surface tissues, especially in moist areas such as the lining of the respiratory tract, mucous membranes (nose, throat, bronchial tubes), and front of the eyes (cornea).

Vitamin A can be stored in the body, especially in the liver. This means that if you eat a lot of the vitamin at one time, for example during the mango season, the vitamin can be stored in the body to last for several months. An excessive amount of retinol is harmful but unlikely, unless one consumes large doses of vitamin tablets. Large amounts of carotene causes yellowing of the skin.

Vitamin D. Many people obtain little or no Vitamin D from their diet, as few foods contain this vitamin. The body makes most of its own requirement when sunlight falls on the skin. Foods that do contain a very small amount of this vitamin are of animal origin, such as eggs, milk, and liver. The only rich dietary source of Vitamin D is cod liver oil.

Vitamin D is relatively resistant to heat and is unlikely to be destroyed or lost in cooking.

Vitamin D helps to make strong bones and teeth by assisting in the absorption of calcium and phosphorus (see Minerals section of this chapter). When there is not enough of the vitamin in the diet, rickets can occur. However, most communities in Papua New Guinea have adequate sunshine all year round, so Vitamin-D deficiency is very unlikely to occur.

Table 1.3 Fat-Soluble Vitamins

Vitamin	Function	Deficiency Disease(s)	Good Food Source
Vitamin A	Eyesight and night vision. Protects surface-tissue cells that line the eyes, respiratory and intestinal tracts.	Night blindness leading to severe eye disease. Infections of the skin, respiratory tract and intestines.	Dark green leaves, yellow fruits and vegetables (pawpaw, mango, pumpkin, sweet potato), dairy

	Essential for growth.	Slowed growth mainly. Occurs in children with severe PEM.	products, egg yolks, liver and some fatty fish.
Vitamin D	Strengthens bones and teeth. Absorption of minerals such as calcium.	Rickets (or softening of bones). Deficiency is unlikely in PNG.	Primarily from sunlight, but also in very small amounts in some foods of animal origin.
Vitamin E	Keeps cell membranes strong. Helps regulate metabolic processes.	MetaboIic problems, poor skin. Deficiency is rare.	Primarily vegetable oils and margarines, and also eggs, fruits and vegetables.
Vitamin K	Regulates blood clotting.	Breeding and anaemia. Deficiency is rare.	Dark green leaves and green vegetables. Made in the gut.

Vitamin E. Vitamin E, also known as *tocopherol,* is essential for normal metabolism. Large amounts of Vitamin E are found in eggs and vegetable oils Smaller amounts are found in fruit, vegetables and meat. A mixed diet usually provides enough Vitamin E, and deficiency is very rare.

Vitamin K. Vitamin K is present in green leafy vegetables, in addition to being made by the bacteria in the gut. Vitamin K is essential for normal blood clotting and deficiency is unlikely in a healthy person. .

Water-Soluble Vitamins

The water soluble group of vitamins are the B group and Vitamin C. These vitamins cannot be stored in the body, so they must be obtained daily from both plant and animal foods. Water soluble vitamins are partially destroyed by heat and can be easily lost in the cooking water. They can also be destroyed when baking soda is added in the cooking of vegetables.

Thiamin (Bl), Riboflavin (B2), Niacin. These three B vitamins help to form a link in the chain of processes by which energy is released from food. They are found in many foods, including green leaves, nuts and legumes (mature beans, lentils, etc), cereals, milk, fish and meat. A mixed diet will therefore provide these vitamins.

Thiamin and niacin are found in the outside layers of cereal grains, which can be removed during mining. Polished white rice and white flour have very little of the B vitamins, while brown rice and wholemeal flour are good sources. The white rice in Papua New Guinea has thiamin added to it to correct the loss of this vitamin.

Deficiency symptoms of these vitamins include slowing of growth in children, irritability, rough and red skin, sore tongue, and digestive problems. However, such deficiencies are rare in Papua New Guinea.

Folic Acid. This B vitamin occurs in liver, dark green leaves, beans and nuts. It is needed to help make proteins that affect the blood. Women, especially pregnant women, need to get enough folic acid to prevent megaloblastic anaemia.

Vitamin B12. Vitamin B12 performs a variety of functions in the body. It is needed to help metabolize protein, fat and carbohydrate and to prevent degeneration of nerve cells, especially of the spinal cord. Perhaps its most important function is to prevent different types of anaemia, particularly pernicious anaemia.

This vitamin is found only in foods of animal origin, namely liver, meat, milk, eggs, and fish. Yeast and fungus that sometimes grow on vegetable foods may also provide this vitamin, and the bacteria in the gut also produce B12. Vitamin B12 deficiency is not very common, even in people who eat only vegetable foods.

Vitamin C. Vitamin C is found in varying amounts in all fresh fruit and vegetables and some staple root crops. It is needed for the formation of tissues, including skin, gums and blood vessels, and is important for the healing of wounds and sores. Therefore, some fresh fruits or vegetables must be eaten daily. People living in towns should be sure to get these foods from the market each day.

Table 1.4 summarizes the food sources and functions of the water-soluble vitamins.

Table 1.4 Water-Soluble Vitamins

Vitamin	**Function**	**Deficiency Disease(s)**	**Good Food Source**
Thiamin (HI)' **Riboflavin), &** **Niacin**	Normal growth and development in children. Part of enzymes for release of energy from food.	Skin & nervous disorders. *Pellagra* is due to niacin deficiency and *beriberi* is due to thiamin deficiency. Neither have	Present in many foods especially beans, nuts, brown and enriched white rice, and some green leaves.

		been found in PNG.	
Folic acid	Formation of some proteins, especially in blood.	Anaemia (Chapter 10).	Liver, dark green leaves, beans and nuts.
B12	Growth, blood and nerve formation. Metabolism of some nutrients.	Anaemia (Chapter 10). Neurological problems.	Liver, milk, meat, eggs, fish. Not found in plant foods.
Vitamin C	Formation of teeth, bones, tissues and blood vessels.	Scurvy. Not found in PNG.	All fresh fruits, vegetables and root staples.

1.7 The Minerals

Minerals are found primarily in soil. They become part of plants by being taken up through the roots. When animals are eat plants, they consume the minerals as well. Some minerals are also found in fresh and salt water and rocks.

Minerals make up 5 - 6% of the total body weight. They are needed by the body in small quantities compared to protein, fats and carbohydrates. We obtain minerals from plants, water and animal food sources. Like vitamins, they are measured in milligram (mg) or microgram (mcg) amounts.

There are two groups of minerals:

1. Major minerals. These are needed in the largest quantities and include calcium, sodium, potassium and chloride.

2. Trace elements. These are needed in extremely small quantities and include iron, iodine, fluoride and zinc.

Calcium. Calcium is needed to make strong bones and teeth. Pregnant and breast feeding women need plenty of calcium to make their children's bones and to provide the calcium in breast milk. Adolescent girls require enough calcium for the proper formation of the pelvis. Calcium is also needed for the normal clotting of blood and normal functioning of muscles. Vitamin D assists with the absorption of calcium from the gut.

Only a few foods contain much calcium, so the daily diet must include enough of these foods in sufficient amounts. These include fish of which the bones are eaten (tinned fish), milk and

milk products, green vegetables, nuts and legumes (mature beans, lentils, etc). Calcium deficiency is not known in PNG, although it has been suggested overseas that it may be one of the factors associated with stunted growth in children.

Sodium, potassium and chloride. The body needs these three minerals to regulate body fluids. A variety of foods contain these minerals, and salt (sodium chloride) is often added to food as flavouring. Deficiency of these minerals rarely occurs unless a person is suffering from severe diarrhoea, in which case these minerals are lost from the body along with fluid. They can be replaced by giving a special salt solution.

Iron. Iron is found in the blood protein *haemoglobin,* which plays an important role in the transport of oxygen from the lungs to the tissues. Haemoglobin gives blood its red colour. Women have a greater need for iron than men due to their monthly blood loss and increased need during pregnancy. Iron is also lost through normal wear and tear of the body and in digestive juices passed through the faeces.

People who lack sufficient iron in their blood develop iron-deficiency anaemia. Keep in mind, however, that anaemia may be due to other causes as well, such as recurrent malaria or other vitamin deficiencies.

Iron obtained from animal foods is more readily absorbed than that from vegetable foods. Therefore, foods such as meat, liver, fish and eggs are the best sources. However, in Papua New Guinea these foods are not as commonly eaten as the vegetable sources of iron, such as dark green leaves, beans, peanuts, some staple root crops and the outside layers of cereals. To get the most iron from these foods, people need to eat a variety of foods at each meal because some substances, such as Vitamin C, help the iron to be better absorbed from the foods.

Iodine. Iodine is needed for production of hormone *thyroxine,* which is produced in the thyroid gland. This hormone regulates the rate at which the internal organs of the body work and how the body uses food to produce heat.

This mineral is found in fish and shellfish and in vegetables growing near to the sea, where there is iodine in the soil. In some. inland areas where the soil is deficient in iodine, the vegetables are also low in iodine, and people may not get enough of the mineral in their food.

Iodine deficiency leads to a swelling of the neck called *goitre.* and growth retardation and mental deficiency in children called *cretinism.*

Fluoride. Fluoride helps to make teeth strong. It occurs naturally in water in some parts of the world. People living in these areas normally have less dental decay than people whose water is fluoride deficient. In some towns, the council adds a little fluoride to the water supply to help prevent dental caries.

Zinc. Zinc is one of the nutrients necessary for healing wounds and chronic ulcers. The best sources of zinc are protein-containing foods such as meat, fish, eggs, whole grains, beans and peanuts.

Zinc deficiencies normally occur in people with Protein Energy Malnutrition (PEM) or who are stressed from surgery or severe burns. Excessive consumption of alcohol can also

contribute to zinc deficiency.

Table 1.5 lists the functions, deficiency symptoms and food sources of eight important minerals. Notice that dark green leaves are very good sources of many vitamins and minerals. The "kumu" (greens) commonly eaten in Papua New Guinea are extremely nutritious foods. There is no need to change to European vegetables, like pale, round cabbages, as these contain fewer of the essential vitamins and minerals. .

Mineral	Function	Deficiency State	Good Food Sources
Iron	Oxygen transport in blood (in haemoglobin). Present in enzymes needed for chemical reactions in cells.	Anaemia (pale skin, dizziness, tiredness, and shortness of breath). High occurrence in PNG.	Dark green. leaves, root staples, meat, fish, liver, eggs, wholemeal bread, brown rice, dried beans and peas and nuts.
Iodine	Formation of. thyroid hormone.	Goitre or cretinism.	Sea foods, seaweeds, iodised salt. Vegetables that grow in soils that contain iodine.
Calcium	Growth and maintenance of bones and teeth. Blood clotting and muscle functioning, including the heart.	Reduced growth and rickets in children. Brittle bones (osteoporosis) in adults.	Green leaves, milk, tinned fish and a variety of dried beans, nuts and seeds. Some in sweet potato.
Fluoride	Strengthens bones and teeth.	Tooth decay.	Occurs naturally in some water, or added to the water supply by council in some towns. Seafood.

Sodium, chloride and potassium	Maintain fluid balance in cells. Regulate muscle contraction.	Muscle cramps, salt, imbalance & dehydration can occur during diarrhoea and sometimes after strenuous exercise.	Many foods. Sodium chloride is added to food as salt.
Zinc	Heal wounds and chronic ulcers.	Possible anorexia (loss of appetite) and growth retardation.	Dried beans and peas, peanuts, dark green leaves, meat, fish and eggs.

1.8 Water

The body is made up of more than 60% water. Blood and some other body substances contain up to 90% water. Water is so important to the body that if it loses approximately 10%, the person will die.

Water is also required for many body processes. The amount of water people need each day really depends on the humidity, temperature and their activity level. People who play sports or live on the coast may require more water each day. Naturally, people will vary in the amount of water they need and the most reasonable guide is our thirst. It is helpful to drink a slightly greater quantity than is necessary to satisfy the thirst. People need to drink 1 - 2 litres of fluids each day, or 4 - 8 cups.

Sources

The best sources of water, other than water itself, are green coconuts, fruit juices, milk, tea and other drinks. Foods like cucumber and watermelon make very refreshing snacks and help replace the water that is lost each day. In fact, most fresh fruit and vegetables contain a lot of water.

Functions

Water performs at least five vital functions in the body:

1. Ensures that all body parts are working properly.

2. Helps maintain body temperature within a desirable range.

3. Serves as a lubricant for joints and. in saliva.

4. Forms a major component in all body fluids.

5. Assists with removal of waste from the body.

1.9 Low Nutrient Foods

Many types of foods contain little or no nutrient value, but we eat them because they taste good.

Flavour Foods

Some foods, like onions, chilli peppers and mushrooms, help meals to taste good. Salt and curry powder also add flavour to foods. These foods do not provide many nutrients themselves, but they are important because they help people to eat more of the other foods by giving more flavour.

Empty-Calorie Foods (Rubbish Foods)

Many foods taste good but do not provide any nutrients except a small amount of energy from sugar. You probably have heard the term *rubbish foods,* which refers to foods like fizzy drinks (lolly-water) and sweets. People who eat these foods on a regular basis may become malnourished because these empty-calorie foods fill them up. They may not eat enough of the nutrient-rich foods available.

Foods with little or no nutrient value include:

Lollies & sweets	Lolly-water
Sweet biscuits	Ice blocks
Cheese-flavoured snacks	
Potato chips	

These types of foods usually cost a lot of money. When people buy them, they are wasting their money on sugar or starch only. Children often are given lolly-water and cheese-flavoured snacks when they are hungry, because these foods fill them up quickly. However, such snacks do not give children the variety of nutrients that their growing bodies require. As a result, these children often become malnourished.

Lolly-water, ice blocks and sweet biscuits also cause bad teeth. Dentists and family health nurses worry about tooth decay. Many town children have very bad teeth because their parents allow them to eat these foods instead of nutritious foods like bananas, peanuts, coconuts, taro, and beans.

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Although beer contains energy it costs a lot of money and it makes people drunk. Some

people think that beer is a good thirst-quencher, when in fact, it causes dehydration because of the alcohol it contains. People who spend their money on beer instead of healthy foods may cause malnutrition in their families, particularly in the children. Beer also results in other social problems.

Tea and coffee offer little in the way of good nutrition. The water is perhaps the only real nutrient. If milk is added, it contributes only a small amount of nutrients, and sugar adds only energy. When consumed in moderation, tea and coffee pose no threat to nutritional status.

People like to drink nice-tasting beverages, especially when they are hot, thirsty or cold. Water and coconut water are by far the best choices.

1.10 Four Food Groups for Papua New Guinea

Until about 1985 nutrition teaching was based on the *Three Food Groups* concept. Although this system was designed originally for use in the classroom, it was widely used to teach nutrition in villages.

In recent years, nutrition extension workers have been encouraged ***not to use the three food groups system***.

Disadvantages of Three Food Groups Concept

The three food group system in Papua New Guinea has been replaced with the Four Food Groups and the specific nutrition messages for several reasons:

1. Eating food from the three food groups in general does not reduce the level of malnutrition in a community. This is because advice is not given on important issues such as when to give the first foods and how often to feed infants and children.

2. A meal containing food from each of the three food groups may be too bulky and contain too little energy for young children. There is no emphasis given on the importance of eating high energy foods to prevent Protein-Energy Malnutrition (PEM).

3. It is not easy to divide foods containing a variety of different nutrients into only three groups. For example, sweet potato is classified as an energy food, not a protective food, yet in many areas it also provides the amounts of Vitamins A & C required each day.

4. The three food groups can be a confusing way of teaching nutrition to village people. Long lists of foods are often given and many of these foods are not even available in some areas, or are too expensive to buy.

For these reasons, the Nutrition Section within the National Department of Health recommends this action:

- A *four food groups system* should be taught to school students in tertiary level nutrition courses (includes nursing, community health workers, etc.).

- Only specific nutrition messages should be taught in the village and in community schools. These should be based on local problems identified in that community and use only locally available foods.

The Four Food Groups format encourages people to include a variety of foods in their diet. This system is more specific than the three groups approach and eliminates the need for having to label certain foods as being only protective, bodybuilding or energy-providing.

The **Four Food Groups** are as follows:

Group 1: Staple Foods. Foods that contain a large amount of carbohydrate and form the basis of meals are in this group. The main foods are sweet potato, cassava, cooking bananas, Singapore taro, tru taro, European potato, breadfruit, yam, sago, rice, flour, bread and hard biscuits.

Group 2: High Energy Foods. Foods that contain a large amount of fat or sugar are in this group. The main foods are cooking oils (like coconut, vegetable, & palm oils) dripping, margarine, mature coconut flesh, coconut cream, marita, peanut butter, pork fat, butter, packet sugar, sugar cane, jam and honey. Avocado, peanuts and other nuts also contain a lot of fat and can be included here, although they are listed in other food groups too.

Group 3: Protein Foods. The main foods in this group are meat (fresh, smoked, tinned, bush), chicken and other birds, fish (fresh, smoked, tinned), shellfish, insects and grubs, eggs, cheese, milk, mature beans and peas and all nuts (peanuts, pandanus).

Group 4: Vegetables and fruit. The most common vegetables eaten in Papua New Guinea are dark green leaves (ferns, tulip, watercress, aibika, pumpkin tips, Chinese cabbage, and other local greens or kumu). Pumpkin, young beans, carrots, tomatoes, corn cob, pitpit, capsicum and other traditional and introduced vegetables are also in this group.

The most common fruits eaten in Papua New Guinea are pawpaw, pineapple, guava, mango, five corner fruit, ripe banana, mandarins, oranges, lemons, lime, sipora, grapefruit, pomelo, rambutans, passion fruit, tree tomatoes, avocado and other traditional and imported fruits such as apples and pears.

How much of the nutrients does a person need?

The amount of each of the nutrients that we require daily depends upon our gender (male or female), age, size, activity level and overall health status. For women, pregnancy and breast feeding are also factors.

Researchers have found that certain amounts of some of the nutrients are needed each day from the diet to keep people healthy. These amounts are called the *Recommended Dietary*

Intakes (RDIs). Table 1.6 lists the RDIs for protein and energy for different people. See Appendix 1, World Health Organization RDls, more information.

Table 1.6 RDIs for Protein and Energy for Different People

Person	Energy (kcal)	Protein (g)
Adult Man (weight 60 kg)	2,850	45
Adult Woman (weight 50 kg)	2,000	37.5
Pregnant Woman	2,285	43.5
Breast feeding Woman (first 6 months)	2,500	55
Child 2 - 3 years (weight 13.5 kg)	1,350	15.5

See Appendix 1, *World Health Organization RDIs,* for many nutrients and age groups.

The adult man and woman. You can see in Table 1.6 that an adult man needs, more energy and more protein than an adult woman. This is because men are bigger than women.

The pregnant woman. A woman needs to eat more when she becomes pregnant to provide the extra energy and protein needed for the developing foetus. You can see that she needs nearly as much energy and protein as a man. She also needs more iron and more folic acid to make extra blood.

The breast feeding woman. A breast feeding woman needs more protein and nearly as much energy as a man. She needs extra food to help make enough bread milk for her child.

Children. Children need more protein and energy, *in relation to their size,* than adults because they need more nutrients for growth.

Sick children. Although not represented in Table 1.6, sick children need to eat more food to keep up their strength and to fight infections. Those children who eat extra protein and energy foods stand a better chance of catching up in their growth. This is important because many children who do not eat extra food during and after sickness remain smaller in size for their ages than those children who do eat more food. These extra foods will also help to repair any damaged tissues that children may suffer during illness.

People who work very hard. People who do a lot of physical work or play sports need extra food to meet their energy needs. They should also drink enough fluids to avoid becoming dehydrated.

Things To Do

1. **Make a Food Collection.** Collect as many different foods as you can. If you are working with a group of people, perhaps each member of the group could bring a different kind of food. You can use the collection in many different ways:

    - Divide all the foods you have into the Four Food Groups.

    - Arrange the foods' into a line. Put the foods with the most energy at one end and the foods with least energy at the other end. Refer to *Appendix* 1 *(Part* 2), *Food Composition Tables,* to find out the energy content of foods.

    - Create one pile for plant proteins and another for animal proteins.

    - Choose the foods that you would give to underweight children to make them grow. Put them in a pile.

2. **Foods in Your Area.** Go to the market and stores in your area. Make a list of all the foods you see.

    - Which protein foods are *easily* found in your area?

    - Which fruits and vegetables are *easily* found in your area?

    - What is the primary staple food of your area? Are others eaten?

    - Which high energy foods are often eaten in your area?

3. **Trade Store Foods.** Assume you purchase all of your foods from local trade stores. Using the Four Food Groups guide, visit some local trade stores and list foods that would be difficult to purchase.

Important Points of Chapter 1

- Food is a basic need of all people. Everyone needs to eat food to stay healthy and to ensure that their bodies grow and function properly.

- The nutrients in food -- carbohydrates, fats, proteins, vitamins, minerals and water --

interact within the body to keep it healthy.

- Foods can be placed into four groups, usually according to the nutrients that they contain and the work they perform in the body:

  Staple Foods, which contain carbohydrate that gives the body the main source of energy it needs to carry out its daily activities.

  High Energy Foods, which contain fat or sugar that provides energy and is stored in the body for warmth and protection of internal organs.

  Protein Foods, which provide animo acids for building and repairing body tissues.

  Vegetables & Fruits, which contain vitamins, minerals and dietary fibre needed to help the body function properly.

- Staple foods (such as sweet potato) contain moderate sources of energy. High energy foods (such as margarine, dripping or coconut cream) should be eaten every day by all children and pregnant and lactating women.

- Different people have different food and nutrient needs. People who have more body mass (taller or heavy-set), and people who work hard, need more food. The following people have special nutrient needs:

  - Menstruating women

  - Pregnant women

  - Breast feeding women

  - Children

  - Sick people