Micronutrients and Water Module Script

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Micronutrients and Water

Welcome to module two, Micronutrients and Water.

What are Micronutrients?

Micronutrients are substances that are needed in much smaller amounts than the macronutrients, carbohydrates, protein, and fat. Another difference between macro and micronutrients is that micronutrients do not provide any energy. Micronutrients are used for many important functions in the body, such as to make enzymes and hormones.

Although our bodies only need small amounts of these nutrients, deficiencies can lead to many problems, some of which can be severe.

Vitamins

Vitamins are organic, or carbon containing, compounds that are used to facilitate chemical reactions or are used for the production of tissues in the body. They are essential in our diet because we cannot make them ourselves.

Although vitamins do not provide energy themselves, some vitamins are needed for the chemical reactions that yield energy from the breakdown of macronutrients.

Categories of Vitamins

There are 13 essential vitamins your body needs to remain healthy. These vitamins fall into two groups: fat-soluble and water-soluble. These terms describe how the body absorbs and stores the vitamins.

Fat Soluble Vitamins

Fat soluble vitamins dissolve in fat, not water. They are absorbed along with dietary fat: thus, it is important to have a source of fat in your meal when eating foods high in fat soluble vitamins.

Excess fat-soluble vitamins are stored in body's fat stores, excessive consumption can build up in stores and lead to toxicity.

Vitamin A and Beta Carotene

Vitamin A can be found in several different forms, including retinoids which are the forms that are used in the body, and carotenoids, which are precursors to retinoids, meaning that they can form retinoids. Beta carotene is the common form of the carotenoids.

Vitamin A is needed for the maintenance of cell membranes, skin, bone, and other tissues, and can function as an antioxidant. The retinol form of vitamin A is required in order to be able to see at night when it is dark.

Vitamin A deficiency is not very common in the US, but if it does occur it can lead to vision problems, blindness, and susceptibility to infections.

Toxicity can occur only with excessive intake of retinoid forms of vitamin A, when we consume excess carotenoids, we just don't convert them to retinoids. Retinoids are found in liver, fish, fortified milk, and eggs. Carotenoids are found in dark green and yellow/orange fruits and vegetables such as carrots, spinach, winter squash, sweet potatoes, mangoes, and cantaloupe.

Vitamin D

The most well-known function of vitamin D is for calcium absorption and bone formation. Basic deficiency of Vitamin D results in rickets, a condition in which the bones weaken and bow under the pressure of body weight. Toxicity is very rare and occurs at very high levels of intake.

Vitamin D can be found in fortified milk and dairy products, fatty fish such as sardines and salmon, and fortified soy products. Vitamin D is found naturally in very few foods. It is difficult to get adequate amounts from food alone.

Vitamin D is unique among the vitamins in that it can be produced by the body when exposed to sunlight, however, there needs to be sufficient exposure in order to produce enough Vitamin D. In northern climates, the sun is not strong enough for most months to provide adequate exposure. In addition, clothing covering the skin prevents exposure, as does the use of sunblock. As a result, most people cannot rely on sunlight for vitamin D production.

Vitamin D

As mentioned before, vitamin D can be synthesized by the body from exposure to ultraviolet sun rays. Cholesterol forms a precursor in the body and this precursor is converted to vitamin D3 after sunlight exposure to the skin.

All vitamin D, whether from dietary or synthesized forms, is activated in the liver and kidney. This activated form of vitamin D works as a hormone in the body.

Calciferol is the plant form of vitamin D, and it is not active in the body. The liver converts this form to cholecalciferol, or vitamin D3. This is the hormone form of vitamin D, but it is still inactive. The kidney then converts this to calcitriol, the active form of vitamin D3.

Vitamin D

There is much ongoing research on the topic of Vitamin D. Previously it was believed that the only function was the absorption of calcium and bone formation. However, recently additional benefits of vitamin D have been discovered, including enhancing immune function, decreasing the risk of cancer, and protection from autoimmune disease. The fact that people are decreasing their sun exposure because of the risk of skin cancer means that it is even more

important to get vitamin D from the diet. In addition, there is some evidence that obesity may increase the amount of vitamin D a person needs.

The current recommendation is for 400 international units of vitamin D per day for infants and 600 international units of vitamin D per day for children and adults. Many experts believe that this level is far too low and should be increased.

Vitamin E

Vitamin E functions as an antioxidant and anticoagulant. Antioxidants are substances that work to disable free radicals, which are atoms with unpaired electrons that cause damage in the body, including to cell membranes, DNA, and receptors. This damage can result in cancer and plaque buildup in the arteries, so antioxidants play an important role in preventing that damage. Anticoagulants prevent blood clots from forming. Vitamin E deficiency can result in nerve damage, anemia, fatigue, weakness and an increased risk of heart disease and some cancers.

Food sources of vitamin E include plant oils, whole grains, eggs, nuts, and seeds. Vitamin E supplements are very popular but should be used with caution because higher intakes can lead to problems such as increased bleeding time. Vitamin E also can have interactions with some medications, so a person taking supplements should always tell their doctor before he prescribes anything.

Vitamin K

Vitamin K is needed for blood clotting and for bone formation. Most infants get an injection of Vitamin K at birth because they are born without much stored. Symptoms of vitamin K deficiency are easy bruising, long bleeding times, and risk of hemorrhage. Although toxicity of vitamin K is uncommon, high doses can reduce the effectiveness of anticoagulant drugs used to prevent blood clotting.

The major food sources of vitamin K are leafy green vegetables, liver and whole grains. Bacteria in our intestine can produce about half of vitamin K needs.

Water Soluble Vitamins

Water soluble vitamins dissolve in water and are not stored in significant amounts in your body. They include 8-B complex vitamins and Vitamin C. They are more easily excreted than fat soluble vitamins. They can also be lost in foods during the cooking process, such as boiling vegetables.

B Vitamins- General Functions

The general functions of the group of vitamins known as the B vitamins include acting as co-enzymes, which enable an enzyme to complete its function, working as catalysts, which creates the start of a chemical reaction, and as part of the energy producing pathways of metabolism.

Thiamin

Thiamin is a B vitamin that is needed for the conversion of glucose into energy. It is also necessary in nerve processes and muscle function. If there is a deficiency in this vitamin, the following symptoms can occur: cardiac failure, damage to the nervous system, apathy, muscle weakness, confusion, irritability, and weight loss.

Thiamin is needed for the metabolism of alcohol; therefore, deficiency is common in alcoholics. Beriberi is a disease caused by prolonged thiamin deficiency. Food sources of thiamin include grains, dairy, pork, and watermelon.

This vitamin can be destroyed by ultraviolet light, which is why milk should be kept in opaque containers.

Riboflavin

Riboflavin is important in energy metabolism and also functions as a coenzyme for other body processes. Deficiency of this nutrient causes inflammation of the membranes of the mouth, skin, eyes, and Gastrointestinal tract. This deficiency often accompanies other nutrient deficiencies. No adverse effects have been found with excess Riboflavin intake.

As mentioned with Thiamin, this vitamin is destroyed by ultraviolet light. Food sources include liver, dairy, clams, whole grains, and fortified and enriched grains.

Niacin

Niacin is required for metabolic reactions and the release of energy from glucose, fat, and alcohol. Niacin deficiency can result in diarrhea, abdominal pain, vomiting, fatigue, loss of memory, headache, inflamed red tongue.

Pellagra is a niacin deficiency disease which causes the following symptoms: diarrhea, dermatitis, dementia, and ultimately death.

Niacin has been found to help lower cholesterol and prevent heart disease so some people take supplements, but excessive intake can cause painful flush, hives, rash, blurred vision, and liver damage.

Food sources of niacin include meat, whole grains, fortified and enriched grains, peanuts, and dairy. Some niacin can be synthesized in the body from the amino acid tryptophan, but not enough to meet the body's needs.

Pyridoxine (Vitamin B6)

Pyridoxine is used in protein and muscle synthesis. It also helps to convert tryptophan to niacin and is required for the formation of blood cells.

Deficiencies cause pernicious anemia, weakness, convulsions, and dermatitis. Low intakes of pyridoxine can increase homocysteine levels.

Homocysteine is an amino acid that has been linked to increased risk of coronary heart disease, stroke and peripheral vascular disorders when found in high levels. Symptoms of pyridoxine toxicity include depression, fatigue, nerve damage, skin lesions, irritability, and headaches.

Supplementation has been used to treat PMS, carpal tunnel syndrome, and sleep disorders, but often resulted in nerve damage from the large doses taken. Pyridoxine is found in bananas, potatoes, chicken, watermelon, legumes, and fortified grains.

Folate

Folate is the generic term for multiple forms of the vitamin that can be found in foods. The forms vary in the amount of the amino acid glutamate that is present. Folic acid is the form that is often found in supplements and has only one glutamate molecule. Most of the folate found in foods has three or more glutamates.

Folate is converted to a coenzyme that helps facilitate reactions that synthesize protein, RNA, DNA, and red blood cells. Inadequate folate in the diet can lead to anemia, confusion, weakness, fatigue, and increased levels of homocysteine.

Folate becomes very important in pregnancy because adequate amounts reduce the risk of neural tube defects. The neural tube defects, including spina bifida and anencephaly (absence of a brain) occur early in pregnancy, so it is important for women to have adequate folate intake prior to getting pregnant in addition to during pregnancy.

Folate from food sources alone appears to cause no harm, but high enough doses of folate from supplementation or fortified foods may mask vitamin B12 deficiency. Folate and folic acid are most commonly found in fortified and enriched grains, green vegetables, legumes, seeds and liver.

Vitamin B-12

Vitamin B-12 is needed for maintaining the nervous system, red blood cell formation and new cell synthesis. Deficiency of vitamin B-12 can result in ataxia, or loss of coordination due to nervous system problems, degeneration of nerves pernicious anemia, fatigue and altered taste perception.

Intrinsic factor is a substance needed to absorb B-12 in the gut. Because we tend to produce less intrinsic factor as we age, deficiency is more common in the elderly. It can also be difficult to get B-12 in adequate amounts in a vegetarian or vegan diet because it is found only in animal products and fortified foods.

Because of the severe symptoms of deficiency, it is important for vegetarians and vegans to eat fortified foods or take a supplement. Vegetarians that eat eggs and dairy can get B-12 from those sources as well. No adverse effects have been found due to excessive vitamin B-12 intake.

Biotin

Biotin is needed for metabolism and energy production. It is required for critical steps in various metabolic processes. Deficiency is rare, but can result in depression, hair loss, lethargy, and hallucinations.

There have been no reported adverse effects of biotin toxicity. Biotin is widespread in foods, but good sources include meat, egg yolks, soy, and fish. Small amounts of biotin are produced by GI bacteria.

Pantothenic Acid

Pantothenic acid is used in energy metabolism and the synthesis of lipids, neurotransmitters, and hemoglobin. Deficiency is rare but can lead to failure of body systems and include the following symptoms: vomiting, nausea, insomnia, depression, and apathy.

There have been no adverse effects of excess pantothenic acid intake. This vitamin is found in numerous foods, but good sources include organ meats, mushrooms, avocados, broccoli, and whole grains.

Vitamin C (Ascorbic Acid)

Vitamin C, also known as ascorbic acid, is used for collagen synthesis, to support proper immune function, and as an antioxidant for protection of cell membranes. It also enhances the absorption of iron.

Collagen is the fibrous protein that gives strength to connective tissue and is critical for the structure of bones and blood vessels and is important for wound healing.

Deficiency symptoms include anemia, atherosclerotic plaques, poor wound healing, bleeding gums, fatigue, easy bruising/hemorrhage, and increases the susceptibility to infections.

Scurvy was the first vitamin deficiency discovered. Although they didn't know what vitamins were, it was discovered that sailors who ate citrus fruits were able to avoid or get rid of the symptoms of scurvy including bleeding gums, easy bruising or hemorrhaging, susceptibility to infections and fatigue.

Smokers need 30 percent more vitamin C as nonsmokers because of the oxidative stress that smoking causes.

High intakes of vitamin C can result in nausea, abdominal cramps, diarrhea, headache, fatigue, hot flashes, and increased incidence of kidney stones.

Common food sources of vitamin C include citrus fruits, strawberries, red bell peppers, broccoli, kiwi, and brussels sprouts.

What are Minerals?

Minerals are simple, inorganic substances that are needed by the body for many functions. Inorganic refers to the fact that these substances do not contain carbon. The general functions

of minerals in the body are to promote chemical reactions and form body structures. Like vitamins, minerals do not provide any energy.

Minerals and Trace Minerals

Minerals are categorized as major, or trace based on the amount needed in the diet. In general, if we require at least 100 mg, or about 1/50th of a teaspoon, of a mineral, it is a major mineral. If we require less, it is a trace mineral.

Calcium

Calcium is required for bone and tooth formation, nerve impulse transfer, muscle contraction, blood clotting and regulation of blood pressure. Deficiency of calcium can result in porous bones that can fracture, convulsion and muscle spasms. Inadequate calcium intake can limit growth and bone formation during the growing years.

Calcium homeostasis, maintenance of blood calcium levels, is a high priority in the body. Calcium circulates in the blood and is stored mostly in bones. The regulation of blood calcium levels allow the body to deposit calcium in the bones when levels rise, and extract calcium from bone if levels fall. This body regulation is important to sustain all functions of calcium.

Many people in the US do not get enough calcium, particularly teens, older children, adult women, and the elderly. This is due to many factors including preference for other drinks such as soft drinks, lactose intolerance, and high intakes of protein and phosphorous which have been linked to lower calcium status. Calcium is absorbed best when consumed with food.

Calcium, Cont.

Excessive intake of calcium is rare but can result in calcium deposits in organs and soft tissues. Signs of toxicity include constipation, kidney stone formation, and interference of absorption of other minerals, such as iron.

The best food sources are dairy products and fortified juices, cereals, and breads. Vegetables such as spinach and broccoli have some calcium, but it is not as easily absorbed.

Osteoporosis

Osteoporosis is decreased bone mass related to the effects of aging, poor diet, and the hormonal effects of menopause. About 1 in 4 women and 1 in 8 men develop osteoporosis.

Bone development occurs largely in youth, finishing before age 24-26. The peak age of bone development is at age 10-16, when bone is formed at 4 times the rate of any other time in life. This is why proper nutrition, especially calcium intake is so important during youth and teenage years. By the time someone is in their 30’s or 40’s, bones begin to demineralize, making them weaker. If strong enough bones were not formed during youth, the effects of demineralization can be worse.

Osteoporosis

Osteoporosis can be influenced by many different factors. Adequate intake of Vitamin D, iron, protein, phosphorous, boron and calcium can increase or maintain bone mass, while inadequate intake can decrease bone mass. Weight bearing activity, including weightlifting, yoga, and walking can also increase bone mass.

Some of the common causes of decreased bone mass include hormonal influences, medications that block calcium absorption, alcohol consumption, cigarette smoking, and genetic factors; people with light complexions or from Asian or Northern European races are more likely to have osteoporosis.

Phosphorus

Phosphorous is another mineral that is needed for strong bone and tooth formation, with about 80% of the phosphorous in the body found in the bones and teeth as calcium phosphate.

Phosphorous is also used for energy production and maintenance of proper acid base balance in the body.

Deficiency is rare but can result in osteoporosis, muscular weakness, bone pain and metabolic disorders. When there is a chronic imbalance in the calcium to phosphorous ratio in the diet, which happens often when people drink a lot of soda but no dairy products, this can contribute to bone loss.

Toxicity can lead to calcification of non-skeletal tissues, in particular the kidneys, but there have been no adverse effects of high dietary phosphorous intakes reported. Phosphorous can be found in dairy products, meats, poultry, fish, seeds and nuts and soft drinks.

Magnesium

Magnesium is needed for calcium metabolism, so it is required for formation of teeth and bones. Magnesium is also used for muscle contraction, nerve impulse transmission and in the functioning of the immune system.

Deficiency of magnesium can result in stunted growth in children, weakness, and confusion; severe magnesium deficiency can cause muscle spasms, hallucinations, and difficulty swallowing. Most of these symptoms are likely related to abnormal nerve functioning due to the lack of magnesium.

Toxicity is rare from foods but can occur from excessive intake of supplements or laxatives and antacids. Symptoms of toxicity include diarrhea, dehydration, and alkalosis. Magnesium can be found in whole grains, legumes, nuts, dark green vegetables, and cocoa.

Sodium

Sodium is an important mineral for the regulation of fluid volume, maintenance of electrolyte balance, muscle contraction and nerve impulse transmission. Sodium deficiency from intake is

very rare, but increased sodium loss through endurance sports, diarrhea or vomiting is possible. Signs of sodium deficiency include muscle cramps, mental apathy, and loss of appetite.

Excessive intake of sodium is very common in the American diet, with most Americans consuming at least twice the recommended sodium intake. Sodium toxicity can result in hypertension and edema. Salt is the main source of sodium in the diet, commonly consumed as added table salt and in processed foods.

Meat, milk, breads, and vegetables contain more moderate amounts of sodium. In general, up to 75% of the sodium in a person's diet comes from salt added to foods in manufacturing, 15% of a person's sodium is added during cooking and at the table, and only 10% of a person's sodium intake comes from sodium naturally found in foods.

Potassium

The main functions of potassium include fluid and electrolyte balance, nerve impulse transmission, and contractions of the smooth, skeletal, and cardiac muscles. Unlike sodium, adequate potassium intake is associated with lower blood pressure. Deficiency of potassium can lead to muscular weakness, irregular heartbeat, paralysis, and confusion.

Toxic levels of potassium are usually filtered out by the kidney, but toxicity can occur in those with kidney problems. Toxicity may also occur from overconsumption of potassium salts or supplements. Signs of toxicity include muscular weakness, vomiting, and slowed or stopped heartbeat. Potassium can be found in all whole foods, with bananas, potatoes, dairy, and grains being especially good sources.

What are Trace Minerals?

Trace minerals are those needed in very small amounts in the diet, generally less than 100 mg per day. Although only very little is needed, trace minerals still contribute to many important body functions, including metabolic pathways, GI tract function, cardiovascular system function, blood, muscle and bone formation, and central nervous system function.

Deficiency of trace minerals can occur and disrupt these functions. Trace minerals include iron, zinc, fluoride, iodine, selenium, copper, manganese, chromium, and molybdenum. We will focus on iron and zinc in our discussion of these minerals

Iron

Iron is an essential nutrient, with functions that include helping to accept, carry and release oxygen and aiding in the utilization of energy. Iron is mainly found in two proteins in the body; it is found in hemoglobin in red blood cells, which carries oxygen in the blood, and it is found in myoglobin in muscles, which makes oxygen available for muscle contractions.

Iron deficiency anemia refers to a severe depletion of iron stores that causes low hemoglobin concentrations. Red blood cells are pale and small in iron deficiency anemia, and they are unable to carry adequate oxygen from the lungs to the tissues. This results in decreased energy metabolism in the cells, and can result in weakness, fatigue, impaired cognitive ability, pale

skin, inability to regulate body temperature, and pica. Chronic iron deficiency anemia has been found to affect school readiness and learning for children.

Toxicity is generally not a risk for most people but can result from a disorder called hemochromatosis or excessive supplementation, and symptoms include GI distress, vomiting, organ damage and infections.

Iron

Iron is found in food sources in 2 different forms: heme and non-heme iron. Heme iron is found in animal products and is highly bioavailable, meaning that it is more efficiently absorbed.

Non-heme iron is found in plant products and is absorbed less readily. The absorption of non-heme iron can be enhanced if it is consumed with animal sources of iron or with food sources of vitamin C at the same meal.

Food sources of iron include meat, poultry, fish, legumes, fortified grains and cereals, and dried fruit.

Zinc

Zinc is required for protein synthesis, RNA and DNA formation, immune system function and wound healing. Zinc deficiency can lead to growth retardation, delayed sexual maturation, impaired immune system function, loss of appetite or taste alterations and hair loss.

Zinc absorption is affected by iron and calcium intake, so people on calcium or iron supplements may need zinc supplementation as well, but the supplements should be taken at different times of day for maximum absorption.

Toxic levels of intake from supplements or fortified lozenges can lead to impaired immunity, loss of appetite, copper, and iron deficiencies, and can cause a metallic taste in the mouth. Good food sources of zinc include meat, poultry, fish, and whole grains.

Water

Water plays an important role in the body and makes up about 50-70% of the body's weight. Muscle tissue is about 73% water, while fat tissue is about 20% water.

Next, we will look at the role water plays in the body.

Functions of Water

Water is a vital part of the body. Water is important for resistance to temperature change, cooling, chemical reactions, pH balance, and body fluids. In addition, water acts as transportation and a lubricant and cushion.

Functions of Water

Because water is so important in the cells, the body works hard to maintain water balance through proper hydration. There are hormones that function to maintain balance. Anti-diuretic hormone, or ADH, is released if there is not enough water in the body. It signals the kidneys to reduce urine flow, thus decreasing water output.

Aldosterone is a hormone that tells the kidneys to retain more sodium and chloride, which will also cause more water retention. When water concentrations are low, your brain also sends a thirst signal.

Regulation of Water Balance

Water balance is achieved through equal fluid input and output. Beverages are the main source of water. Many foods also contribute smaller amounts of water, including soups, fruits and vegetables, tofu and water packed tuna.

Even foods you may not think of contain water, although in smaller amounts, including potatoes, corn, rice, skinless chicken, and baked salmon.

Some metabolic processes make up the remaining water input in the body. The main place for fluid output is the kidneys through urine. However, perspiration through the skin and evaporation in the lungs, as well as fluid excreted in feces also account for some of the fluid output in the body.

Functions of Water

Because water is a major component of the blood stream, water balance can affect blood volume and therefore, blood pressure. Excess water will increase blood volume and extra volume will put pressure on the blood vessels. If blood pressure gets too high, the kidneys will try to regulate volume through the hormones ADH and aldosterone.

Renin is a hormone that activates the formation of angiotensin I. Angiotensin I is converted to Angiotensin II, which triggers the release of aldosterone.

In addition, angiotensin II will signal for the restriction of blood vessels in the response to the decrease in blood volume that will occur as the kidneys excrete water.

Functions of Water

Water also serves as a transportation method for things such as the water-soluble nutrients. Water can help flush toxins from the body through excretion in the urine.

Water helps to regulate body temperature through perspiration, by absorbing excess heat and then evaporating through skin pores.

Water is also needed for most of the metabolic reactions that take place in the body, therefore water is important for energy.

Functions of Water

Water serves other functions in the body, including working as a cushion for synovial fluid in the joints, and as a lubricant in saliva and tears. Water is also a major part of amniotic fluid, which is important as a shock absorber for a developing fetus.

Dietary Reference Intakes (DRIs)

Lastly, vitamins and minerals have a set of reference values for determining nutritional need called the Dietary Reference Intakes.

DRIs

Dietary reference values are a set of values used for determining nutritional needs. There are DRIs for the macronutrients as well as the vitamins and minerals. The DRIs are determined based on the scientific evidence available for each nutrient.

Estimated Average Requirements, or EARs, is the amount of a nutrient estimated to meet the needs of 50% of the population. The EAR is used primarily for assessing the intake of the general population, not individuals.

Recommended dietary allowances, or RDA, is the amount of a nutrient needed to prevent deficiency in 98% of the population.

Adequate intakes is a goal amount of a nutrient that is set for those nutrients where a RDA could not be determined. Tolerable upper limit is the highest amount of a nutrient that is likely to produce no adverse health effects in 98% of individuals.

Daily values are used on the food label, they include 2 types of standards, the RDAs and daily reference values.

Daily reference values are used for nutrients that do not have an RDA, such as saturated fat and cholesterol. Reading food labels and planning a balanced diet to include all nutrients will be discussed in a later module.

Link: https://health.gov/our-work/nutrition-physical-activity/dietary-guidelines/dietary-reference-intakes-dris

Test Your Knowledge:

Now is time to test your knowledge!

Question 1

Question 1: Which of the following fat-soluble vitamins can be synthesized by the body?

A. Vitamin D B. Vitamin A C. Vitamin K D. a and c

Answer: D. Both vitamin D and vitamin K can be synthesized by the body. Vitamin D with the help of the sun, and vitamin K with GI bacteria

Question 2

Question 2: Which of the following is false about water soluble vitamins?

A. They are not stored in significant amounts in the body. B. They are easily excreted by the body, therefore high intakes are not a concern. C. They can be lost in the cooking process. D. They include 8 B-complex vitamins and vitamin C.

Answer: B. Although it is true that water soluble vitamins are more easily excreted than fat soluble vitamins, there have been adverse effects with toxicity of niacin, folate, vitamin B6 and vitamin C.

True/False

Question 3: Neural tube defects occur early in pregnancy, so it is important for women to have adequate folate intake prior to getting pregnant in addition to during pregnancy.

Answer: A. True

Question 4

Question 4: Iron Deficiency anemia has been shown to affect school readiness and learning in children.

A. True B. False

Answer: A. True

Question 5

Question 5: Water is needed in all of the following functions except:

A. pH balance B. Transportation C. Blood volume regulation D. Hormone regulation E. Lubrication

Answer: D. Water is needed in all of the above functions except hormone regulation.

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Quiz Result

This Completes the Module

This completes the module Micronutrients and Water, presented by the Minnesota Department of Health, WIC Program.

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