NUTRITION OF HUMAN BODY LECTURE1

Prof.Dr.Luma abd almunim baker
Stage 4 th/ elective
biochemistryl

CLASSIFICATION OF FOOD AND PROXIMATE COMPONENTS OF FOOD:

Food vary widely in their contents of various nutrients, they have been classified into three groups on the nutritional basis - Energy yielding, Body building and Protective food. 1) Energy yielding foods: Foods rich in carbohydrates and fats are called energy yielding foods. They provide energy to sustain the involuntary processes essential for continuance of life to carry out various professional, household and recreational activities and to convert food ingested into usable nutrients in the body. The energy needed is supplied by the oxidation of foods consumed. Cereals, roots and tubers, dried fruits, oils, butter and ghee are all good sources of energy.

2) Body building foods:

Fats/Lipids

Fat = 9 calories per gram

Fats serve several important functions in the body:

- Make up lipid membranes
- Help to transport vitamins
- Energy storage
- Required to produce sex hormones

Saturated fats:
- Straight fatty acid tails
- Solid at room temperature
(ex. Butter)

Unsaturated fats:
- Bent fatty acid tails (due to double bond)
- Tend to be liquid at room temperature
(ex. Olive oil)

Trans fats:
- Contain trans double bonds
- Rare in nature (produced during partial hydrogenation)
- Solid at room temperature
(ex. shortening)

3) Protective and Regulatory foods:

Foods rich in protein, minerals and vitamins are known as protective and regulatory foods. They

are essential for health and regulate activities such as maintenance of body temperature, muscle

contraction, control of water balance, clotting of blood, removal of waste products from the body

and maintaining heartbeat. Milk, egg, liver, fruits and vegetables are protective foods.

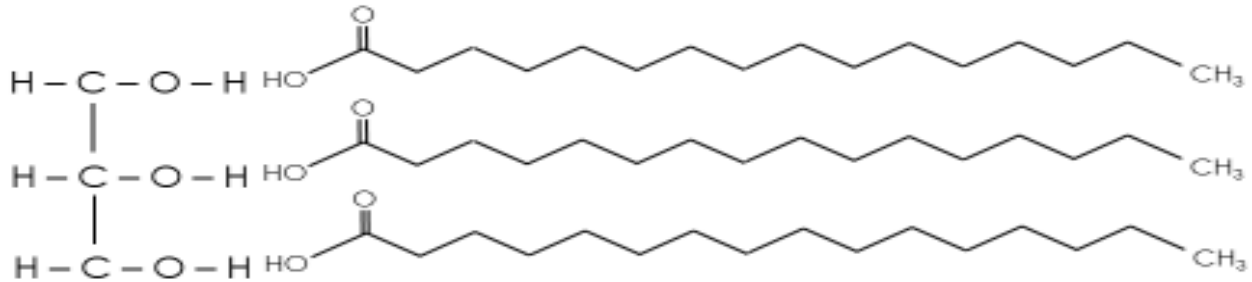
Protective foods are further classified into two groups-

i) Food rich in vitamins, minerals and proteins of high biological value. Exa - Milk, eggs and

liver.

ii) Food rich in certain vitamins and mineral only. Exa – Green leafy vegetables and fruits.

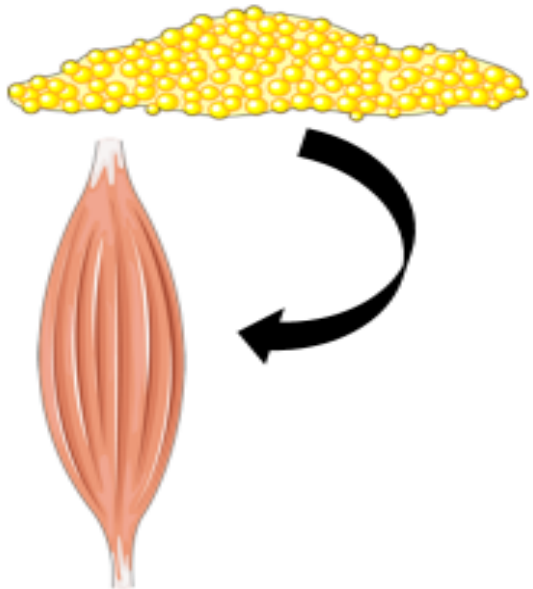
Fat & Skeletal Muscle



Glycerol backbone **3 Fatty Acids**

Taken to the blood stream and broken down

The more fatty acids in the blood stream, the more can be taken up by muscle and used for fuel

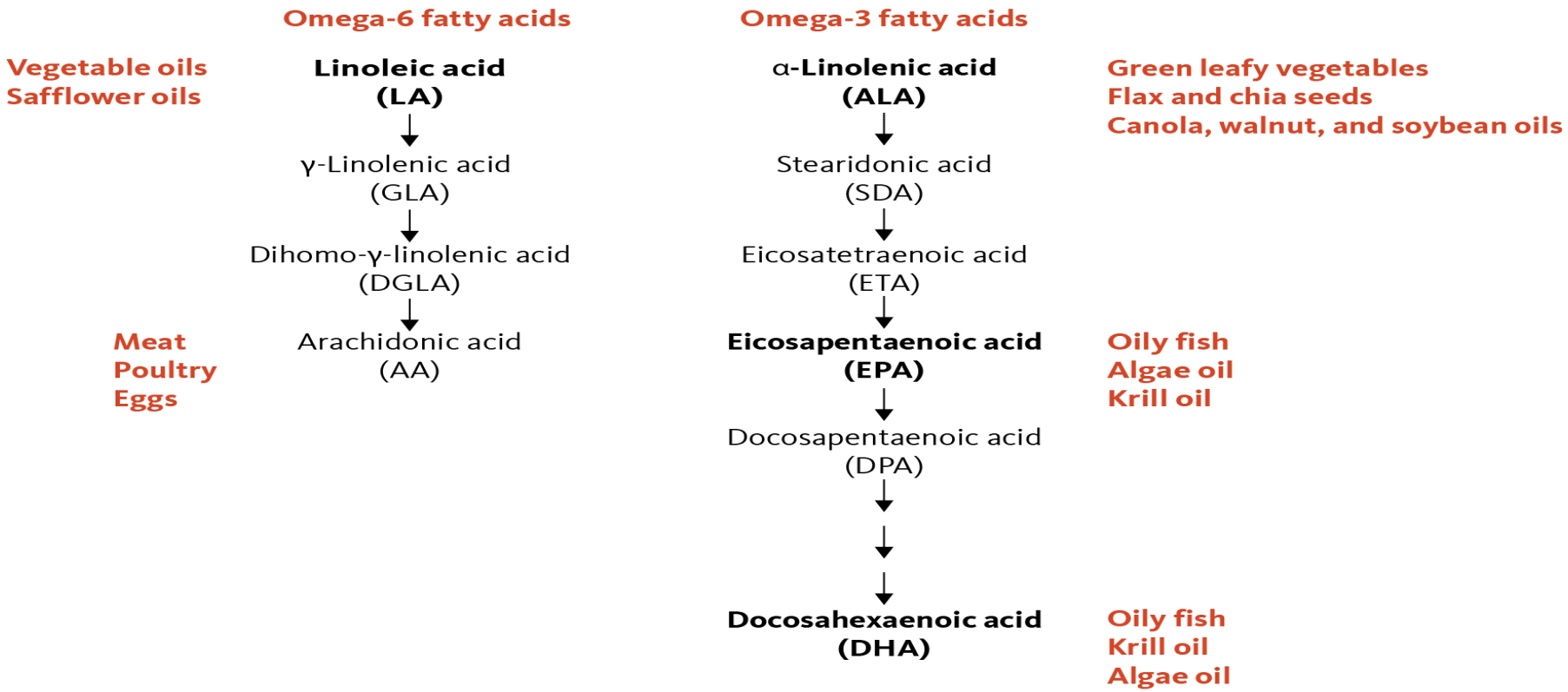


Some fat can be stored in the muscle (intramuscular triglycerides [IMTG]) to be used quickly for fuel

Gordon & Wardlaw. *Contemporary nutrition 6th ed.* 2004

FATTY ACIDS ARE THE BUILDING BLOCKS OF THE FAT IN OUR BODIES AND IN THE FOOD WE EAT. DURING DIGESTION, THE BODY BREAKS DOWN FATS INTO FATTY ACIDS, WHICH CAN THEN BE ABSORBED INTO THE BLOOD. FATTY ACID MOLECULES ARE USUALLY JOINED TOGETHER IN GROUPS OF THREE, FORMING A MOLECULE CALLED A TRIGLYCERIDE.

Figure 2. Essential Fatty Acids and Dietary Sources



Omega-6 (n-6) and omega-3 (n-3) fatty acids comprise the two classes of essential fatty acids (EFA). The parent compounds of each class, linoleic acid (LA) and α-linolenic acid (ALA) (bold font), give rise to longer chain derivatives inside the body. Due to low efficiency of conversion of ALA to the long-chain omega-3 PUFA, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), it is recommended to obtain EPA and DHA from additional sources. Dietary sources of the different long-chain PUFA are listed in the figure.

FATTY ACIDS, NUTRITION AND THE FATTY ACIDS

Pre-Activity Assignment: Fatty Acids, Nutrition and the Fatty Acids, Nutrition and Health ,answer the following questions before class.

1.A trans fatty acid is one

a.that has no carbon-carbon double bonds directly adjacent to each other.b.that is a major component of phospholipids in cell membranes.c.in which the hydrogens attached to adjacent carbons in a carbon-carbon double covalentbond are on opposite sides of the molecule.d.in which the hydrogens attached to adjacent carbons in a carbon-carbon double covalentbond are on the same side of the molecule.e.that is saturated with hydrogens.

2.Types of polyunsaturated fatty acids that are necessary in the human diet because theycannot be synthesized by the body are called _____ fatty acids

THANK YOU

Carbohydrates (CHO)

Carbohydrates = calories per gram

Made up of carbon, hydrogen, and oxygen ($C_6H_{12}O_6$).

In plants

CHO = Sugars
Starches
Fibre

In the body

Glucose (in the blood)
Glycogen (in the liver and muscle)

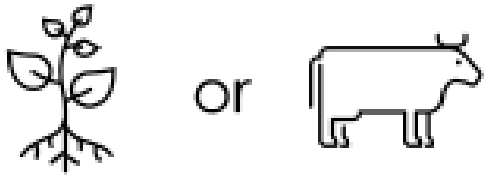
Carbohydrates are commonly known as a source of energy for the body.

Vitamins

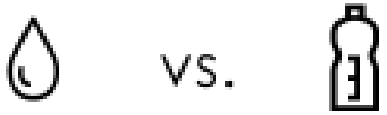
Vitamins = 0 calories per gram

- Are required for normal function, growth and maintenance
- Assist in chemical reactions

Can come from:



Are categorized by solubility:



Fat vs. Water

In order to be classified as a vitamin:

1. The body is not able to synthesize enough of the nutrient to maintain health
2. Prolonged absence of the nutrient produces deficiency symptoms

Vitamins- Fat Soluble

Vitamin	Major Function
Vitamin A (preformed vitamin A and provitamin A)	Promote vision: night and color; promote resistance to bacterial infection and overall immune system through mucus production; promote growth; prevent drying skin and eyes; antioxidant; acne treatment
Vitamin D	Increase absorption of calcium and phosphorus; Maintain optimal blood calcium and calcification of bone; skin development
Vitamin E	Antioxidant: prevents breakdown of vitamin A and unsaturated fatty acids; improves vitamin A absorption; metabolizes iron in cells; maintains nervous tissue and immune function
Vitamin K	Activation of blood-clotting factors, Activation of proteins involved in bone metabolism

Vitamins- Water Soluble

Vitamin	Major Function
Thiamin (vitamin B-1)	Coenzyme of carbohydrate metabolism; nerve function
Riboflavin (vitamin B-2)	Coenzyme of oxygen requiring pathways like fatty-acid breakdown, homocysteine metabolism
Niacin (vitamin B-3)	Used by almost all metabolic pathways; coenzyme of energy metabolism; makes new compounds; coenzyme of fat synthesis
Pantothenic Acid (vitamin B-5)	Coenzyme of energy metabolism from carbs, fat, and protein; coenzyme of fat synthesis; coenzyme of fat breakdown
Vitamin B-6 (pyridoxine)	Coenzyme for numerous enzymes of carb, fat, and especially in protein metabolism by splitting nitrogen group from amino acid; neurotransmitter synthesis; hemoglobin synthesis; white blood cell synthesis
Biotin (vitamin B-7)	Coenzyme of glucose production and fat synthesis by adding carbon dioxide to other compounds
Folate vitamin B-9) (folate is the natural form which contains more glutamic acid which slows absorption; folic acid is chemical form added to foods and supplements without glutamic acid. vitamin B-9)	Coenzyme involved in DNA synthesis to help form new red blood cells by supplying/accepting single carbon compounds; helps form neurotransmitters in the brain to help with depression
Vitamin B-12 (Cobalamin)	Coenzyme of folate metabolism in that it converts folate to its active form; maintains myelin sheaths to insulate neurons from each other and maintain nerve function; homocysteine metabolism
Vitamin C (Ascorbic Acid)	Collagen synthesis for connective tissue and wound healing; hormone synthesis; neurotransmitter synthesis; possible antioxidant activity; reduces destruction of folate; increases iron absorption; immune system and defense versus common cold
Choline	Part of acetylcholine which is a neurotransmitter; part of lecithin which is a phospholipid; homocysteine metabolism

Gordon & Wardlaw. *Contemporary nutrition 6th ed.* 2004

NUTRITION OF HUMAN BODY
LECTURE2

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CLASSIFICATION OF FOOD AND PROXIMATE COMPONENTS OF FOOD:

Protein

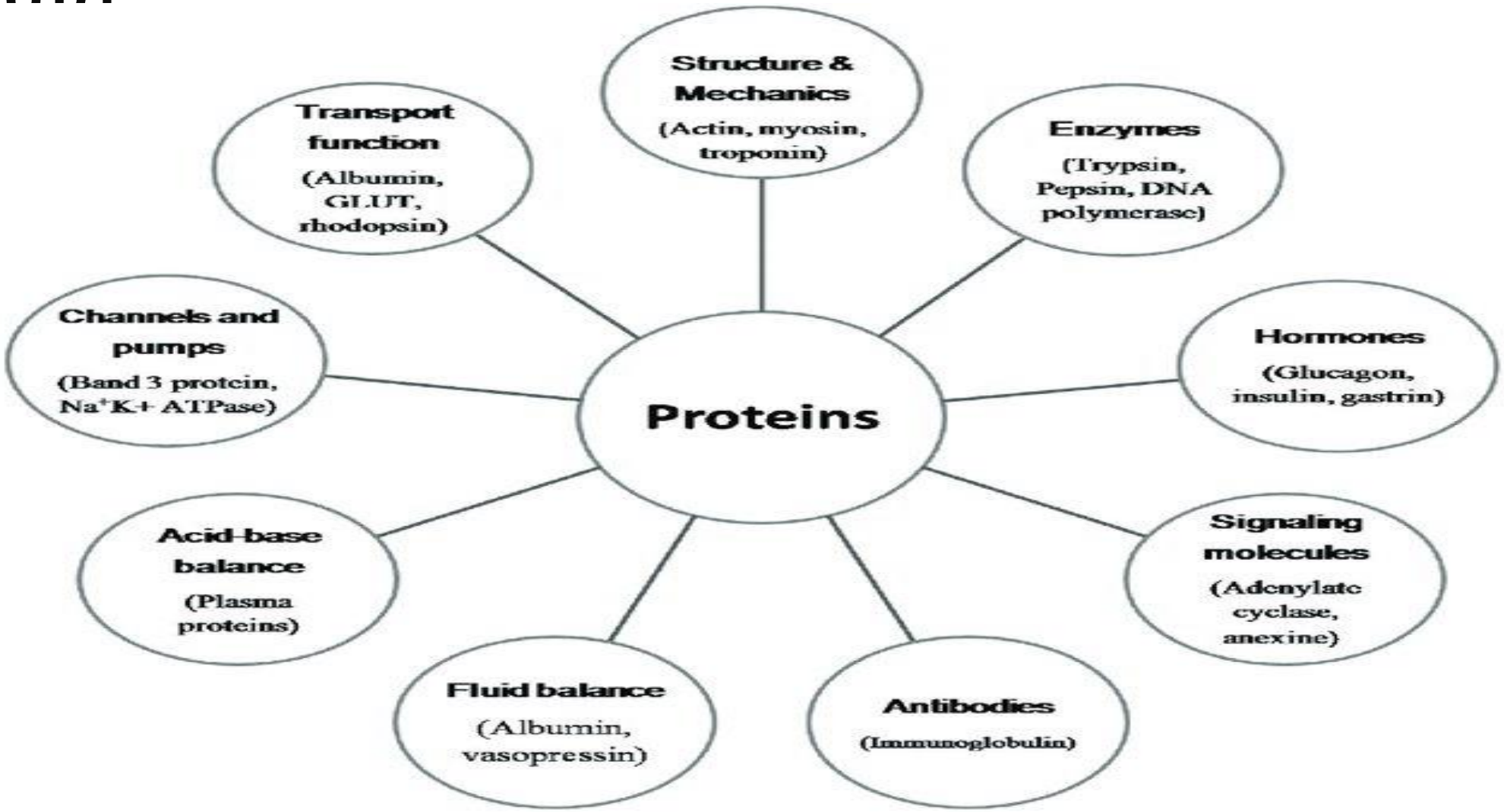
Protein = 4 calories per gram

Proteins are involved in:

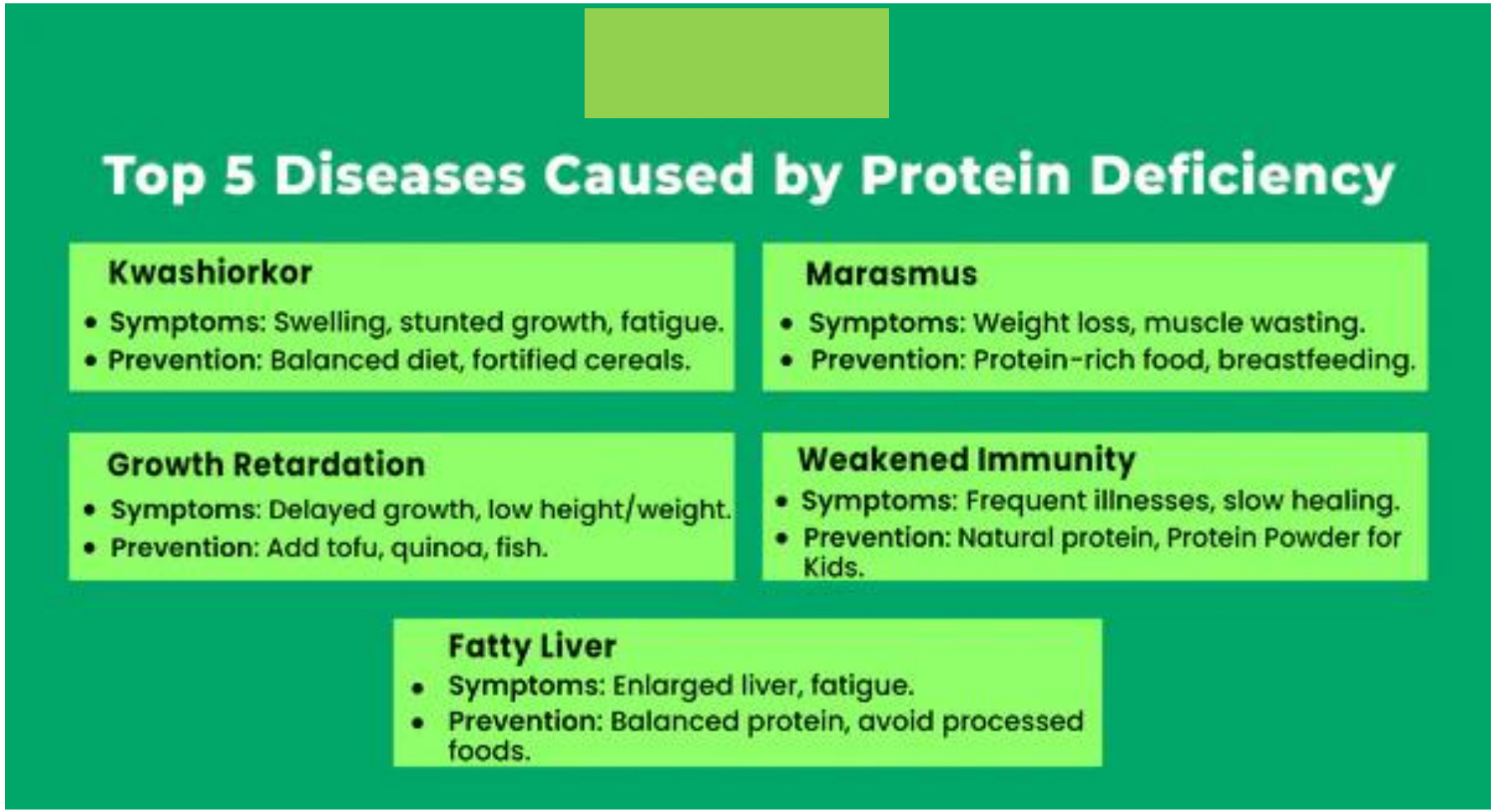
- Blood clotting
- Fluid balance
- Hormone production
- Enzyme production
- Cell repair
- Connective tissues
- Neurotransmitters
- and many more!

Gordon & Wardlaw. *Contemporary nutrition* 6th ed. 2004

MULTIPLE FUNCTIONS OF PROTEINS IN HUMAN BODY



DISEASE CAUSED BY DEFICIENCY OF PROTEIN?



IMPORTANCE OF A BALANCED DIET FOR PROTEIN INTAKE

Ensuring a balanced diet rich in protein is key to preventing diseases caused by deficiency of protein. A well-rounded approach includes:

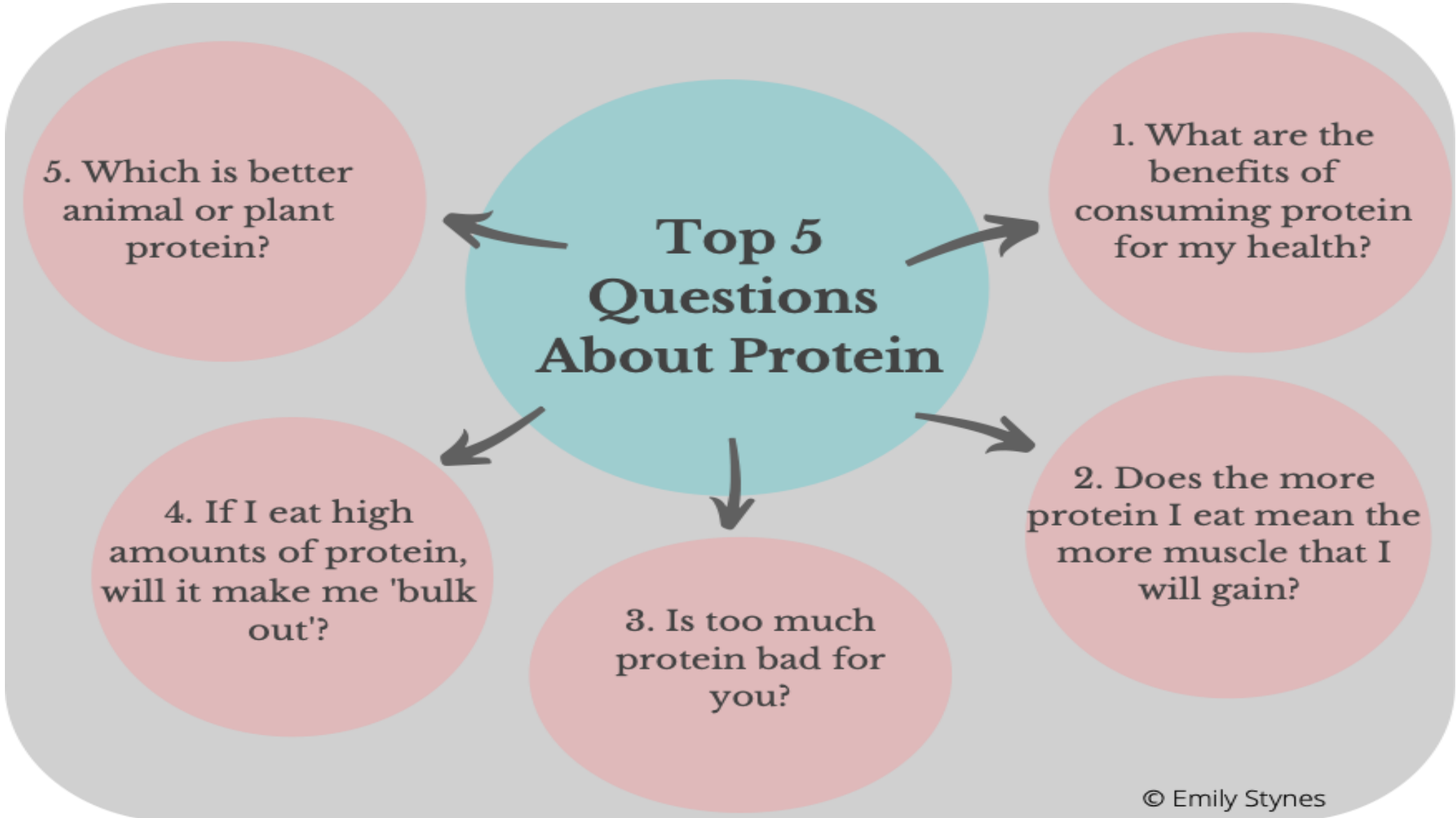
Diverse Protein Sources: Include foods like eggs, milk, lentils, nuts, and seeds to ensure a complete amino acid profile.

Whole Foods Over Processed Foods: Avoid processed foods with class 2 preservatives, as they can reduce nutritional quality and harm overall health.

Meal Variety: Introduce protein-rich foods through different recipes like lentil soups, yogurt smoothies, or nut butter sandwiches to make meals enjoyable.

Fortified Foods: Where natural sources are limited, consider fortified cereals or beverages as additional sources of protein.

Complementary Nutrients: Pair protein intake with vitamins and minerals like calcium and iron to enhance absorption and overall growth.


Top 5 Questions About Protein
1. What are the benefits of consuming protein for my health?
2. Does the more protein I eat mean the more muscle that I will gain?
3. Is too much protein bad for you?
4. If I eat high amounts of protein, will it make me 'bulk out'?
5. Which is better animal or plant protein?
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THANK YOU

NUTRITION OF HUMAN BODY
LECTURE3

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VITAMINS

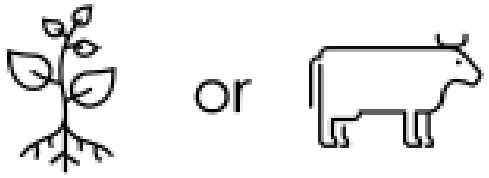
Vitamins and minerals are micronutrients required by the body to carry out a range of normal functions. However, these micronutrients are not produced in our bodies and must be derived from the food we eat. Vitamins are organic substances that are generally classified as either fat soluble or water soluble.

Vitamins

Vitamins = 0 calories per gram

- Are required for normal function, growth and maintenance
- Assist in chemical reactions

Can come from:



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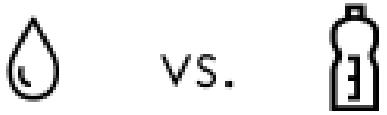

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TYPES OF VITAMINS AND THEIR FUNCTIONS

Vitamins and minerals are a form of nutrient (called micronutrients) that are needed in small amounts. Although micronutrients don't give us energy, they are involved in the metabolic processes that enable us to get energy from carbohydrates, protein and fat, which are also known as macronutrients.

Different vitamins serve different purposes and contribute to different bodily functions. There are 13 vitamins in total and 8 of these come from the B-group of vitamins.

VITAMIN A DEFICIENCY RISKS

Because of the various roles that vitamin A plays in the body, deficiency can have several health effects. These include:

increased risk of infections

night blindness and irreversible blindness (xeropthalmia)

excessive keratin build-up of the skin.

TRACE ELEMENTS

Trace elements are also essential nutrients that your body needs to work properly, but in much smaller amounts than vitamins and minerals. They include iodine and fluorine.

Trace elements are found in small amounts in a variety of foods such as meat, fish, cereals, milk and dairy foods, vegetables and nuts

Thank you

NUTRITION OF HUMAN BODY
LECTURE4

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CLASSIFICATION OF PROTEINS:

Proteins may be classified 1) on the basis of their structure and 2) on the basis of their quality or nutrition value i.e. the amino acids present in them.

1) Classification of proteins by Structure:

On the basis of structure proteins are classified into three types –

i) Simple Protein: These proteins are made up of amino acids only. Exa. – Zein in corn, Albumin in egg white and Gliadin in wheat consists of amino acids only.

iii) Conjugated Proteins: These proteins have a non-protein molecule attached to the protein. Exa. – Blood protein haemoglobin, which contains a haeme (iron) group attached to protein and milk protein casein, which has a phosphate group attached.

iv) Derived Proteins: These result from a partial breakdown of a native protein. Proteases, peptones and polypeptides are formed when digestive enzymes begin their action on proteins.

) CLASSIFICATION OF PROTEINS BY NUTRITION OR QUALITY:

Proteins are classified into three groups on the basis of their nutrition or quality.

i) First Class Protein or Complete Proteins: These proteins contain all essential amino acids in sufficient proportions and amounts to meet the body's need for growth and repair of tissue cells. A complete protein food has a high BV. They are found in animal foods. Exa. – Eggs, milk, meat, fish and poultry are complete protein foods.

ii) Second Class Protein or Partially Complete Proteins: These are proteins in which one or more essential amino acids are present in inadequate amounts. They cannot synthesize tissues without the help of other proteins. The value of each is increased when it is consumed in combination with another incomplete protein at the same meal. They can maintain life. They are found in plant foods. Exa. – Cereals, pulses, nuts and oilseed are partially complete protein foods. Cereals contain inadequate amounts of essential amino acid lysine and pulses are deficient in essential amino acid, methionine.

iii) Incomplete Proteins: These proteins are incapable of growth and repair of body cells. They cannot maintain life. One or more essential amino acids may be completely lacking in these proteins. Exa. – Gelatin and Zein in corn. Gelatin lacks three essential amino acids and is the only animal protein which is

incomplete.

PROTEIN DEFICIENCY DISEASES:

i) A reduced protein intake over a prolonged period of time leads to loss of weight, fatigue, anemia, nutritional oedema, lowered resistance to infection and poor healing of wounds.

ii) Protein deficiency is more marked during periods when proteins needs are more e.g. during infancy, childhood, pregnancy and lactation. Deficiency occurs when an individual does not eat enough proteins.

iii) It is one of the reasons for diseases like breast cancer, colon cancer, heart disease and osteoporosis.

iv) Congenital protein C or S deficiency causes abnormal blood clotting. This disorder causes an increased risk of clot formation, called thrombosis.

v) Inadequate supply of proteins in the food consumed among small children in the age group of 1-3 years caused a disease called Kwashiorkor. A child suffering from this disease has a very poor diet with stunted growth, bulging eyes, long curved thin legs, dark skin and luster less hair.

PROTEIN DEFICIENCY DISEASES

- **Symptoms:-**

a) Child loses appetite.
b) The bones of legs bend.
c) The chest protrudes abnormally.

- **Age group** - 1-3 years :-
- **Protection**:- Protein rich food items should be eaten.

Thank you

NUTRITION OF HUMAN BODY
LECTURE5

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MINERALS

Composition and Sources:

The body contains about 24 minerals all of which are derived from the diet. The important minerals are calcium, phosphorous, potassium, sodium, chloride, magnesium, iron, copper, iodine, fluorine and zinc.

The body needs many minerals; these are called essential minerals. Essential minerals are divided into major minerals (macrominerals) and trace minerals (microminerals). These two groups of minerals are equally important, but trace minerals are needed in smaller amounts than major minerals.

Macrominerals or Major minerals: These are Sodium, Chloride, Potassium, Calcium, Phosphorus, Magnesium and Sulfur

Microminerals or Trace minerals: These are Iron, Zinc, Iodine, Selenium, Copper, Manganese, Fluoride, Chromium and Molybdenum. Other trace nutrients known to be essential in tiny amounts include nickel, silicon, vanadium, and cobalt.

DEFICIENCY AND EXCESS INTAKE DISEASE AND FUNCTIONS OF MINERALS:

1) Calcium:

Calcium is essential for bone growth and strength, as well as muscle, heart and digestive system health. Sources of the mineral include dairy products, green leafy vegetables and sardines eaten with bones, nuts and seeds.

Sources: Dairy products such as milk, yoghurt and cheese, kelp, broccoli, almonds, sardines eaten with the bones and sesame seeds.

RDA: The recommended daily amount (RDA) is 1000 mg.

Function: Calcium is a macromineral that is needed to maintain strong and healthy bones and teeth. It is also involved in normal blood clotting, muscle and nerve function, lowering blood pressure and is thought to prevent colon cancer.

Symptoms of deficiency: Muscle weakness, spasms and cramp, softening of the bones, which could lead to osteoporosis, back pain, brittle bones and fractures.

2) CHLORIDE:

Chloride is a necessary mineral for digestive health. It helps in the production of hydrocholoric acid in the stomach and cellular pump functions. It can be found in table salt.

Sources: Table salt and foods that contain sodium chloride.

Function: Required for the formation of acids in the stomach as well as regulating fluid in all blood vessels and cells.

RDA: The RDA is 2300 mg.

Symptoms of deficiency: A deficiency is very uncommon but may cause excessive amounts of potassium to be lost and low blood pressure.

3) MAGNESIUM:

Magnesium is necessary for processing enzymes important for metabolism, especially in bones,

muscles, and soft tissue. Foods with magnesium include nuts, soy beans, and cocoa.

Sources: Whole grains, green leafy vegetables, shellfish, nuts and bananas.

RDA: The RDA is 420 mg.

Function: A very important macromineral that is contained in our bones. It is needed to convert

blood sugar into energy, control muscle and nerve function, maintain a normal heart rhythm and

blood clotting. Research has proved that magnesium protects and treats heart disease, lowers high

blood pressure, can ease asthma attacks and PMS in women.

Symptoms of deficiency: The risk of heart disease and diabetes is increased and can also cause

heartbeat irregularities, confusion, muscle cramps and kidney stones.

4) PHOSPHOROUS:

Phosphorous is required for bone health, energy processing, and many other functions in the body.

Foods rich in phosphorous are meat, poultry, fish, eggs, and dairy products.

Sources: meat, poultry, fish, milk, cheese, nuts, seeds and whole grains.

RDA: The RDA for phosphorous is 700 mg.

Function: Phosphorous is another important mineral involved in the formation and maintenance

of strong and healthy bones and teeth. It also helps to supply energy to every cell in the body and

is needed to absorb a number of vitamins.

Symptoms of deficiency: A deficiency in phosphorous is fairly rare, however, symptoms would

include weak and painful bones and teeth, stiff joints, tiredness and a loss of calcium from the

body.

5) POTASSIUM:

Potassium is needed for regulating how the body processes energy and maintains metabolism, as well as contributing to nerve function. Foods high in potassium include legumes, potato skins, tomatoes, and bananas.

Sources: Fresh fruit and vegetables, particularly avocados, bananas, oranges, potatoes. Also dried fruit, nuts, seeds, meat, poultry and milk.

RDA: The RDA for potassium is 4700 mg.

Function: Potassium, along with sodium, works to regulate fluid in the body. Potassium also helps to maintain a regular heartbeat and low blood pressure and enables glucose in the body to be converted to glycogen, a storable form of energy.

Symptoms of deficiency: Muscle weakness, nausea, confusion and feelings of being really thirsty.

6) SODIUM:

Sodium is necessary for regulating body fluid, nerve function, and heart health. Foods with

sodium are table salt, sea vegetables, milk, and spinach.

Sources: Salt, shellfish, anchovies, dairy products especially butter, yeast extracts, processed

meats, avocados and offal.

RDA: The RDA for sodium is 1500 mg.

Function: Helps to maintain muscles and nerves in good working order and works together with

potassium, regulating the fluids in the body.

Symptoms of deficiency: A deficiency is very rare but is possible through sweating, diarrhoea or

vomiting and symptoms include sickness and dizziness, muscle cramps and dehydration.

Thank you