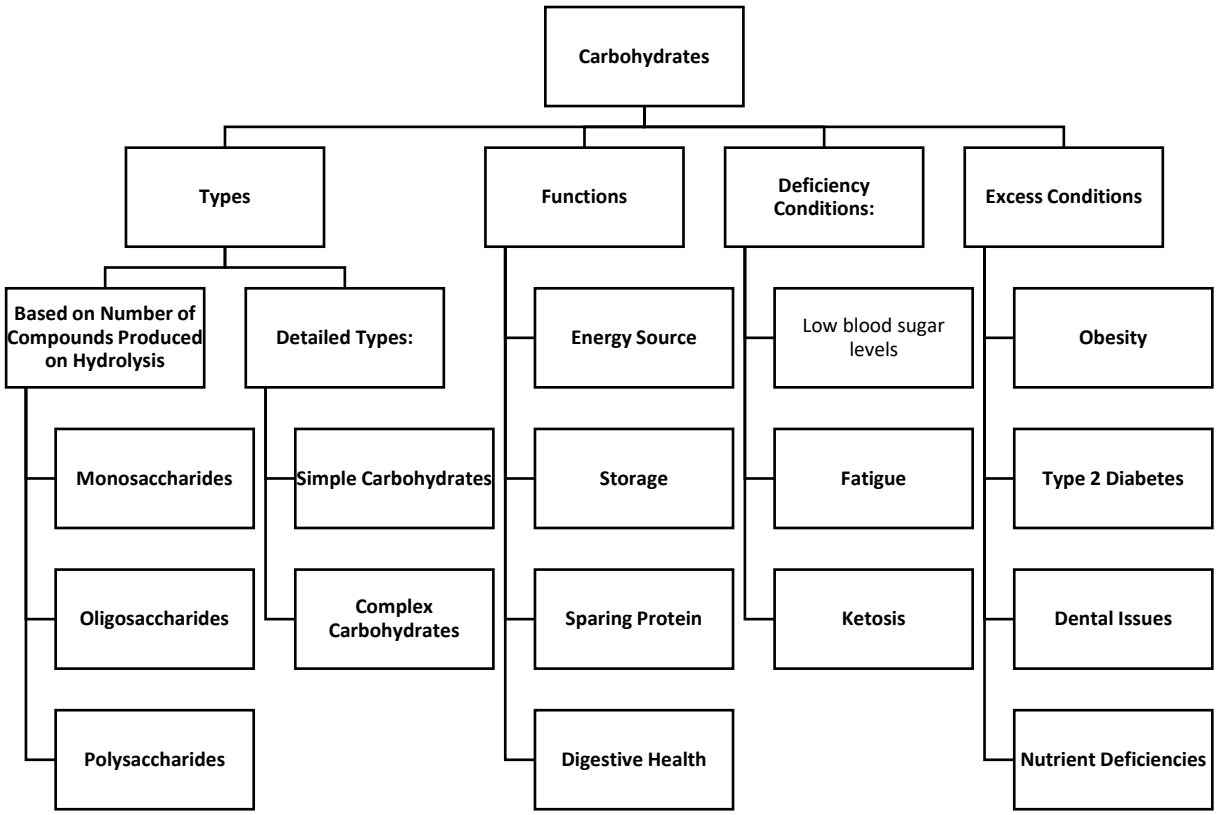
UNIT 2

Nutrition

Definition of Nutrition

Nutrition is the science that studies how food and beverages affect health and well-being. It involves the processes by which living organisms obtain, digest, absorb, and utilize nutrients from food to support growth, maintenance, and energy production. Nutrients include carbohydrates, proteins, fats, vitamins, and minerals, each playing a vital role in bodily functions.

Aspect	Macronutrients	Micronutrients
Definition	Nutrients needed in large amounts.	Nutrients needed in small amounts.
Types	Carbohydrates, Proteins, Fats	Vitamins, Minerals
Functions	Provide energy, support growth.	Support immune function, regulate processes.
Sources	Grains, meat, dairy, oils	Fruits, vegetables, nuts, meat
Daily Requirement	Measured in grams	Measured in milligrams/micrograms
Deficiency Effects	Fatigue, muscle weakness	Weak immune response, anemia



Carbohydrates

Definition: Carbohydrates are optically active polyhydroxy aldehydes or ketones, or molecules that yield such compounds on hydrolysis.

Types:

1. **Monosaccharides:**
    - Simplest form of carbohydrates (single sugar units).
    - Examples: Glucose, fructose.
2. **Oligosaccharides:**
    - Composed of 2-10 sugar units.
    - Examples: Sucrose, maltose.
3. **Polysaccharides:**
    - Composed of multiple sugar units.
    - Examples: Starch, cellulose.

Detailed Types:

1. **Simple Carbohydrates:**
    - Definition: Also known as sugars, composed of one or two sugar molecules.
    - Examples: Glucose, fructose, sucrose, lactose.
    - Sources: Fruits, honey, milk, candy, sugary beverages.
2. **Complex Carbohydrates:**
    - Definition: Made up of long chains of sugar molecules that take longer to digest.
    - Examples: Starches, dietary fiber.
    - Sources: Whole grains (brown rice, oats, whole wheat), legumes (beans, lentils), vegetables (potatoes, corn), whole grain bread/pasta.

Functions:

- **Energy Source**: Primary source of energy, providing 4 calories per gram.
- **Storage**: Excess carbohydrates are stored as glycogen in the liver and muscles.
- **Sparing Protein**: Prevents protein from being used as an energy source.
- **Digestive Health**: Dietary fiber helps with digestion, promoting bowel regularity and preventing constipation.

Deficiency Conditions:

- **Hypoglycemia**: Low blood sugar levels, leading to weakness and confusion.
- **Fatigue**: Low energy levels due to insufficient carbohydrate intake.
- **Ketosis**: Low carbohydrate intake causes the body to use fat as an energy source, leading to the production of ketones.

Excess Conditions:

- **Obesity**: Excess calories from carbohydrates can lead to weight gain.
- **Type 2 Diabetes**: Prolonged high intake can contribute to insulin resistance.
- **Dental Issues**: Sugars contribute to tooth decay.
- **Nutrient Deficiencies**: Overconsumption of simple sugars may lead to reduced intake of nutrient-rich foods.

Proteins

Types

1. **Complete Proteins**:
    - Contain all nine essential amino acids.
    - Sources: Animal products and some plant sources.
2. **Incomplete Proteins**:
    - Lack one or more essential amino acids.
    - Sources: Most plant foods (beans, lentils, nuts, grains).
3. **Complementary Proteins**:
    - Two or more incomplete protein sources combined to provide all essential amino acids.
    - Examples: Rice and beans, peanut butter on whole-grain bread.

Sources

- **Animal Sources**:
- **Plant Sources**:

Functions

- **Building Blocks of Tissues**: Proteins are essential for the growth, repair, and maintenance of body tissues, including muscles, organs, and skin.
- **Enzymatic Functions**: Many enzymes are proteins that catalyze biochemical reactions in the body, aiding digestion and metabolism.
- **Hormonal Functions**: Some hormones, like insulin and growth hormone, are proteins that regulate various physiological processes.
- **Immune Function**: Antibodies, which are proteins, help the body defend against infections and diseases.
- **Transport and Storage**: Proteins such as hemoglobin transport oxygen in the blood, while others store essential nutrients (e.g., ferritin stores iron).
- **Energy Source**: In times of need, proteins can be broken down into amino acids for energy, providing 4 calories per gram.

Deficiency Conditions

- **Protein-Energy Malnutrition (PEM)**: A condition resulting from inadequate protein intake, often seen in developing countries. Symptoms include muscle wasting, weakness, and stunted growth in children.
- **Kwashiorkor**: A severe form of malnutrition caused by protein deficiency, characterized by swelling (edema), liver enlargement, skin changes, and a weakened immune system.
- **Marasmus**: A form of severe malnutrition caused by a lack of both protein and calories, leading to extreme weight loss, muscle wasting, and stunted growth.
- **Edema**: Protein deficiency can lead to fluid retention in tissues, causing swelling.

Excess Condition

- **Kidney Damage**: Excessive protein intake can strain the kidneys, especially in individuals with pre-existing kidney conditions, potentially leading to kidney damage.
- **Dehydration**: High protein diets can lead to increased urine production as the body excretes excess nitrogen, which can cause dehydration if fluid intake is insufficient.
- **Nutrient Imbalances**: Focusing too much on protein can lead to deficiencies in other essential nutrients, such as carbohydrates and fats, which are also important for health.
- **Weight Gain**: Overconsumption of protein, especially from high-fat sources, can contribute to excess calorie intake and weight gain.

- **Digestive Issues**: High protein diets may cause constipation or other digestive problems if fiber intake is low.

- Here's a table summarizing fats and lipids, including their types, sources, functions, deficiency conditions, and excess conditions:

Aspect	Details
Types	- **Saturated Fats**: Typically solid at room temperature; found in animal products (e.g., butter, meat). - **Unsaturated Fats**: Usually liquid at room temperature; divided into: - **Monounsaturated Fats**: Found in olive oil, avocados, and nuts. - **Polyunsaturated Fats**: Found in fatty fish, walnuts, flaxseeds, and vegetable oils (e.g., omega-3 and omega-6). - **Trans Fats**: Created during hydrogenation; found in some processed foods and margarine.
Sources	- **Animal Sources**: Meat, dairy products, butter, lard, and fatty fish. - **Plant Sources**: Nuts, seeds, avocados, olives, and vegetable oils (e.g., olive oil, canola oil).
Functions	- **Energy Storage**: Provide a concentrated source of energy (9 calories per gram). - **Cell Structure**: Integral part of cell membranes, maintaining structure and function. - **Hormone Production**: Serve as precursors for hormones (e.g., steroid hormones). - **Insulation**: Help insulate the body and protect vital organs. - **Nutrient Absorption**: Aid in the absorption of fat-soluble vitamins (A, D, E, K).

Aspect	Details
	- **Flavor and Satiety**: Enhance flavor and promote feelings of fullness in foods.
Deficiency Conditions	- **Essential Fatty Acid Deficiency**: Symptoms include dry skin, hair loss, poor wound healing, and increased susceptibility to infections.
	- **Fat-Soluble Vitamin Deficiencies**: Lack of fats can lead to deficiencies in vitamins A, D, E, and K, affecting vision, bone health, and immune function.
Excess Condition	- **Weight Gain**: Excessive fat intake can lead to obesity due to high calorie density.
	- **Heart Disease**: High intake of saturated and trans fats can raise LDL cholesterol levels, increasing the risk of heart disease.
	- **Insulin Resistance**: High fat intake, especially from unhealthy sources, can contribute to insulin resistance and type 2 diabetes.
	- **Digestive Issues**: Excessive fat intake may lead to gastrointestinal discomfort, including bloating and diarrhea.
	- **Inflammation**: High consumption of trans fats and excessive omega-6 fatty acids can promote inflammation in the body.

Aspect	Details
Types	- **Water-Soluble Vitamins**: Dissolve in water; include Vitamin C and B-complex vitamins (B1, B2, B3, B5, B6, B7, B9, B12).
	- **Fat-Soluble Vitamins**: Dissolve in fat; include Vitamins A, D, E, and K.
Sources	- **Vitamin A**: Carrots, sweet potatoes, spinach, and animal liver.
	- **Vitamin B**: Whole grains, meat, eggs, dairy, legumes, nuts, and seeds.
	- **Vitamin C**: Citrus fruits, strawberries, bell peppers, broccoli, and tomatoes.
	- **Vitamin D**: Fatty fish, fortified dairy products, egg yolks, and sunlight exposure.
	- **Vitamin E**: Nuts, seeds, vegetable oils, spinach, and broccoli.
	- **Vitamin K**: Leafy green vegetables (kale, spinach), broccoli, and Brussels sprouts.
Functions	- **Vitamin A**: Important for vision, immune function, and skin health.
	- **B Vitamins**: Support energy metabolism, red blood cell production, and brain function.
	- **Vitamin C**: Acts as an antioxidant, supports immune function, and aids in collagen production.
	- **Vitamin D**: Essential for calcium absorption and bone health; supports immune function.
	- **Vitamin E**: Acts as an antioxidant, protecting cells from damage.
	- **Vitamin K**: Essential for blood clotting and bone metabolism.
Deficiency Conditions	- **Vitamin A**: Night blindness, dry skin, and increased susceptibility to infections.
	- **B Vitamins**: Fatigue, anemia, neurological issues (e.g., B12 deficiency can cause nerve damage).
	- **Vitamin C**: Scurvy, characterized by fatigue, gum disease, and skin problems.
	- **Vitamin D**: Rickets in children (bone deformities) and osteomalacia in adults (soft bones).
	- **Vitamin E**: Neuropathy and poor immune function.

Aspect	Details
Excess Condition	- **Vitamin K**: Increased bleeding and bruising. - **Vitamin A**: Toxicity can cause nausea, headaches, dizziness, and liver damage. - **B Vitamins**: Generally low toxicity, but excessive B6 can cause nerve damage; excessive niacin can lead to flushing and liver issues. - **Vitamin C**: Excess may cause gastrointestinal discomfort and increase the risk of kidney stones. - **Vitamin D**: Toxicity can lead to hypercalcemia (high calcium levels), causing nausea and kidney damage. - **Vitamin E**: High doses can interfere with blood clotting and increase the risk of hemorrhage. - **Vitamin K**: Generally low toxicity, but excessive supplementation may interfere with anticoagulant medications.

Minerals

Macro minerals: Needed in larger amounts; include calcium, potassium, magnesium, sodium, phosphorus, and Sulphur.

Trace Minerals: Needed in smaller amounts; include iron, zinc, copper, selenium, iodine, manganese, and fluoride.

Mineral	Type	Sources	Functions	Deficiency Conditions	Excess Condition
Calcium	Macromineral	Dairy products, leafy greens, almonds, and fortified foods.	Essential for bone health, muscle function, and nerve signaling.	Weak bones (osteoporosis), muscle cramps, and dental problems.	Hypercalcemia can lead to kidney stones, nausea, and confusion.
Potassium	Macromineral	Bananas, oranges, potatoes, spinach, and legumes.	Regulates fluid balance, muscle contractions, and nerve signals.	Muscle weakness, cramping, irregular heartbeats, and hypertension.	Hyperkalemia can cause irregular heart rhythms and potentially be life-threatening.
Magnesium	Macromineral	Nuts, seeds, whole grains, green leafy vegetables, and legumes.	Involved in over 300 enzymatic reactions, including energy production and muscle function.	Muscle cramps, fatigue, weakness, and osteoporosis.	Excess may cause diarrhea, nausea, and abdominal cramping.
Iron	Trace mineral	Red meat, poultry, fish, beans, lentils, and fortified cereals.	Crucial for oxygen transport in red blood cells and energy metabolism.	Iron-deficiency anemia, fatigue, weakness, and pale skin.	Toxicity can lead to liver damage, gastrointestinal distress, and increased risk of infections.

Mineral	Type	Sources	Functions	Deficiency Conditions	Excess Condition
Zinc	Trace mineral	Meat, shellfish, legumes, seeds, nuts, and whole grains.	Supports immune function, wound healing, and DNA synthesis.	Impaired immune function, hair loss, diarrhea, and delayed wound healing.	Excessive intake can cause nausea, vomiting, loss of appetite, and impaired immune function.
Iodine	Trace mineral	Iodized salt, seafood, dairy products, and eggs.	Essential for thyroid hormone production, which regulates metabolism.	Goiter (enlarged thyroid) and hypothyroidism.	Excessive iodine can lead to thyroid dysfunction, including hyperthyroidism.
Selenium	Trace mineral	Brazil nuts, seafood, meat, and grains.	Acts as an antioxidant, supporting immune function and thyroid health.	Keshan disease (a type of cardiomyopathy) and immune dysfunction.	Toxicity may result in selenosis, characterized by gastrointestinal upset, hair loss, and fatigue.

Water

- **Types**:
  - **Free Water**: Water that is not bound to food particles; easily accessible in food and drinks.
  - **Bound Water**: Water that is bound within food structures; not easily extracted (e.g., in fruits and vegetables).
- **Sources**:
  - Drinking water (tap, bottled, filtered).
  - Beverages (juices, milk, tea, coffee).
  - Foods (fruits like watermelon and oranges; vegetables like cucumbers and lettuce).
- **Functions**:
  - Regulates body temperature through sweating and respiration.
  - Aids in digestion and absorption of nutrients.
  - Transports nutrients and oxygen to cells.
  - Removes waste products through urine and perspiration.
  - Provides a medium for biochemical reactions in the body.
- **Deficiency Conditions**:
  - Dehydration, leading to symptoms like thirst, dry mouth, fatigue, and dizziness.
  - Severe dehydration can result in confusion, heat-related illnesses, and kidney problems.
- **Excess Condition**:
  - Water intoxication (hyperhydration) can dilute electrolytes in the body, leading to hyponatremia.
  - Symptoms of excess water intake can include headache, nausea, vomiting, and in severe cases, seizures and coma.