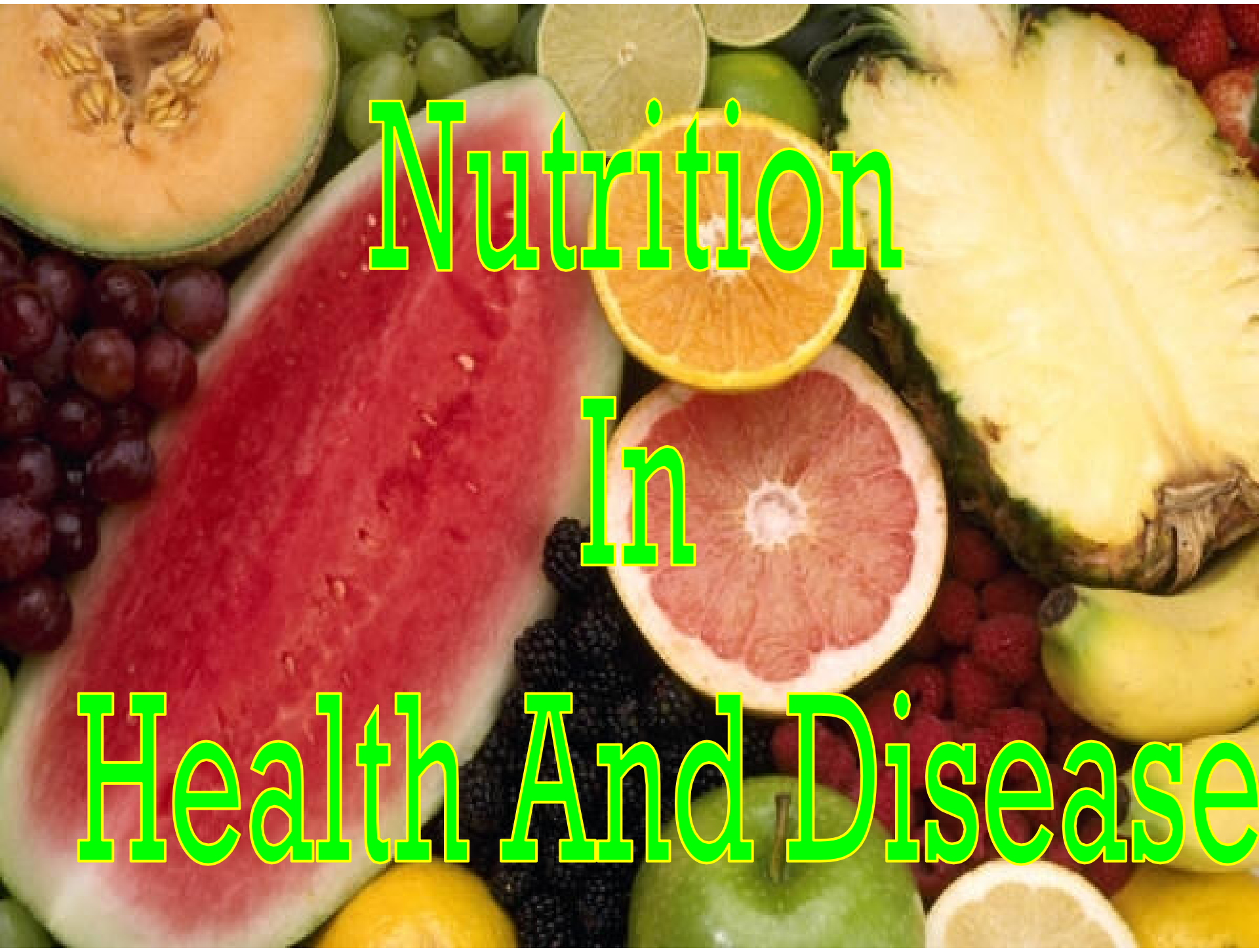


Synopsis

- What is **Nutrition and its importance**?
- **Composition of Food and its role** in human body.
- **Calorific Values/Energy content** of Food constituents.

- **Energy requirement by the body**
- **Basal Metabolic Rate (BMR)**
- **Respiratory Quotient(RQ)**
- **Specific Dynamic Action (SDA)**

- **Balanced Diet and its Importance**

- Nutritional Disorders
  - **PEM- Kwashiorkor and Marasmus**
  - **Obesity**

INTRODUCTION

What is Nutrition?

Nutrition is a wide branch of science which deals with:

- **Components of human food** and **their role** in human body
- **Calculations of**
  - **Energy content of foods**
  - **Energy requirement by human beings**

❖Nutrition Explores

❖**How to choose particular food/ type of diet?**

❖**Planning of balanced diet in various conditions.**

❖Nutritional Studies Involves

❖**Relation of Nutrients in health and disease.**

❖**Nutritional disorders** due to **under and over nutrition.**

STUDY OF NUTRITION

ANSWERS FOLLOWING QUESTIONS

- WHY TO EAT FOOD ?
- What are the Dietary Nutrients and their Role to human body?
- What are Macro and Micronutrients?
- WHAT FORM AND AMOUNT OF DIETARY NUTRIENTS TO BE INGESTED?
- What is a Balanced Diet?
- WHAT HAPPENS IF A FOOD EATEN IN A BALANCED/IMBALANCED WAY ?

The Importance of Good Nutrition

What Is The Main Purpose of Eating Food ?

- **Food/Diet** is a **prime requisite for human body survival and existence.**

- **Main purpose of Food is to:**

- **Provide Energy (Fuel)** for cellular activities.
- **Supply basic building blocks, to build Macrobiomolecules, for structural and functional role in the body.**
- **Enable Accessory growth factors.**

• Role Of Human Food

- **Build The Cell and Subcellular Structures**
- **Maintains** all **body functions**
- **Regulates Metabolism**
- **Vital for growth** and **development**
- **Therapeutic benefits**
  - **–Healing of diseases**
  - **–Prevention of diseases**

- **What we eat is what we build**
- **Remember Proper Nutrition**

- **Maintains normal growth, health and reproduction.**

- **Rewards healthy and happy life**

- **Improves life span**

How Should Be Our Eating?

One Should Eat

To Live

A Healthy and Happy Life

- Ingest food Nutrients with
  - **–Appropriate quantity**
  - **–Good quality**
- This is very **essential** for normal healthy **life.**

- **Ignorance and wrong food habits** are
- Responsible for **most illnesses of Human being**.

- **'Prevention Is Better Than Cure'**
  - **Good and Proper diet** is a best way to **prevent many diseases.**

- **A sound knowledge of nutrition to a doctor is of paramount importance.**
  - To maintain his/her **own good health.**
  - **Advice for planned diets**, to the **patients** to maintain their good health's.

Composition of Food and Their Role in Human Body or Nutritive Value of Nutrients

What To Eat? And What Not To Eat?

- **Nutrients** are organic or inorganic molecules that are **crucially required for human growth & well-being.**

- **Food** items derived from **plant or animal sources contain nutrients**.

- **~ 40 nutrients identified and present in food items.**

Chief Nutrients Of Food Substances

Six Classes of Nutrients

- Carbohydrates
- Lipids (Fats)
- Proteins
- Vitamins
- Minerals
- Water

Classification Of Nutrients

- There are four ways to classify the classes of nutrients:
  - I. Essential or Nonessential Nutrients
  - II. Organic or Inorganic Nutrients
  - III. Macronutrient or Micronutrients
  - IV. Calorific or Non calorific Nutrients

- **Essential Nutrients –**

- **Nutrients not biosynthesized in body** or cannot make enough of to meet the bodies need.
- **These nutrients must be obtained from foods.**
  - **Examples:**
    - **Vitamins**
    - **Minerals**
    - **Some of the amino acids and fatty acids.**

- **Nonessential Nutrients –**

- **Nutrients readily biosynthesized by body** from other ingested nutrients

  → Examples:
    - **Cholesterol**
    - **Non Essential Amino acids**
    - **Non Essential Fatty acids**

- **Organic Nutrients** - contain carbon
  - **Carbohydrates**
  - **Lipids**
  - **Proteins**
  - **Vitamins**

- **Inorganic Nutrients** - do not contain carbon
  - **Minerals**
  - **Water**

- **Macronutrients-**
- Required in large quantities

–Carbohydrates
–Lipids
–Proteins
–Water

- **Micronutrients**
  - Required in small quantities.

– Minerals
– Vitamins

- **Energy-yielding nutrients /Calorific Nutrients:**
  - **Carbohydrates**
  - **Lipids**
  - **Proteins**

- **Non energy yielding/Non Calorific**
  - –Vitamins
  - –Minerals

Nutritional Goals

- **Quality** intake of food allows the body to function at best and **promotes health**.
  - –Quality intake should **provide adequate levels of each nutrient**.
- **Quantity** intake of food promotes a **healthy body weight.**

- **Nutrition Influences on:**
  - **Health**
  - **Appearance**
  - **Behavior**
  - **Mood**

The Main Food Groups

Fruit and Vegetables

Fruits and vegetables grow on plants: underground, on the ground or in trees.

Every day we should eat at least 5 portions of fruit and vegetables. (A portion is about a handful.)

Fruit and vegetables give us fibre and vitamins and minerals.

Take 5 a day everyday!

Grains and Pulses

This food group includes wheat, corn, barley, rice, lentils, beans etc.

These are all from plants and form a staple part of the diet for people all over the world.

Grains and pulses give us carbohydrates and proteins.

Nuts are another source of protein.

What is..?

Rice is the staple food in China and much of the East. What is it in the West (UK, USA)?

Dairy Products

Dairy foods are made from milk (usually cow's milk, but can be from other animals like goats or sheep). Dairy foods give us proteins and fats. They are also a good source of calcium which is good for bones and teeth.

These foods include:

- **Cheese (hard, soft, cottage)**
- **Yogurt**
- **Food high in milk or milk products.**

Weird fact

Our brains are 80% fat.

Meat, Fish and Eggs

The main nutrients derived from meat are proteins, but it also gives us fats and some minerals.

The meat and fish group includes:

- **Chicken and all poultry**
- **Fish and shellfish**
- **Beef, pork and lamb**
- **Eggs are included in this group too.**

Athletes eat lots of protein; they help to build muscles.

Foodie fact

Sushi (raw fish) is now Marks and Spencer's best-selling lunchtime snack.

Body Composition

Nutrients

GROUPS OF NUTRIENTS:

- Carbohydrates
- Proteins
- Fats
- Vitamins
- Minerals
- Water

Carbohydrates

- **Carbohydrates**: are the **Sugars** and **Starch** present in food.

- They are classified as either **simple or complex Carbohydrates.**

- Simple carbohydrates: are Sugars Examples include:
  - ❖Glucose
  - ❖Fructose
  - ❖Lactose

- Complex Carbohydrates are Starches-Present in
  - ❖Whole grains
  - ❖Legumes

- **Simple Carbohydrates**
  - pop, candy, sweets, fruit
  - individual Glucose or Fructose molecules
  - Recent studies reported **Refined sugars are Brain damaging**

- **Complex Carbohydrates**
  - pasta, rice, breads, potatoes
  - Chains of glucose molecules

Dietary Fiber

- **Fiber is an**

- **Indigestible complex Carbohydrate**

- Non calorific

Substances As Dietary Fiber

- Cellulose
- Hemicellulose
- Pectins
- Gum
- Lignin
- Mucilage

- **Sources Of Dietary Fibers**

- Richly present in **plant food substances.**

- **Poorly** present in **refined and commercial food products.**

Types Of Dietary Fibers

- **Soluble Dietary Fiber** –

- **Decreases Cholesterol levels**
- Found in oat bran, fruits and veggies

- **Insoluble Dietary Fiber**-

- **Reduces risk of colon cancer**
- Found in wheat bran and grains

- **Recommendation of Dietary Fiber:**
- **25-40 gm per day**

Check
are we getting enough
dietary Fiber through your foods ?

Ways to Get More Fiber

- Eat more fruits and vegetables
- Eat whole grain foods

Advantages Of Dietary Fiber

- Act as roughage
- Holds water
- Forms soft and bulky feces
- Increases bowel movement
- Easy defecation
- Prevents constipation

- Dietary fiber corrects **hyperglycemia** and **hypercholesterolemia**

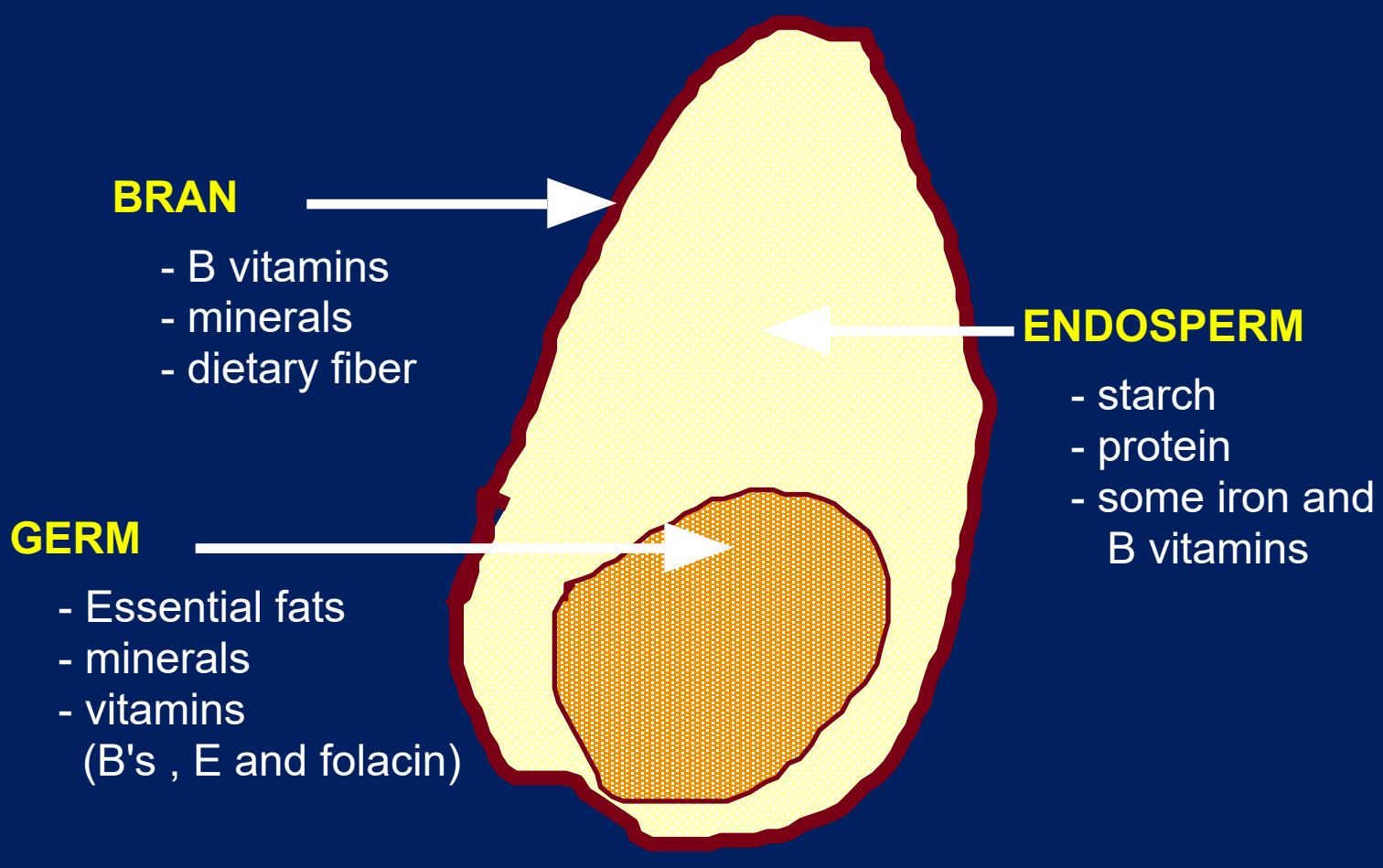
- **Fiber Reduces risk of:**
  - **Diverticular disease of colon**
  - **Colon cancer**
  - **Varicose veins**

- Good **satiety and non calorific value** of dietary fiber
- Helps in **management of obesity.**

Disadvantage Of Dietary Fiber

- It binds with **trace elements and reduces its absorption.**
- **Decreases** absorption of **fat soluble vitamins.**

A Grain of Wheat



- **Germinated legumes** have **partial dextrinization of Starch.**
- Which is **good for digestion, absorption and utilization**.

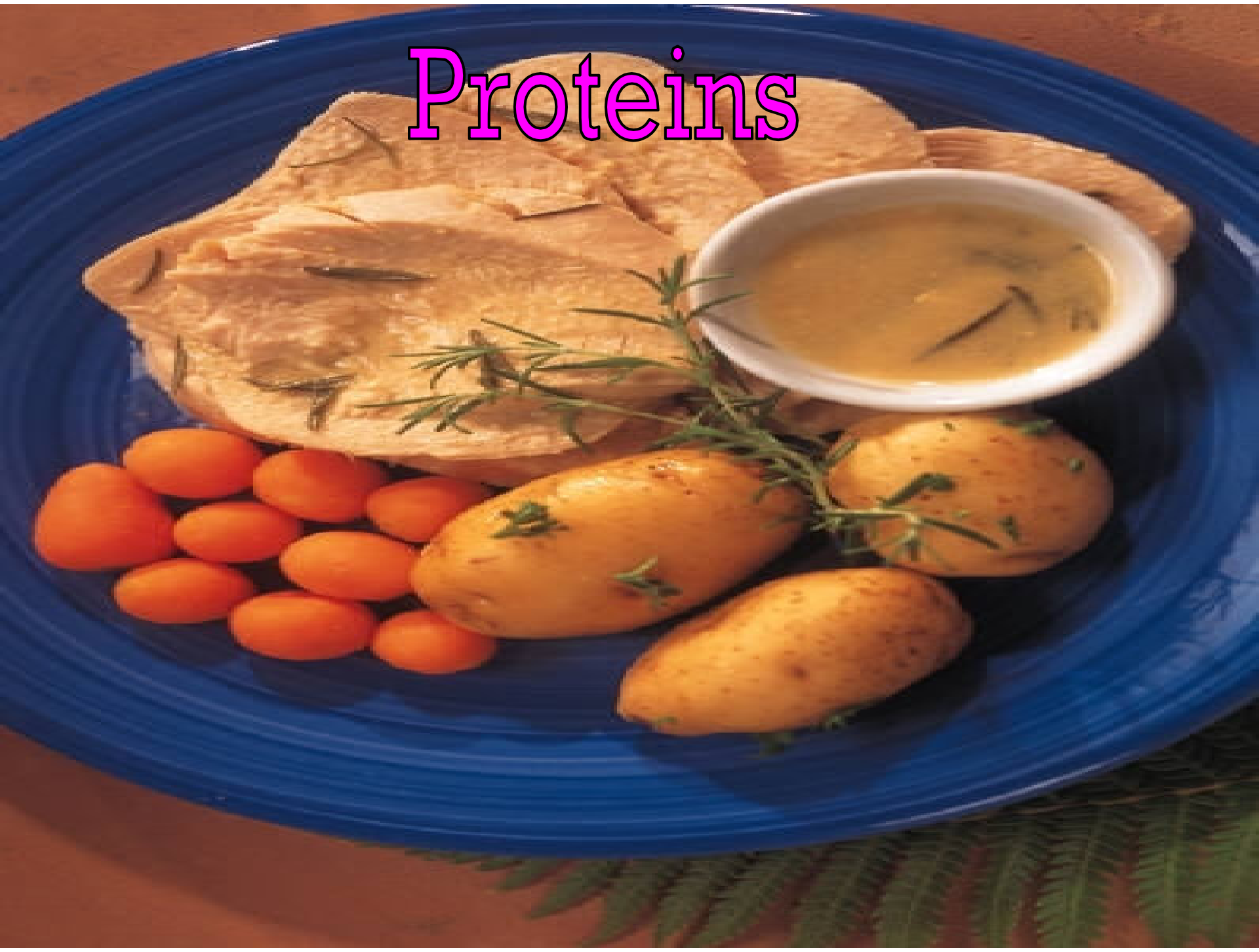
Functions Of Carbohydrates

- Readily available source & supply most of the bodies primary energy needs
- Antiketogenic
- Build structure of cells
- Store calories as Glycogen
- Excess Carbs convert to Fat
- Amino acid synthesis
- Cellulose as roughage

Quantity And Quality Of Carbohydrates To Be Ingested

- An Adult individual with his/her routine activities should adjust the Carbohydrates intake.
- **RDA for Carbohydrates- 400-600 gm/day**

- Ingestion of **Starchy food is more preferable**.
- **Refined sugars have high glycemic index** so the quantity should be reduced.
- Dietary **fiber in form of Celluloses to be ingested.**



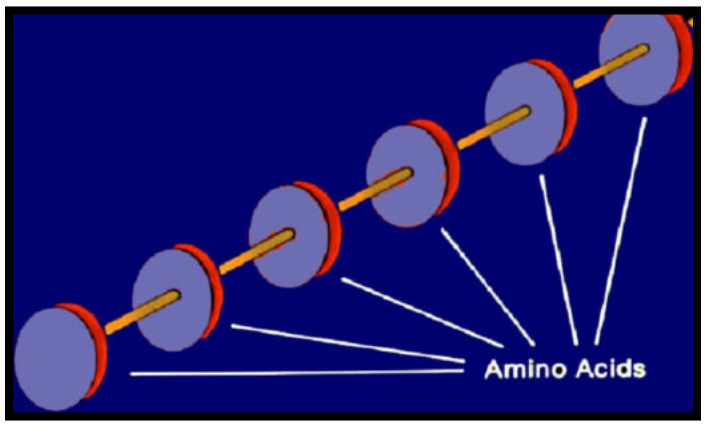
Proteins

- **Dietary Proteins** are nutrients , **provide essential amino acids building blocks for tissue proteins.**

- **Proteins are of structural and Functional importance**

- Maintain **growth, repair and function** of the body cells and tissues.

- **Sources of dietary Protein**
  - **Animal (complete)**
    - meats, dairy
  - **Vegetable (incomplete)**
    - beans, nuts, legumes, grains



Amino acids linked together

- **Types of Amino Acids**
  - **Nonessential (10)** – can be made by body
  - **Essential (8)** – must be made by body
  - **Semiessential (2)-** Made in body to less amount need also from diet

Nutritional Classification Of Proteins

- **Dietary Proteins nutritionally classified into two groups:**
  - **Complete Proteins**
  - **Incomplete Proteins**

- **Complete Proteins/ First Class Proteins/High Biologically Valued**

- Complete Protein contains adequate amounts of **all essential amino acids.**

SOURCES INCLUDE:

Animal Origin Proteins

- Fish
- Meat
- Poultry Meat and Eggs,
- Milk, Cheese and yogurt
- Soya Bean products

- **Incomplete Proteins**

- **Incomplete Proteins lack one or more essential amino acids** (limiting amino acid).

SOURCES INCLUDE:

- Beans
- Pulses (Limit in Met)
- Nuts
- Whole grains (Limit in Lys and Thr)

Dietary Protein Requirements

- **RDA average = 0.8-1.0 g/kg body weight/Day**

- **RDA Athlete = 1.2-1.6 g/kg/day**

- **High levels of Dietary Protein intake above 2 g/kg/day can be harmful to the body**

Biological Value Of Proteins

- Dietary Proteins differ in their **quality i.e**
- **Efficiency of digestibility and absorption capacity**.

- An **effectiveness of dietary Protein** is in
- **Providing amount of essential amino acids** for tissue Protein biosynthesis.

Evaluating Protein Quality

- **Biologic Value (BV) of Protein:**
- **Amount of ingested Nitrogen retained in the body compared with Nitrogen absorbed.**

$$\text{Biological Value} = \frac{\text{Nitrogen Retained}}{\text{Nitrogen Absorbed}} \times 100$$

Biological Value of Protein is

Percentage of Nitrogen absorbed and retained in the body.

- **Thus BV of Protein** indicates effectiveness of utilization of dietary Proteins

- **Proteins** with **high biological value**(B.V) are also termed as:
  - **Superior Proteins**
  - **Complete proteins**
  - **First class Proteins**

- All **animal origin Proteins** rich in all essential amino acids **are of high B.V.**

- Dietary Proteins with high biological value **support good tissue biosynthesis and retain the Proteins in body for their functional use.**

- Complete Proteins with high biological value **maintain Positive/Nitrogen equilibrium**

- **Plant proteins** are of **low B.V** since **deficient in one or two essential amino acids.**

- **Net Protein Utilization (NPU):**
  - Percentage of Nitrogen consumed that is retained by the body.

Mutual Supplementation Of Dietary Proteins Improves Biological Value Of Proteins

- Eating **Pulses** and **Grains** gives all essential Amino acids required for the tissue Protein biosynthesis.
  - Dal and Roti
  - Rice and Dal
  - Idli and Sambhar
  - Rajma Chanwal
  - Chhole Chanwal

Source Of Protein	B.V	Limiting Amino acid
Egg	94	Nil
Milk	84	Sulfur containing amino acids
Fish	85	Tryptophan
Meat	75	Sulfur containing amino acids
Soya Beans	65	Sulfur containing amino acids

Source Of Protein	B.V	Limiting Amino acid
Rice	68	Lysine and Threonine
Wheat	58	Lysine and Threonine
Pulses	58	Sulfur containing amino acids

- **Biological value of protein affects nitrogen balance.**
  - Low B.V proteins leads to **negative nitrogen balance.**
  - **Increased loss of** NPN substance **Urea in urine.**

Functions Of Dietary Proteins

- Supply amino acids for growth & repair of body tissues
- Biosynthesize all tissue Proteins
  - **Hemoglobin**
  - **Nucleoproteins**
  - **Glycoprotein**
  - **Lipoproteins**

- Enzymes
- Hormones
- Antibodies
- ETC Components
- Collagen (bones)
- Keratin (nails & hair)

- Protein **serve as a source of energy :**
  - When there is **shortage of Lipids & Carbohydrates** in the body.

- Proteins has **role in osmoregulation ,transport and acid-base balance**

LIPIDS

- Dietary lipids **predominantly** contains **Triacylglycerol** (TAG).

- TAG to human body serves as a **secondary source of energy** on long term basis.

- TAG stored as **reserve food in adiposecytes**
- Provides energy in **between meals , fasting and starvation condition**.

- The other forms of dietary lipids viz **Phospholipids and Cholesterol** has structural and functional role in the body.

- Fats/Oils are type of neutral lipids, insoluble in water.
- **Fatty acids** are the building blocks of various tissue Lipids .

Types of Fatty Acids

- **Saturated Fatty Acids**
  - Animal sources
  - **Solid at room temperature**
  - High intake is associated with an **increased risk of heart disease**
- **Unsaturated Fatty Acids (MUFAS and PUFAS)**
  - Vegetable sources
  - Liquid at room temperature
  - Associated with a **reduced risk of heart disease**
- **Trans Fatty Acids**
  - Hydrogenation to alter "state" of fat example **Vanaspati Dalda**
  - **Increase shelf-life & market availability**
  - **Repeated heating of Oils**

Composition of Oils (%)

Type	Sat	Poly	Mono
safflower	09	75	16
sunflower	10	66	24
corn	13	59	28
soybean	14	58	28
sesame	14	42	44
peanut	17	32	51
palm	49	09	42
olive	14	08	78
canola	07	35	58

- Those **Fatty acids** are considered as **good**
- Who on entry in body get **easily metabolized** and give good effect to body.

- Those **Fatty acids** are considered as **bad**
- Which are **more stable and** get **less metabolized** and **remain for long time** in the body.
- As the fatty acids remain for long time it **increases the risk of Atherosclerosis**.

Quality and Quantity Of Dietary Lipids

- **Quantity of Dietary Lipids 60 gm/day**
- **Quality of Dietary Lipids:**
  - TAG with mixture of Fatty acids linked
  - Fatty acids in ratio of **MUFA:PUFA:SFA 1:1:1**
  - **Zero Trans Fatty acids**
  - **Equal proportion of Antioxidants To protect In vivo PUFA's**
  - **Adequate Carbohydrate Diet-No too much excess of Glucose to transform into Fatty acids and Cholesterol**

- **Fatty food is associated**

–With **fat soluble vitamins** A, D, E, and K

–**Sources of Linoleic acid-** essential fatty acid that is needed for growth and healthy skin.

Recommendations for Fat Consumption

- **Dietary Fat Recommendations**

- **Less than 30% of calories** in diet from dietary Lipids.
- Less than 1/3 of dietary fat should be saturated.

- **Ways to Decrease Intake of Fat**
  - –Minimize **"fast" foods and Snacks**
  - –Minimize **processed foods**
  - –Use **better cuts of Red meat**
  - –Use **low fat alternatives**
  - –**Pork Fat**
  - –**Choose foods with "Natural Lipids"**

Food s Should be rich In Essential Fatty Acids (EFAs)

- Linoleic acid (LA)
- Linolenic (LNA) or Alpha Linolenic acid or (ALA)
- Arachidonic Acid

Omega-3 and Omega-6 Fatty acids

- **Linolenic Acid** (18:3n-3) belongs to the omega-3 family of fatty acids

- **Linoleic Acid** (18:2n-6) belongs to the omega-6 family

Role Of Essential Fatty Acids (EFAs)

- **LA can be converted to both Arachidonic and Linolenic acids**
- Essential FA are necessary for **growth, skin & hair integrity.**
- Regulation of **Cholesterol metabolism.**
- **Lipotropic activity**
- **Decreased platelet adhesiveness and reproduction**.

- **Rich Dietary Sources of Linoleic Acid :**
  - **Soya oil**
  - **Sunflower oil**
  - **Safflower oil**
  - **Sesame seeds**
  - **Corn oil**
  - **Most nuts**

- **Dietary Sources Of Linolenic Acid :**
  - **Flax seeds(abundantly)**
  - **Walnuts(Small quantities)**
  - **Cold pressed Canola oil**
  - **Wheat germ**
  - **Dark green leafy vegetables**

- **Diets with <1-2% EFAs will affect growth rate, cause dry scaly rash and poor wound healing**

- The right ratio of LA to ALA in the diet
- About 3:1 or 2:1, is important
- An imbalance in the ratio
- May lead to a variety of mental disorders,
- including hyperactivity, depression, brain allergies, and schizophrenia

• Docosa Hexenoic Acid (DHA-C22)

- Is high in the phospholipids of brain gray matter .
- DHA is rich in Algae and Fishes
- It is the main component of CNS importance for its function
- Depletion of DHA in the brain can result in learning deficits/Cognitive Function.

- **DHA** appears to be important for visual and neurological development

- **EPA** and **DHA** supplementation during pregnancy
- Has evidenced beneficial effects on long-term cognitive development in children

Functions Of Lipids

- A concentrated & reserve secondary source of energy
- Physical protection for vessels, nerves, organs
- Insulate against changes in temperature
- Structure of body tissues, cell membranes & nuclei
- Carry the fat-soluble vitamins (A, D, E, K)
- Give appetite appeal
- Aid satiety (delay emptying time of the stomach)
- Spare Protein
- Supply Linoleic acid, the other essential fatty acids.

- High intake of **animal origin food is linked** to **increased blood Cholesterol .**
- Excess Cholesterol can lead to an **increased risk of Atherosclerosis and heart disease.**

Vitamins and Minerals

Vitamins

- Organic substances that are vital for human body.

- Vitamins are **accessory growth factors to human body.**

- **Vitamins are classified into two groups:**

- **Water-soluble Vitamins:**

- Vitamins dissolve in water and pass easily into the blood during digestion.
- The body does not store these so they need to be replenished regularly.
- Includes **vitamins C, and Vitamin B Complex** members B1 ,B2, B3,B5, B6, Folic acid, and B12.

- Excesses of water soluble vitamins will be excreted in the urine.
- However, B-6 and Niacin can be toxic when ingested in unusually large amounts.

- **Fat-soluble vitamins**

- These include vitamins A, D, E, and K.
- These Vitamins are absorbed, stored, and transported through dietary fat.
- Body stores these vitamins in fatty tissue, liver, and kidneys.
- Excess buildup in tissues can be

Fat Soluble Vitamins

- Consist of Vitamins A, D, E, and K
- Absorbed at the small intestine in the presence of bile (and fatty substances).
- Overdoses can be toxic (A and D)

Vitamin Supplementation?

- Not necessary if diet is healthy
- Multivitamins are safe (100% RDA)
- Not all vitamins are “pure”
- Can be toxic at high doses

Vitamin A	Role in vision, growth and differentiation of germinal epithelial cells, anticancer	Fish Liver Sweet potatoes, Carrots
Vitamin B	Form Coenzymes, help enzymes in metabolic reactions	Green leafy vegetables, Fruits, yeast
Vitamin C	Collagen synthesis, Steroidogenesis, Iron metabolism, Healing skin, preventing colds	Citrus fruit, tomatoes
Vitamin D	Calcium metabolism, Strengthen bones	Milk Sunlight
Vitamin E	Potent Antioxidant, Helps strengthen cells	Vegetable Oils, nuts

- Most of the **vitamins except very few are not biosynthesized in human body.**
- Vitamins are **associated with various plant and animal origin foods of nature.**
- Ingestion of foods rich in vitamins is mandatory for a good health.
- Vitamins helps to **maintain growth ,health and reproduction**.
- They do not generate calories/Non calorific
- Most Vitamin B complex members **serve as Coenzymes for Enzyme action.**

- **Vitamins** help to regulate many vital body processes that include:
  - **Digestion**
  - **Absorption**
  - **Metabolism**
  - **Bone Ossification**
  - **Vision**
  - **Antioxidant role**

Minerals

Minerals

- Inorganic elements found in food that are essential for life processes
- About 25 are essential Minerals

- Minerals are classified as:
  - Macro minerals
  - Trace minerals

- **Macro Minerals: S**odium, Potassium, Chloride, Calcium, Phosphorus, Magnesium, Sulfur
- **Trace Elements:** Iron, Zinc, Selenium, Molybdenum, Iodine, Copper, Manganese, Fluoride, Chromium

Macro Minerals

- **Calcium**
- Is needed for bone and teeth rigidity
- Helps in blood clotting,
- Muscle contraction & normal nerve functions.

- **Phosphorous**
- Helps build strong bones & teeth
- Forms various Phosphorylated compounds.

- **Sodium, Chloride, Potassium**
- **Serve as body Electrolytes**
- Work together to regulate the fluids in the body
- Help regulate the nervous system, muscle functions & nutrient absorption in the cells

- **Magnesium**

- Helps regulate body temperature,
- Muscle contractions & the nervous system
- Helps cells metabolize Carbohydrates, Fats, and Proteins

- **Sulfur**

- Helps in detoxification reactions (PAPS)
- Is present in the amino acids in proteins
- A component of constituents of mucopolysaccharides & essential compounds

Microminerals

- **Iron** combines with Protein to form Hemoglobin
- **Iodine** is needed by Thyroid gland to produce Thyroxine
- **Copper** is necessary in the formation of Hemoglobin
- **Fluorine** helps reduce incidence of tooth decay
- **Zinc** plays an important role in the formation of protein,
- Thus, assists in wound healing, blood formation and general growth & maintenance of all tissues

- **Cobalt** is a component of vitamin B12
- **Manganese** is necessary for normal development of bones and connective tissues
- **Chromium** maintains normal glucose uptake into cells & helps insulin bind to cells

- **Selenium** along with vitamin E protects cells from destruction.
- Glutathione Peroxidase contains Selenium.
- **Molybdenum** is a component of Xanthine oxidase and Aldehyde oxidase

- **Functions Of Minerals**

- Body cannot manufacture Minerals but are needed for forming healthy bones and teeth .
- Regulate many vital body processes.
- Aids in muscle function
- Help transmit messages in nervous system

Mineral Guidelines

- Dietary supplementation of Calcium is beneficial for post-menopausal women
- **Salt should be limited in the diet of hypertensives.**

Calcium

- Important for preventing osteoporosis
- RDA = 800-1000 mg/day
- Found in dairy products and vegetables

High protein diets leach calcium from bones and promote osteoporosis

Iron

- Important component of hemoglobin
- Iron deficiency is known as anemia

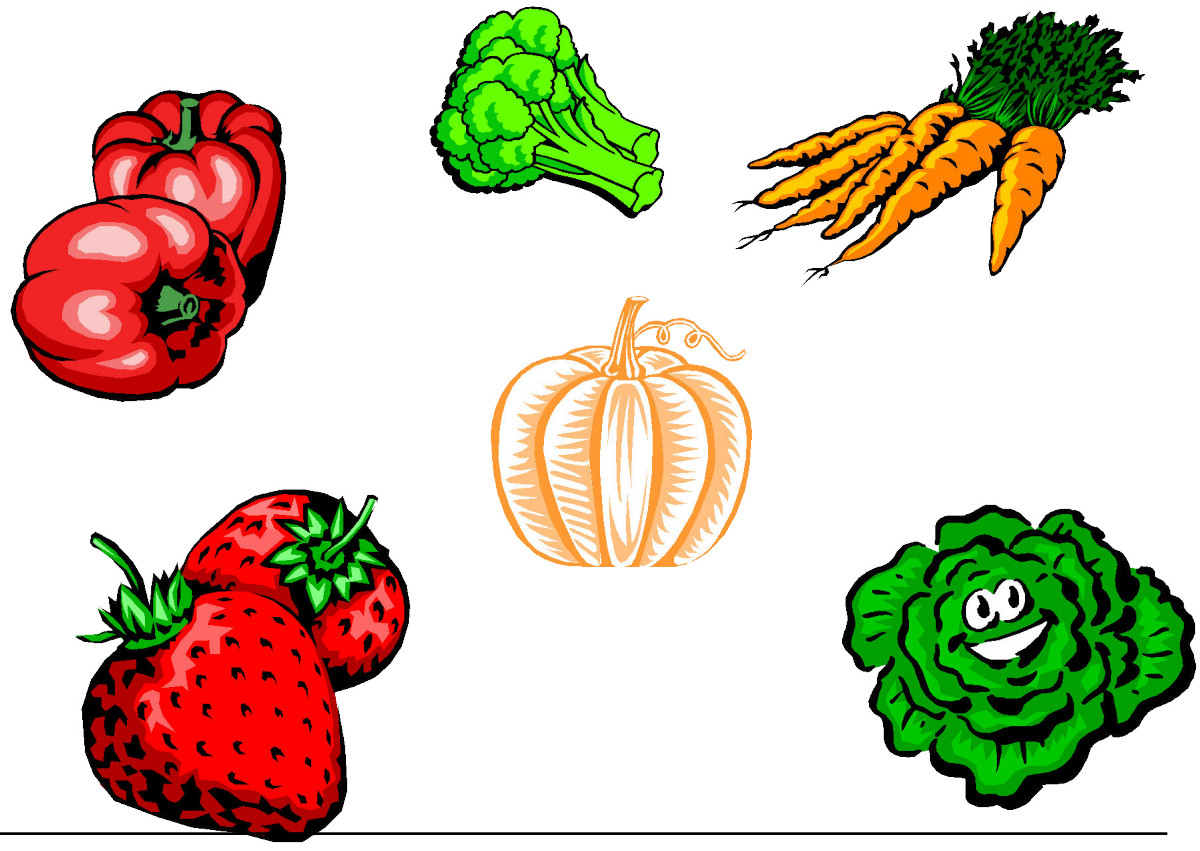
(Symptoms: shortness of breath, fatigue)

Antioxidants

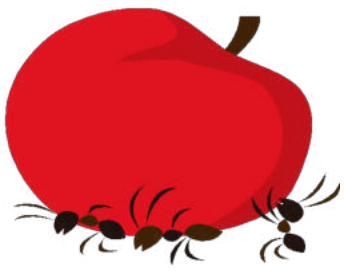
- Antioxidants are chemical substances which fight with free radicals.
- Antioxidants prevents Peroxidation of biomolecules.
- Antioxidants protect the biomolecules of human body.
- Promote healthy status to human body.

Dietary Sources Of Antioxidants

- **Pigmented Fruits and Vegetables**
- Broccoli
- Cantaloupe
- Carrot
- Bananas
- Mango
- Pumpkin
- Red Pepper
- Spinach
- Strawberries
- Sweet potato



Fresh Fruit and Vegetables



- **These contain Fibre ,Minerals, Vitamins and Antioxidants.**

Water

- Water makes up around **65% of the body weight**.

Remember

- It's important to drink **at least 8 cups of water a day** to maintain health.

Role Of Body Water

- Water is essential to keep the body healthy.

- It helps to **cook** , **swallow and digest food**.

- It keeps the **body hydrated.**

- **Water Helps to Maintain Many bodily functions.**

- Chief component of blood plasma which **serves as** a **transport media**.

- **Bodies solvent** helps in **metabolic reactions**(**Hydrolase and Hydratase**).

- **Lubricates joints** and **mucous membranes.**

- **Serve as Shock absorber** in eyes, spinal cord, and amniotic sac (during pregnancy).
- Absorb , transport and **eliminate nutrients and metabolic wastes.**
- Perspiration/sweating helps to maintain **normal body temperature.**

Remember

- **Man** can **live for many days without food**,
- But **cannot live few days without water**.

Calorific Values Of Food
OR
Energy Content Of Food

Calorimetry

- **Calorimetry** is a term used to **measure energy content of food and its nutrients.**

- **Calorific value of food is defined as :**
- An **amount of energy released by the combustion of 1 gram of nutrient.**

  (Carbohydrate/Lipid/Protein)

Determination Of Calorific Values of Food

- **Bomb Calorimeter** is used to **determine Calorific values of food nutrients.**

Bomb Calorimeter

- **It is a closed metallic Oxygen chamber** with **electrically heated platinum wires.**
- **When food is placed inside it and operated**
- **It combust the Nutrients and determines the calorific value of foods.**
- **Nowadays** there are **highly automated efficient combustion Calorimetric systems** available
- **To compute the energy contents of food and body.**

Kilocalories

- **Kilocalorie/Calorie is a Unit for measuring heat energy,** of food and energy requirement for the body.
- **When you hear "Calorie," it is really a kilocalorie**

Definition of Kilocalorie

- **1 kilocalorie** is amount of **heat required to raise the temperature of 1 gram of water with 1 degree Celsius.**

Calorific Contents of Nutrients

- **Macronutrients (Calorific)**
  - **–Carbohydrates = 4 Cal/g**
  - **–Proteins = 4 Cal/g**
  - **(5.3 Cal/g in Bomb Calorimeter)**
  - **–Fats = 9 Cal/g**

- **Carbohydrates and Fats are completely oxidized** in the body to **CO2 and H2O.**

- **Proteins are not completely oxidized in the body.**

- **Nitrogenous excretory product Urea still contain oxidizable carbon and hydrogen in it.**

- **Micronutrients (Non Calorific)**
  - **–Vitamins = 0 Cal/g**
  - **–Minerals = 0 Cal/g**
  - **–Water = 0 Cal/g**

Calorific value of Foods

- Food contain **mixture of nutrients.**
- Calorific value of foods depends upon **the amount of nutrients present in it.**

Calculation of Calorific Value of Food Stuffs

- Food energy is the **amount of energy liberated by food nutrients.**

- **Through digestion absorption and assimilation of food nutrients.**

Energy is provided by the following

Carbohydrates:

60% (45-65%) of the diet

1gm provides 4 kcal

Fats:

35% (25-45%) of the diet

1gm short-chain provides 5.3 kcal

1gm medium-chain provides 8.3 kcal

1gm long-chain provides 9 kcal

Proteins:

11% (9-15%) of the diet

1gm provides 4 kcal

Calculation Of Energy Content Of Foods

100 gram of Wheat flour contains

- **69.6 gm Carbohydrates**
- **12.0 gm Proteins**
- **1.5 gm Fat**

- Calories of 100 gm Wheat flour= (69.6x4)+(12x4)+(9x1.5)=**340 Calories**

- **Energy Content of foods is computed as:**
- **Multiplying** the **amounts of calorific nutrients in 100 gm of food with their physiological calorific values.**
- **Finally adding up the values**.

Energy Requirements by Human body

- **Human body daily requires** sufficient **amount of energy** to expend on **various body activities.**
- **This energy need is provided by combustion/oxidation of food nutrients of calorific values**.
  - **Usually Carbohydrates and Fats**
  - **In emergencies Proteins.**

Energy Requirement By Human Body Differs In Different Phases Of Life

- Approximately **80-120 kcal/kg body weight** for the **1st year of life**.

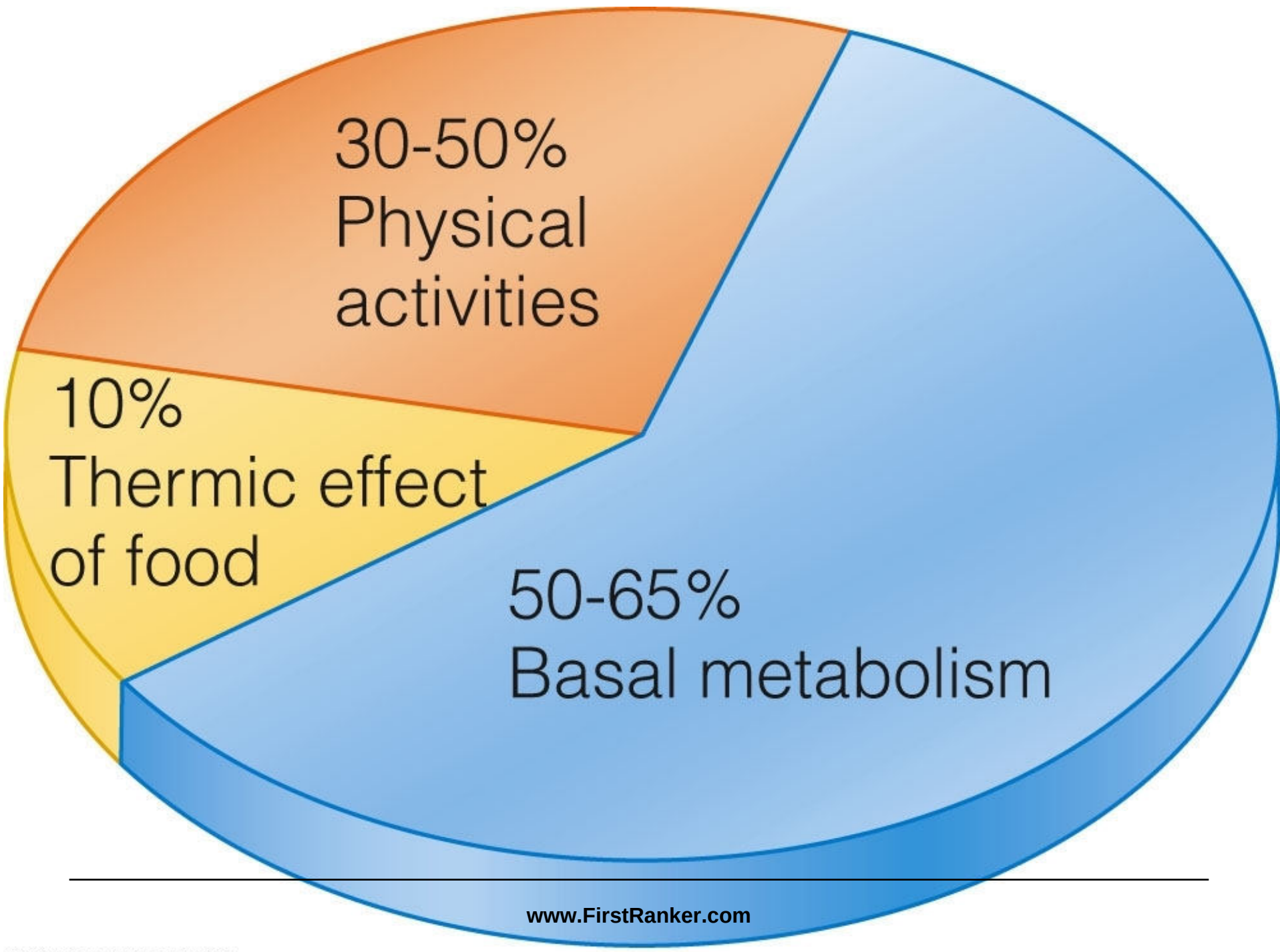
- Approximate **2500 Kcal/day for an Adult individual**

An Amount of Energy Needed by a body is Based on:

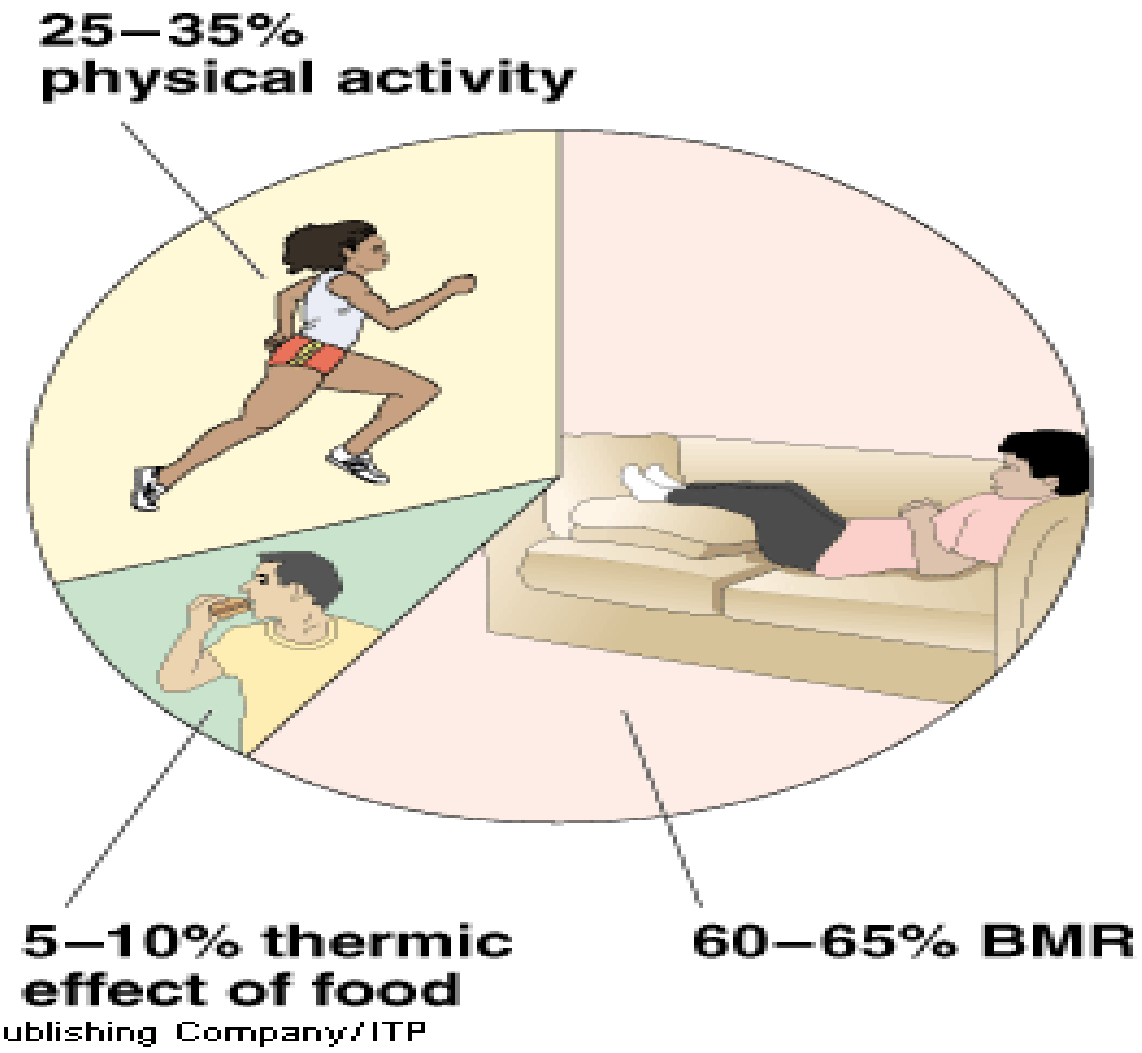
1. **Basal Metabolism (BMR)**

2. **Physical Activities**

3. **Specific Dynamic Action of foods(SDA)/ Thermic effect**



BMR > Activity > Dietary Thermogenesis



Basal Metabolic Rate (BMR)

What Is

- **Basal Metabolic Rate (BMR) ?**

- **BMR is** the **minimum amount of energy required by the** body to maintain life in **basal condition**.

- **Basal condition of body is :**

1) **Post absorptive phase**
2) **Awake condition**
3) **Thermo neutral environment**
4) **Complete physical and mental rest**

- **BMR** is the **minimum resting energy expenditures by an awake alert person**.

- The **energy required in basal condition** is consumed for the **involuntary actions of body viz**
  - **Pumping of Heart**
  - **Blood Circulation**
  - **Respiration process by Lungs**
  - **Muscular Twitching and reflexes**
  - **Intestinal Peristalsis**
  - **Metabolic Reactions**
  - **Renal Functions**

Determination Of BMR

Preparation Of Patient For BMR Estimation

- **In early morning subject should be in:**
  - **Post absorptive phase** (12 hr Fast)
  - **Physically and mentally relaxed**
  - **Lying position, awake condition**
  - **Room Temperature** should be around **21-25 degree centigrade**
  - **Normal humidity**

- **Direct Method For BMR Determination Using :**
  - **Benedict Roth Apparatus**
  - **Dubois Apparatus**

- **Benedict-Roth Apparatus**

- **Calculates the amount of Oxygen consumed** under the specific **basal conditions.**

- **Oxygen consumption for 2-6 minutes** and **measure the value from graph.**

- **Indirect Method of BMR Determination:**
  - **Analysis of expired air**
  - **Determining of O2 consumption and CO2 output.**
- **The total heat production is determined** and is then
- **Calculated per sq.m of body surface per hour**

BMR= Total heat production in Cal/hr

Body surface area in Sq.m

Normal Values Of BMR

- **Males= 35-40 kcal/ sq.m /hr**
- **Females= 30-35 kcal/ sq.m /hr**

- **Indirect Calorimetry:**
- **Calculates Respiratory Quotient**

- Oxygen Consumption
- Carbon Dioxide Production

- **Spirometer or Respirometer** apparatus is used to **measure the amount of Oxygen consumed and Carbon dioxide produced.**
- This helps in calculating the energy expended.

Respiratory Quotient

- ***Respiratory Quotient (RQ)*** is **ratio of volume of carbon dioxide produced** to **volume of Oxygen consumed** by an individual in a **given interval of time.**

Respiratory Quotient (RQ)

$$RQ = \frac{\text{Volume of } CO_2 \text{ Produced}}{\text{Volume of } O_2 \text{ Consumed}}$$

At the CELL

Each substrate has its own RQ value.

(Carbohydrates (1.0) vs Fatty acids (0.7))

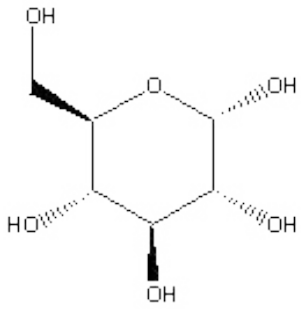
- ***Respiratory Quotient* (RQ)**

  - Amt CO_2 produced/O_2 consumed
  - **Varies for different Calorific Nutrients**

- **Amount of CO_2 formed does not always equal amount of O_2 consumed**

RQ for CHO and FAT

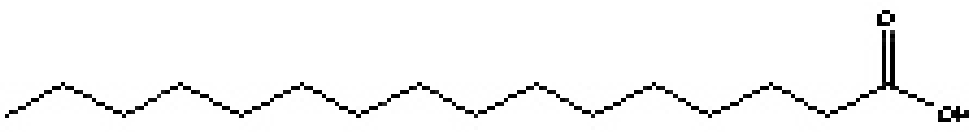
Carbohydrate (Glucose):



$C_6H_{12}O_6 + 6O_2 \rightarrow\rightarrow\rightarrow 6CO_2 + 6H_2O + Energy$

RQ = $6CO_2$ / $6O_2$ = <u>1.00</u>

Fat (Palmitic Acid):



$C_{16}H_{32}O_2 + 23O_2 \rightarrow\rightarrow\rightarrow 16CO_2 + 16H_2O + Energy$

RQ = $16CO_2$ / $23O_2$ = <u>0.70</u>

- **R.Q of Protein is 0.8**
- **R.Q of Mixed diet is 0.85**

- **R.Q in Heavy work exceeds more than 1.**
  - During heavy exercise the **tissue metabolism is increased.**
  - **CO_2 out put is increased by enhanced pulmonary ventilation**
  - **Oxygen consumption** is **not proportionately increased.**

- Thus R.Q is an **indicator of metabolic status.**
- **R.Q of food stuffs depend upon:**
  - **Type of food Nutrients**
  - **Their varying proportions**

- **RQ value can be used** to find the **amount energy produced** per litre of Oxygen consumed

- **Conditions increasing R.Q**

- **Violent Exercise**
- **Fever**
- **Acidosis**

- **Conditions Decreasing R.Q**

- **Starvation**
- **Diabetes mellitus**
- **Alkalosis**

Significance Of R.Q

- **R.Q value helps in:**
  - **Estimation of Basal Metabolic Rate**
  - **Type of food oxidized**
  - **Diagnosis of various pathological conditions** such as **Acidosis , Diabetes mellitus ,fever etc.**

- **To estimate the Calories needed for basal metabolism/hour**:
  - **For Men**: Multiply body weight (lbs) by 11
  - **For Women:** Multiply body weight (lbs) by 10

Average Calories Required for Basal Metabolism is 70 C/hr or 1680 C/day

Factors Affecting BMR

BMR is Influenced By Many Factors.

- Age
- Sex
- Body Surface Area
- Climate/Environmental Temperature
- Nutritional Status
- Hormones
- Pregnancy
- Physical Activity- Exercises

- Circadian Rhythms
- Emotional State
- Smoking and Caffeine
- Body temperature
- Diseases
- Digestive Processing

(Specific Dynamic Action)

- Aquatic Salinity (Osmoregulation)

Age

- **Infants and children** have much **higher BMR than adults**.
- **Growth** increases BMR.
- **Highest BMR** is noted at age of **5-6 yrs** (58kcal/sq.m/hr)
- **BMR** is gradually **decreased** as **age proceeds**

Gender/Sex

- BMR of **men is always higher than women**.
  - **Men possess**
    - increased lean muscle mass.
    - increased physical activities.

Body Surface Area

- **Body surface area** is related **to height and weight of an individual.**
- BMR is directly proportional to the **body surface area.**

- Increased Body Surface (**lean muscle**) area has greater BMR.

- **Lean muscle mass is more metabolically demanding than Fatty tissue.**

- **Lean tall p**ersons with **greater muscle** mass has **higher BMR.**

- **Obese short** persons with **lower lean muscle** mass has **lower BMR**.

- **Lower body Fat** percentage **higher is the BMR**.

- **Higher** the **body Fat** percentage **lower is the BMR**.

Climate/Environment Temperature

- BMR is decreased in **summer**
- BMR is increased in **winters**

Nutrition

- **BMR is lower** in persons with **malnutrition and starvation.**

Endocrine Secretion/Hormones

- **Thyroid hormone influences directly on BMR**
  - **BMR is increased** in **hyperthyroidism**
  - **BMR is decreased** in **hypothyroidism**.

- High levels of **Growth hormone and Epinephrine** also **increases BMR**.

Pregnancy

- **BMR is raised by 5% in pregnancy.**

BMR For Physical Activity

ACTIVITY LEVEL	PERCENTAGE OF BASAL METABOLISM CALORIES
Inactive: sitting most of the day; <2 hours moving about slowly or standing	30%
Moderate: sitting most of the day; walking or standing 2-4 hours, no strenuous activity	50%
Active: physically active for >4 hours a day; little sitting or standing; some strenuous activity	75%

Thus BMR Increases With Rate Of Physical Activity

Circadian Rhythms

- BMR is **lower in sleep**
- BMR is **higher in awake**

Emotional State

- **Stress** increases BMR

Smoking and Caffeine

- **Smoking and ingestion of Caffeine** increases BMR.

Body Temperature

- BMR increases with increasing **body temperature** .
- An elevation of body temperature above 37^0C will increase BMR by 13% per ^{0}C.
- **Thus in Fever BMR is raised.**

BMR In Diseased Conditions

- **BMR is increased in**

- **Fevers**
- **Leukemia**
- **Cardiac Failure**
- **Hypertension**
- **Metabolic disorders**
- **Surgery**
- **Infections**
- **Anorexia**

Significance Of BMR Calculation

- BMR values help in **calculating energy requirement** of an individual body which help in **planning of diets.**

- To know the **effect of food and drugs** on BMR

- BMR value **checks the basal metabolism** and **disease conditions**.

- BMR values help in **assessing Thyroid function.**

Energy Required For Physical Activities

- **Energy requirement** for an individual per day **varies from:**
  - **Person to person**
  - **Action to action**
  - **Mode of life style**
  - **Type of occupation**

Energy Requiring Factors For Physical Activities

- Age
- Sex
- Body Surface Area –

  Body weight ,size and height
- Nature of work
- Duration and intensity of work.

Workers	Calories/Day	B.M.R %
Light Workers Teachers, Doctors, Office Workers	2200-2500	30-40%
Moderate Workers Students, House wives	2500-3000	40-50%
Heavy Workers Farmers ,Miners, Athlete	3000-3500	50-60%
Very Heavy Workers Rickshaw Pullers, Construction Workers	3500-4000	60-100%

Activity	Energy Expenditure in Calories/ hour
Sitting	25 Calories/hour
Standing	30 Calories/hour
Writing	30 Calories/hour
Car Driving	**60 Calories/hour**
Typing	75 Calories/hour
Walking Upstairs	800 Calories/hour

Every **physical activity** needs energy above BMR

Energy Cost of Physical Activities

Activity	*Cal/KgBW/Hour*
Bicycling (fast)	**7,6**
Bicycling (slow)	**2,5**
Dancing (foxtrot)	**3,8**
Dancing (waltz)	**3,0**
Dish washing	**1,0**
Driving	**0,9**
Table tennis	**4,4**
Marathon run	**7,0**
Sawying	**5,7**
Walking 5 km/h	**2,0**
Writing	**0,4**
Playing piano	**2,0**
Sewing	**0,6**

Specific Dynamic Action (SDA)
Thermogenic Effect Of Food (TEF)

SDA also termed as Calorigenic Action Of Food.

- **SDA** is the **extra heat produced when food** is consumed by the body, **over and above the calculated calorific value**.

- **25 gm of dietary proteins** when consumed in the body should produce 100 Calories of energy.
- **25 x 4= 100 Calories**
- But actual heat produced is **130 Calories**
- **Thus 30 Calories of energy is extra**.

- SDA is referred to an **increased heat production** following an intake of food.
- SDA **heat is expended for digestion and absorption** of food.

SDA or TEF

- SDA of Protein diet → 30%
- SDA of Carbohydrate diet → 5%
- SDA of Lipid diet → 13%

Dietary Proteins Has Highest SDA Values

- **Protein rich meal** eaten in **hot weather** feels the body **hot and sweaty**.

- Protein rich meal in **cold weather** provide **cozy and comfortable feeling**.

- SDA accounts for approximately 10% of the body's **total** energy need (basal needs and energy needs)

SDA of food is the amount of energy required to digest mixed food (Carbohydrate, protein, lipid, fruit & vegetable).

Approximately 10% of BMR is required as the SDA of food

Adult 60 Kg, requires BMR =24 Cal/kg

BMR = 1440 Cal
SDA = 144 Cal
Total = 1584 Cal (BMR+SDA)

Significance Of SDA

- **Heat of SDA** can be utilized for **maintaining body temperature** but **not for muscular activity.**

Conditions with Decreased SDA

- Conditions where amino acid catabolism decreased
- **SDA is decreased**
  - **Starvation**
  - **Growth**
  - **Pregnancy**
  - **Convalescence period** (Recovery)

Balanced Diet OR Prudent Diet

(Thoughtful And Careful Way Of Eating)

- **Nutrition** is a **first need of human beings.**
- **General health and well being of a body depends on**
- **Nutritional status of an individual**

- If human body is considered as a Machine
  - Food is our fuel

Composition of Food Nutrients Determines:

- Bodies composition and built
- Bodies strength to cope up with interacting environmental pollutants
- Bodies capacity to grow, repair and reproduce.

What Is a Balanced Diet?

Balanced Diet
IS A Planned Diet At Various Physiological States

Balanced Diet A Healthy Diet

- **Nutritionists planned the diet considering :**

- **Various physiological phases of human life**

- **Human Nutritional requirement of the body**
  - **Calculates the energy requirement per day related to**
  - **BMR and various physical activities.**

- Its necessary to maintain **balanced diet since:**

- What we **eat today,** will affect our **health in the future.**

Maintain Balanced Diet By

- Eating items from **all food groups**

- With **appropriate quantity and good quality** to provide all nutritionally essential nutrients.

- **Eating properly and regularly (Timely) without skipping the whole meals.**

- It is **especially important** to **take care of eating during**
- **Growth, Pregnancy and lactation**
  - **Remember a young plant, not given proper nutrients grows up to a poor specimen with less/no fruits and flowers.**

Features of Balanced Diet

- **Balanced diet provides the mixture** of **all dietary nutrients in:**
  - **–Adequate quantity**
    (Restrict to RDA values)
  - **–Good quality**

- **Balanced Diet Provides**
  - **–Calorific needs**
  - **–Building blocks**
  - **–Accessory Growth factors**

- Balanced diet **does not allow an individual**
- **To ingest any one dietary nutrient in excess or less amount.**
- **Thus Balanced diet prevents a body**
- **To suffer from over or under nutritional disorders.**

Points To Consider While Planning For Balanced Diet

1. Physiological States
2. BMR (Considering all factors)
3. Physical activities of an individual
4. SDA

- The food included during planning of balanced **diet should be locally available**

- The food should be **within economic means of people.**

- It should **fit with local food habits.**

- Balanced diet food items should be **easily digestible and palatable.**

- The food eaten should **contain all the chief constituents** which **suffice bodies health, growth and reproduction.**

- An individual **should eat following food groups in recommended quantity and quality** and maintain balanced diet.
  - **Cereals and Pulses**
  - **Milk**
  - **Meat and Fish**
  - **Vegetables and Fruits**

- **RDA values differ** during **different physiological states** of human body
- viz growth, pregnancy, lactation and convalescence.

Points To Remember

- During **growth, pregnancy and Lactation** the **dietary intake should be increased**
- To **build the body and maintain reproduction** respectively.

Indian Balanced Diet

- The **Nutrition Expert Group constituted by ICMR**
- Taking into **account of Indian available foods**
- Has **recommended the composition of Balanced diets for Indians.**

The Indian balanced diet composed of

- Cereals : Rice, Wheat,Jawar
- Pulses
- Vegetables- Roots,Tubers
- Fruits
- Milk and Milk products
- Oil
- Sugar
- Fish
- Meat
- Eggs

Recommended Daily Allowance(RDA)

- **RDA of Chief Nutrients for an Adult Individual**
- **Prescribed by WHO**
- **Modified by ICMR as per Indian conditions**

Nutrient	RDA in Grams
Carbohydrates	400 gm
Fats	70 gm
Proteins	60 gm
Fiber	40 gm

- **Carbohydrate content of Some common foods**

Food Item	Carbohydrate Content
Cane Sugar	100 %
Rice	80%
Wheat	70-80%
Bread	50-60%
Potatoes	25%

Vitamins	RDA
Vitamin A	3000- 4000 IU
Vitamin D	200-400 IU
Vitamin E	9 mg
Vitamin K	70 ug
Vitamin C	60 mg
Folate	400 ug
Thiamine (B1)	1.2 mg

Vitamins	RDA
Biotin	30 mcg
Riboflavin (B2)	1.2 mg
Niacin (B3)	15mg
Pantothenic (B5)	5 mg
Pyridoxine (B6)	1.6 mg
Cyanocobalamin (B12)	2.4 ug

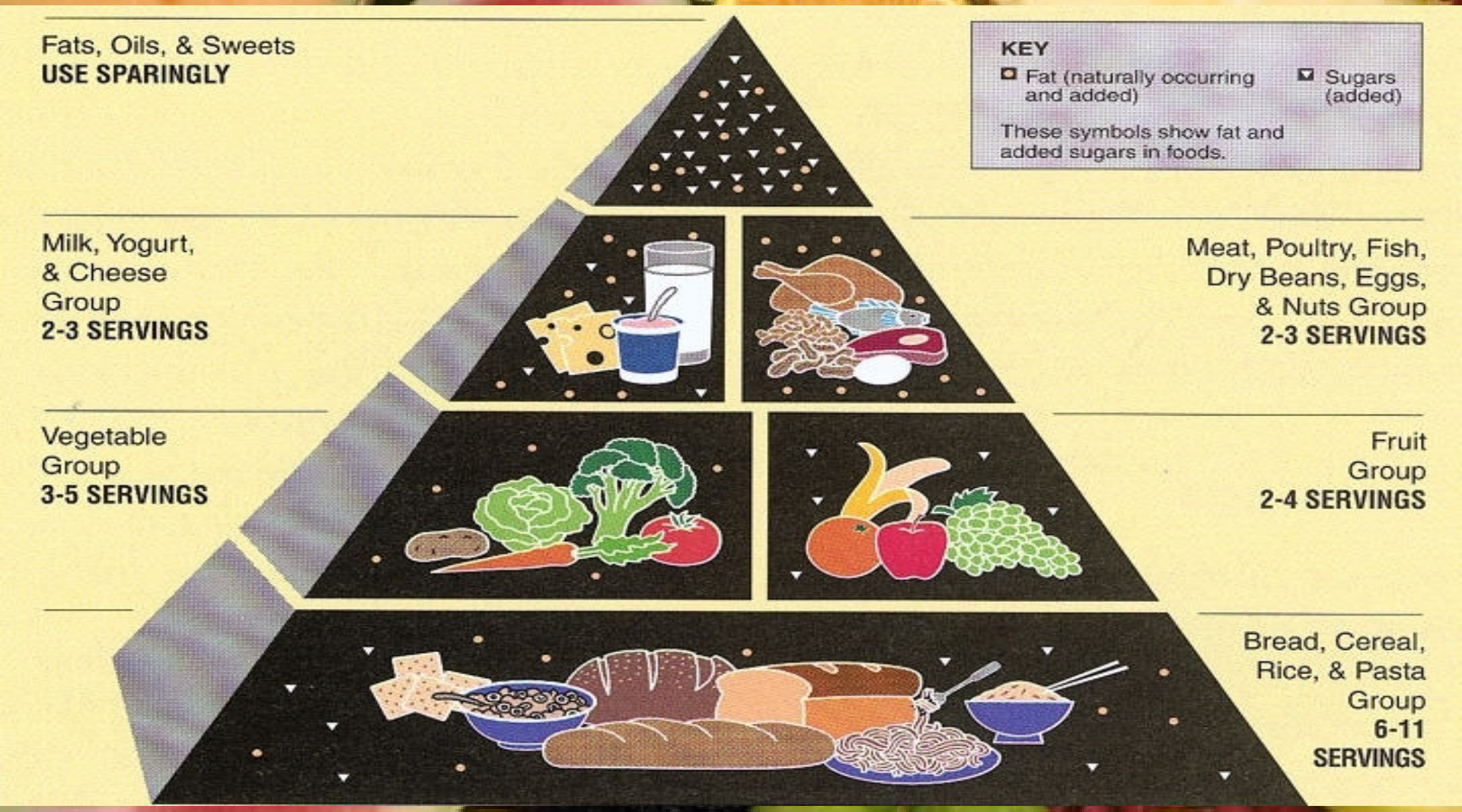
Minerals	RDA
Calcium (Ca)	1200 mg
Phosphorus (P)	700 mg
Magnesium (Mg)	370 mg
Sodium (Na)	500 mg
Chloride (Cl)	750 mg
Potassium (K)	2000 mg

Minerals	RDA
Iodine (I)	150 ug
Iron (Fe)	10 mg
Copper (Cu)	1.5 mg
Zinc (Zn)	14 mg
Selenium (Se)	60 ug

Minerals	RDA
Molybdenum (Mo)	75 ug
Manganese (Mn)	2 mg
Fluoride (F)	4 mg
Chromium (Cr)	50 ug

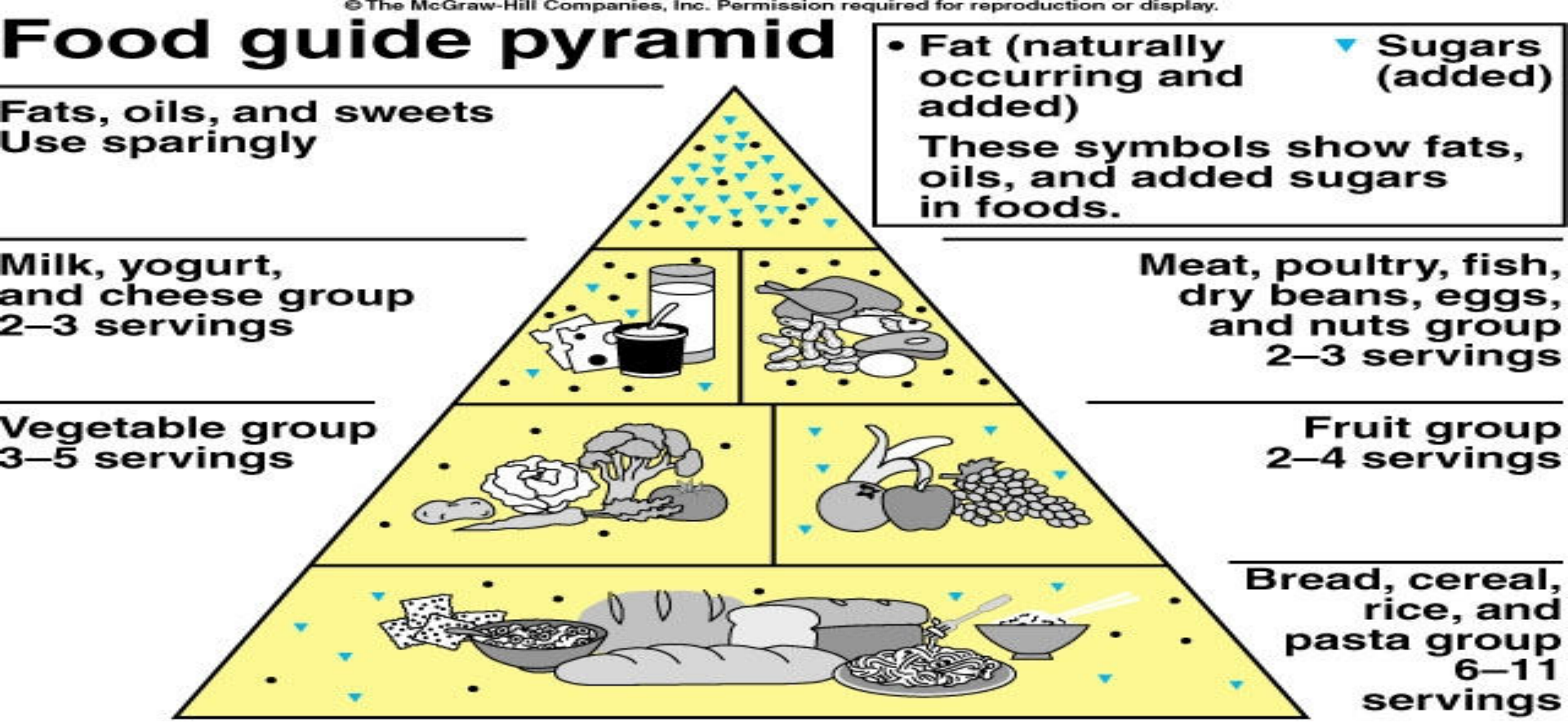
- Eat different forms of foods to keep healthy
- OR
- **Eat varied type of diet in a day**

The Food Guide Pyramid



Eat A Balanced Diet

Guidelines for Healthy Eating

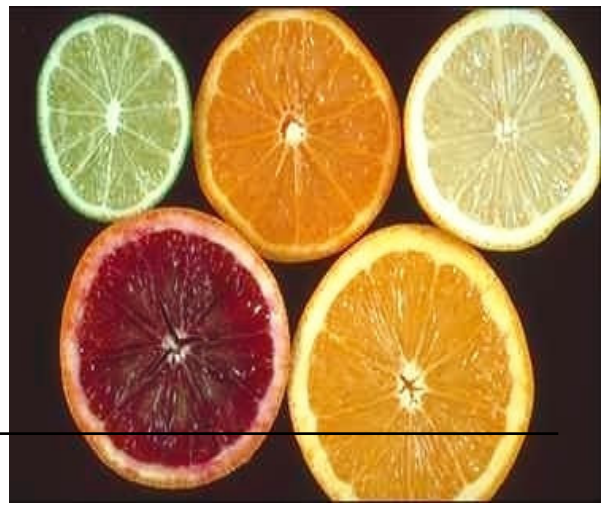


Follow principles in the Food Guide Pyramid

- **75% of a day's food**
- Should come from **grains, vegetables and fruits**

- Extra servings of green and yellow vegetables may be beneficial

- Extra **consumption of citrus and other fruits may be beneficial**



Tips For Eating Well

- Eat **regular meals**
- **Do not skip breakfast**
- Eat foods **from all food groups** /According to the **food pyramid**
- **Limit processed /Junk food**

- Prefer **meals on starchy foods**
- Eat **Egg and Fish**
- Eat **adequate amounts of vitamins and minerals**
- Eat **lots of fruit and vegetables**

- **Eat fresh and natural foods**
- **Cut down saturated fats , trans fats and refined sugars.**
- Try to **eat less salt** (no more than 5g/day)
- **Restrict Alcohol**
- **Limit Tea and coffee**
- **Drink plenty of water**
- **Remain active and try to maintain a healthy weight**.

Regularly Recall the 8 tips

Significance Of Balanced Diet

Balanced Diet Makes Life Healthy And Happy

- Eating balanced diet right from the **beginning of life builds:**
- **The organ system of human body with full of strength and vital capacity**
- This prepares the **body to face any critical conditions.**
  - **Metabolic stress**
  - **Infections etc**

- **Balanced diet Significantly**

- Maintains bodies **normal growth , health and reproduction.**

- **Prevents** from the **suffering of nutritional disorders.**

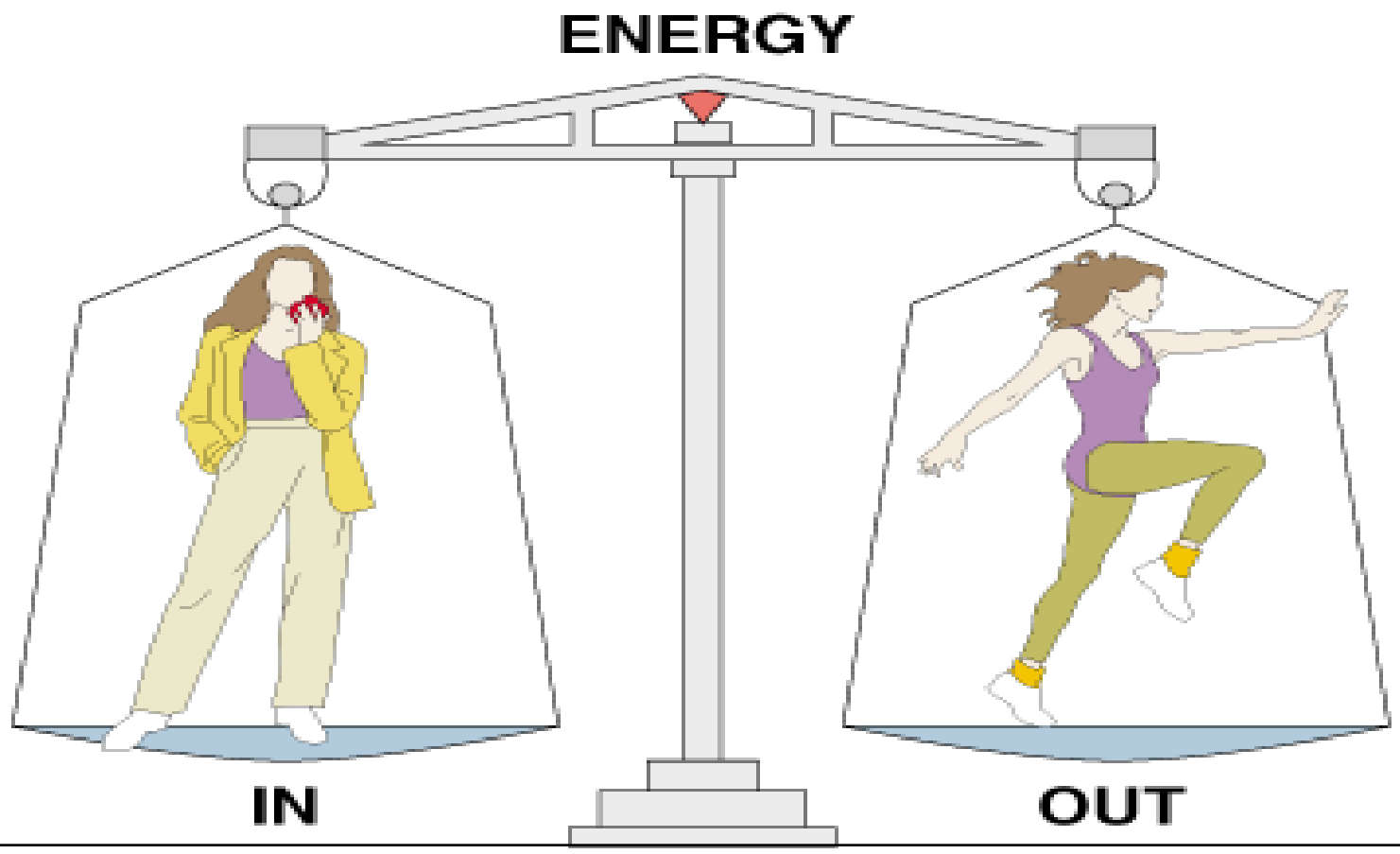
- **Increases span of healthy and happy life.**

Energy Balance and Imbalance

- **Body weight is stable** when **energy consumed is equal to energy expended.**
- This is termed as **Nitrogen balance**.

Energy Balance:

Input vs Output



One pound of body weight is equal to 3,500 kilocalories

- **Body weight increases**, when **energy consumed is greater than energy expended.**

- **Body weight decreases** when **energy consumed is less than it expenditure.**

- **Balanced Energy Intake**: not losing or gaining weight
- **Negative Energy Balance**
  - Weight loss: Energy intake < Energy expended
- **Positive Energy Balance**
  - Weight gain: Energy intake > Energy expended

Nutritional Disorders

MALNUTRITION

A pathological state resulting from a relative or absolute deficiency or excess of one or more essential nutrients.

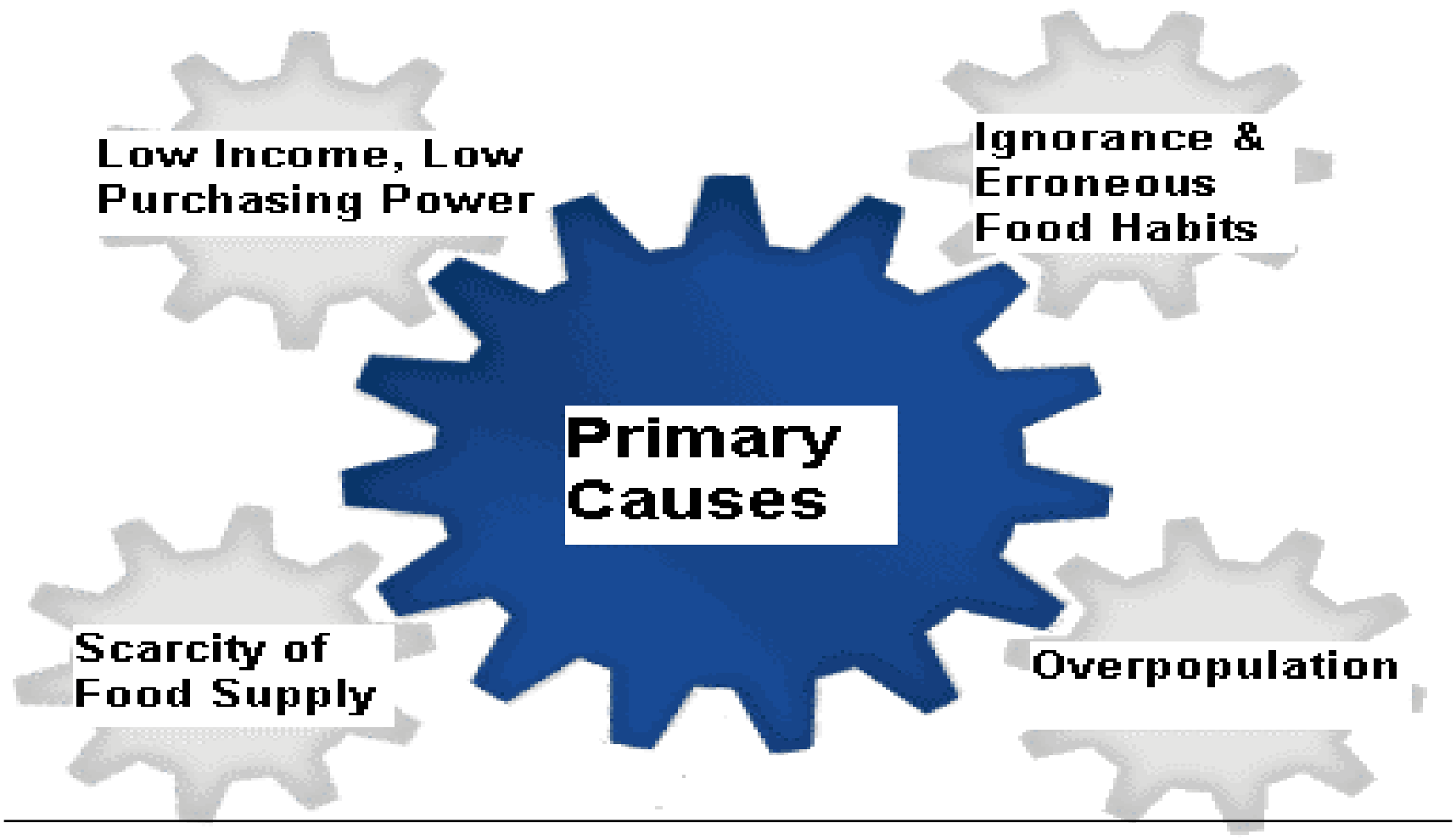
Forms of Malnutrition

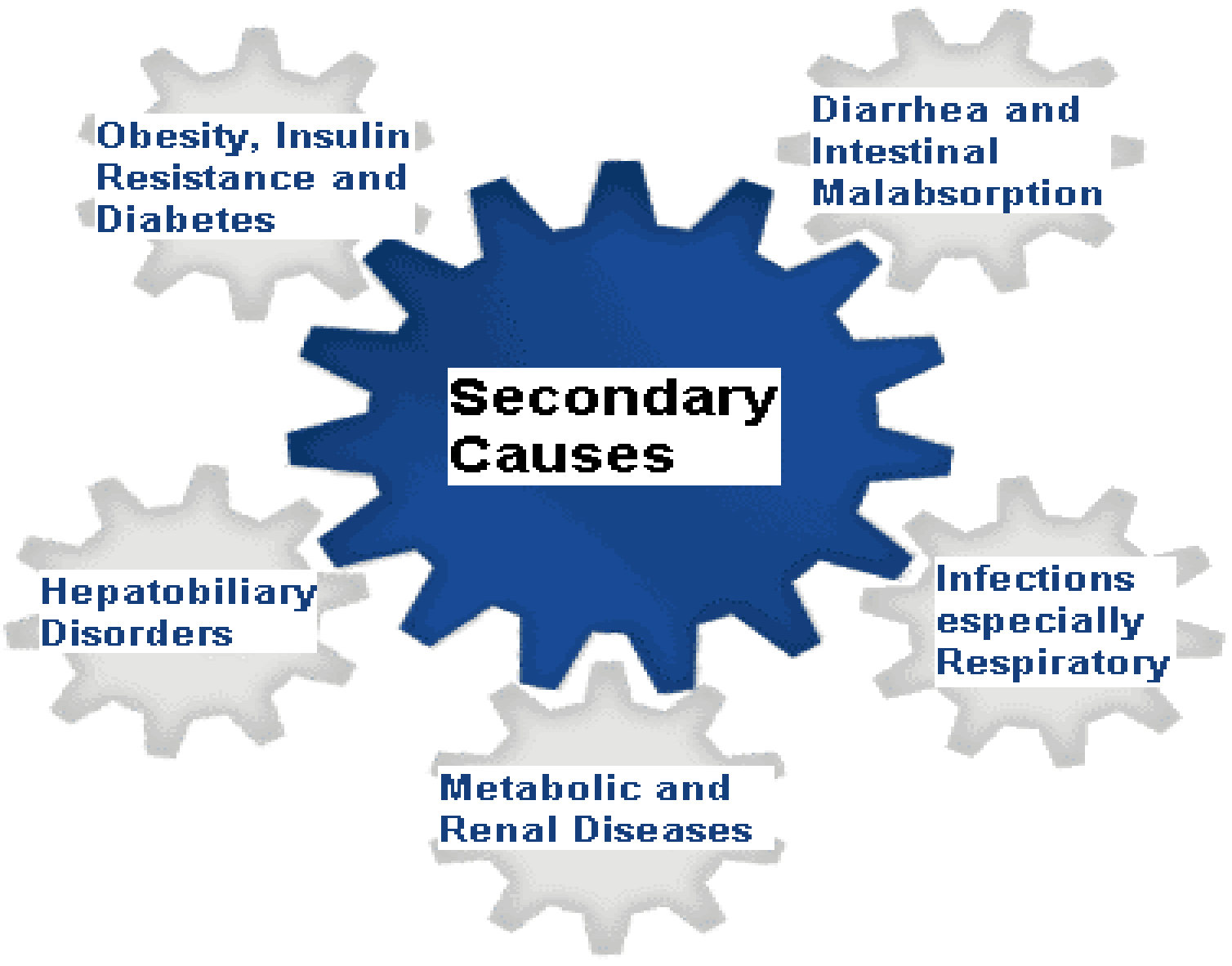
- **Undernutrition:**
  Kwashiorkor, Marasmus
- **Overnutrition:**
  Obesity, Hypervitaminosis
- **Specific Deficiency:**
  Kwashiorkor, Hypovitaminoses, Mineral Deficiencies
- **Imbalance:** Electrolyte Imbalance

- **Human beings suffer from Nutritional disorders due to:**
  - **Lack of general awareness**
  - **Illiteracy**
  - **Poverty**
  - **Wrong food habits**
  - **Disorders**

- **The availability of food is not uniform due to:**
  - **Unequal distribution of food items**
  - **Unequal economical status of human population**

ETIOLOGY OF MALNUTRITION





Types Of Nutritional Disorders

- Under Nutritional Disorders
- Over Nutritional Disorders

Under Nutritional Disorders

Under Nutritional Disorders

- It is a **type of Malnutrition**.
- **Less intake** of food nutrients.
- **Insufficient building blocks** and vital growth factors.
- Insufficient **energy sources**.

Protein Energy Malnutrition(PEM)/ Protein Calorie Malnutrition (PCM)

- **Protein Energy Malnutrition (PEM)**

- **Protein and Energy deficiency go hand in hand.**
- This combination leads to **protein-energy malnutrition**

- PEM is the **worlds most widespread malnutrition problem in developing countries**.

PEM PRECIPITATING FACTORS

- **LACK OF FOOD (Famine, Poverty)**
- **INADEQUATE BREAST FEEDING**
- **WRONG CONCEPTS ABOUT NUTRITION**
- **DIARRHOEA & MALABSORPTION**
- **INFECTIONS (Worms, Measles, T.B)**

EPIDEMIOLOGY & ETIOLOGY

- Seen most **commonly in the first year of life due to lack of breast feeding and the use of dilute animal milk.**
- **Poverty or famine and diarrhoea are the usual precipitating factors**
- **Ignorance & poor maternal nutrition are also contributory factor**

Development Of PEM

- The **majority of world's** children live in **developing countries**
- Lack of food & clean water, poor sanitation, infection & social unrest lead to **LBW & PEM**

- **PEM leads to**
- **Increased Rates of Infant Mortality**

- **PEM** disorders caused **due to lack of adequate Proteins and Energy in the diet.**

- According to **W.H.O** **PEM is the most important public health problem prevailing in developing countries**.

- **PEM most common in Africa, Central America, South America, Middle East, SE/E Asia**
- Also see in US
  - **Homeless**
  - **Inner-city**
  - **Rural poverty**

- **PEM most often affects children:**
  - **500 million children** are malnourished
  - >50% of deaths of <5 children (5 million/year)

- **Adults may also be affected with PEM**
  - Men at greatest risk are:
    - Those living in poverty
    - Elderly living alone
    - Addicts
    - Those with eating-disorders
    - Those with long-term illness

Forms Of PEM

- **Protein Energy Malnutrition (PEM) includes**

  – **Kwashiorkor**
  – **Marasmus**
  – **Marasmic Kwashiorkar**

(Noted during Starvation or Wasting extreme energy deprivation)

»**Kwashiorkor**
»**Marasmus**

- **Two Facets of PEM**

Kwashiorkor

- Kwashiorkor means sickness of **displaced/deposed child.**

- **Kwashiorkar** describe the **sickness of weaning,**

- That **affects the first born child,** **when the second child is born.**

KWASHIORKOR Historical Aspects

- The **word Kwashiorkor was introduced to the medical literature in 1933 ,by Cecilly Williams**, a **British Nurse**.
- **Kwashiorkor is the Ghanaian name** for the **Evil Spirit**

Biochemical Cause

- **Kwashiorkar** is an **extreme condition** **of Protein Energy Malnutrition**

- **Caused due to ingestion of Protein deficient diet.**

Cause

- **Age of onset- 1 to 5 years**
- Child gets **displaced by mothers attention.**
- **Ingestion of low dietary Proteins**
- **No milk fed instead low protein diet like gruel prepared from grains and potatoes is fed.**

Biochemical Alterations

- **Amino acid deficiency** for tissue protein biosynthesis.
- **Serum Albumin levels markedly decreased < 2gm%**
- **Digestive Enzymes lowered**
- **Overall body Proteins are lowered**
- **Serum Cortisol levels decreased**

Clinical Signs And Symptoms

- **Enlarged abdomen**
- **Pitting edema** of trunk, limbs and eyelids **(Low serum Albumin)**
- **Moon Face**
- **Anemia**
- **Growth retardation**
- **Loss of weight, lethargic**

- **PSYCHOMOTOR CHANGES**
- **SKIN DEPIGMENTATION**

- **Failure of digestion and absorption due to lack of digestive enzymes.**

- **Due to indigestion of food**
  - ❖ **Loss of appetite and anorexia**
  - ❖ **Diarrhea**
  - ❖ **Water and Electrolyte imbalance**

- **Subnormal Immunocompetence**

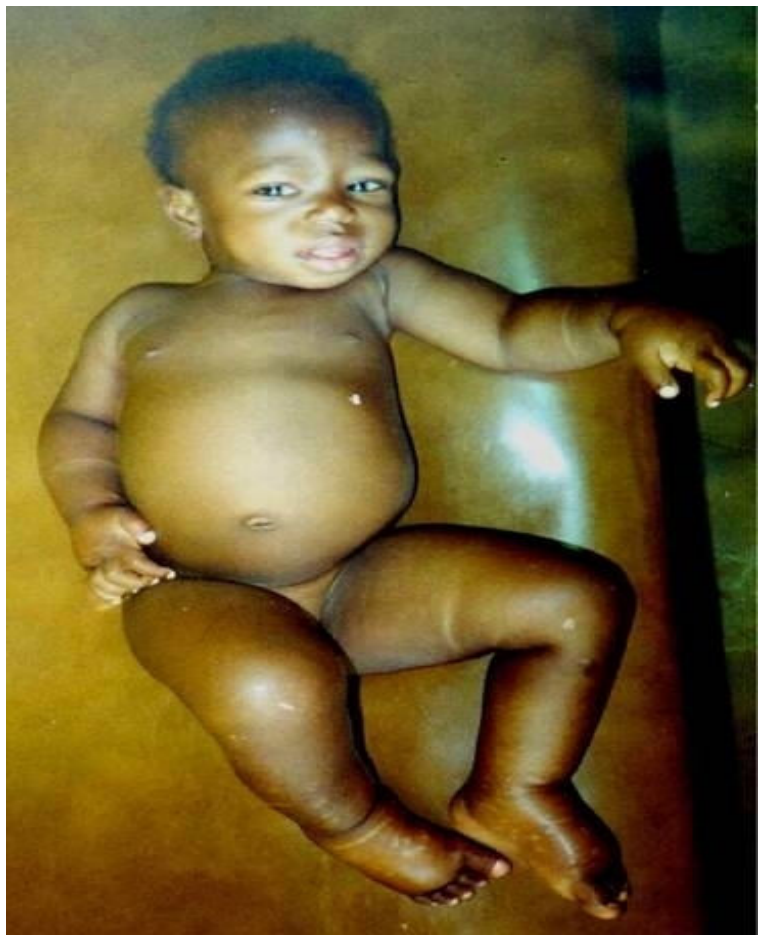
  (Low Immunity)
- **Mental Changes observed-Low Neurotransmitters**
- **Fatty Liver-Low/No mobilization of Lipids**
- **Sparse ,soft, thin and curly hairs**
- **Glossitis**
- **Conjunctivitis**

- **One theory says Kwashiorkar** is a result of **Liver insult** with **hypoproteinemia and oedema**.

- **Food toxins** like **Aflatoxin** have been suggested as **precipitating factors for Kwashiorkar.**

Kwashiorkor (Edematous Malnutrition)

- Underweight with Edema
- Stunted growth
- Irritable, difficult to feed
- Highest mortality – 50 to 60%



Treatment Of Kwashiorkar

- **Gradual feeding with good quality food proteins**
  - –Milk
  - –Egg
  - –Legumes /Pulses

Marasmus

- **Marasmus** means **neglected child**
- Marasmus is a **disorder of PEM** where an **infant is virtually starving**
- Due to **lack of both dietary calories and proteins.**

- The term **Marasmus** is derived from the **Greek** word, **which means wasting.**
- Marasmus involves inadequate **intake of Protein and Calories and is characterized by emaciation.**
- **Marasmus represents** the **end result of starvation** where **both proteins and calories are deficient.**

Causes Of Marasmus

- Age of onset- **Below 1 year**
- **Deficiency of both Calories and Proteins.**
- Marasmus occurs in areas where there is **severe starvation and famine/draught conditions**.

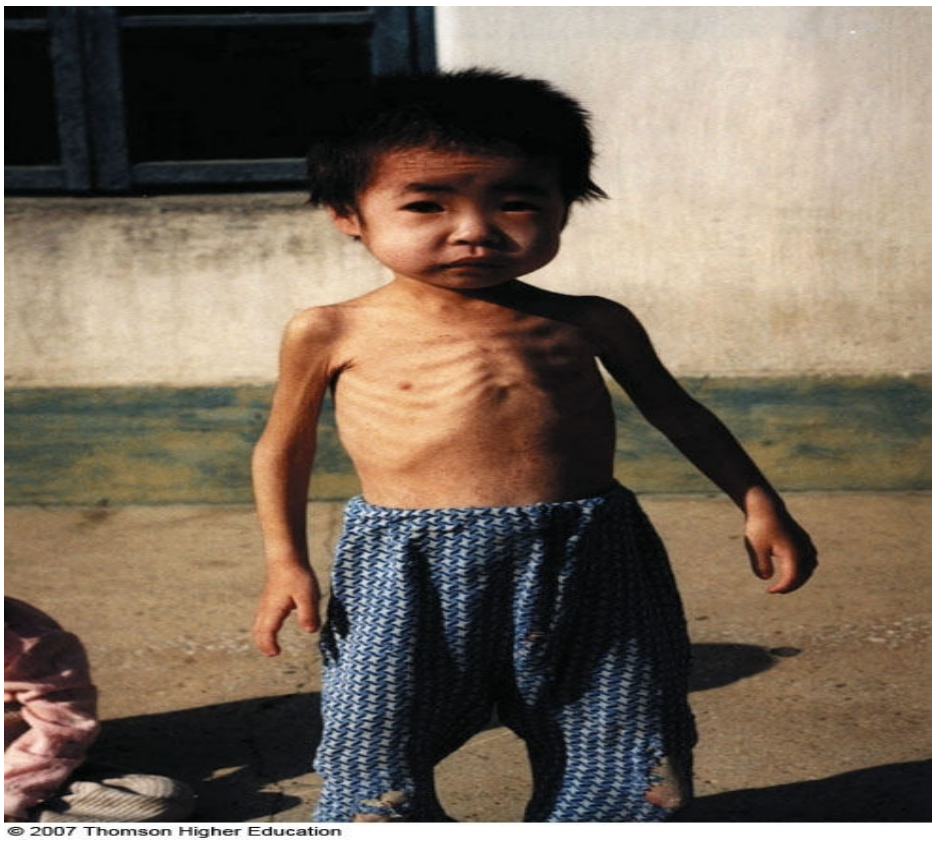
Biochemical Alterations In Marasmus

- Serum **Albumin levels 2-3 gm%**
- Serum **Cortisol levels increased**

Clinical Signs And Symptoms

- Marked **growth retardation**
- Severe **Muscle wasting**
- **Loss of sub cutaneous fat**
- Extreme **loss of body weight**
- **No Edema**
- **No mental changes**
- **No characteristic change in hair**
- **Appetite is normal**
- **Skin becomes dry and atrophic**
- **Child looks older than his age**

- Feels Hungry
- Diarrhoea & Dehydration
- Alert but miserable



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Differentiation Between Kwashiorkar And Marasmus

Features	Kwashiorkor Displaced Child	Marasmus Neglected Child
Age Of Onset	1-5 years	Below 1 year
Cause	Deficiency of dietary Protein	Deficiency Of dietary Proteins and Calories
Serum Albumin	< 2gm%	2-3 gm%
Edema	Significantly Present	Absent
Muscle Wasting	Not severe	Markedly sever
Growth Retardation	Present	Markedly noted

Features	Kwashiorkor	Marasmus
Attitude and Appearance	Lethargic ,apathetic Face looks plump	Irritable and fretful Shrunken with skin and bones
Appetite	Anorexia	Normal
Skin Changes	Crazy pavement Dermatitis	Dry and atrophic
Hair Changes	Sparse, soft thin and curly	No characteristic change
Serum Cortisol	Decreased	Increased

Investigations for PEM

- **Full Blood Counts**
- **Blood Glucose**
- **Serum Electrolytes, Ca, P**
- **Serum Proteins and Albumin**
- **Septic screening**
- **Stool & urine for parasites & Microbes**
- **Mantoux test**

NON-ROUTINE TESTS

- Hair analysis
- Skin biopsy
- Urinary Creatinine
- Measurement of trace elements levels, iron, zinc & Iodine

Complications of P.E.M

- Hypoglycemia
- Hypothermia
- Hypokalemia
- Hyponatremia
- Heart failure
- Dehydration & shock
- Infections (bacterial, viral & thrush)

Treatment

- **Slow refeeding**
  - –Small frequent feeding round the clock
  - –Patient encouragement of food
- **Nutritional rehabilitation**
  - –Play and teaching
  - –Control infections

In Acute/ life threatening Cases:

- –**Fluid and Electrolytes**
  - •K and Mg shifts
  - •Oral rehydration, slowly 70-100 ml/kg

– **Infections: Main cause of death**
  - Aggressive treatment
– **Other deficiencies**
  - Anemia and Heart failure,
  - Care with transfusions and no diuretics
  - Vitamin A: immediate treatment

- Dietary support:
- **3-4 g protein & 200 Cal /kg body wt/day + Vitamins & Minerals**
- Prevention of hypothermia
- Counsel parents & plan future care including **immunization & diet supplements**.

KEY POINT FEEDING

- Continue breast feeding
- Add frequent small feeds
- Use liquid diet
- Give vitamin A & Folic acid
- With diarrhea use lactose-free or soya bean formula

PROGNOSIS

- Kwashiorkor have greater risk of morbidity & mortality compared to Marasmus and under weight
- Early detection & adequate treatment are associated with good outcome
- Late ill-effects on IQ, behavior & cognitive functions are doubtful and not proven

Over Nutrition Disorders

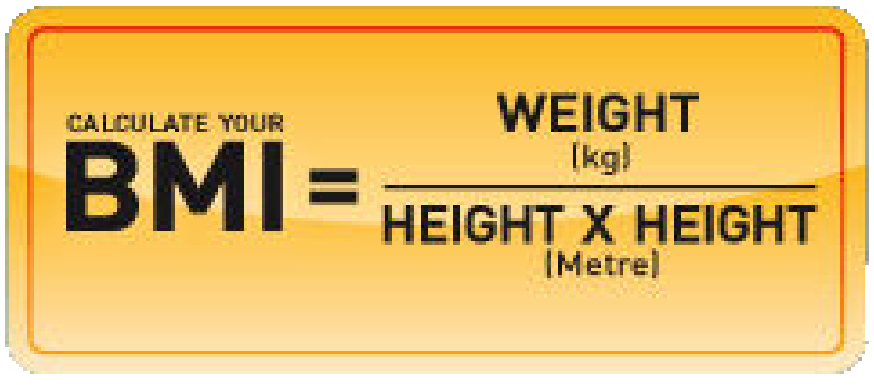
Obesity

Obesity

- Generalized, excessive accumulation of fat in subcutaneous & other tissues
- Classification according to "desirable" weight standard:
  - Overweight ~ ≥10%
  - Obese ~ ≥20%

Obesity Is Identified By Measurement Of Body Mass Index (BMI)

$$\text{Body Mass Index} = \frac{\text{Weight (in kg)}}{\text{Height}^2 \text{ (in m)}}$$



OBESITY

Body Mass Index (BMI)

$$BMI = \frac{\text{weight (kg)}}{\text{height}^2 \text{ (m)}}$$

BMI	NIH Classification
<18.5	Underweight
18.5-24.9	Normal Weight
25-29.9	Overweight
30-34.9	Obesity I
35-39.9	Obesity II
>40	Extreme Obesity

BMI CHART

weight (kilograms)

height (meters)	height squared	50	60	70	80	90	100	110	120	130
2.0	4.0	12.5	15.0	17.5	20.0	22.5	25.0	27.5	30.0	32.5
1.9	3.6	13.9	16.6	19.4	22.2	24.9	27.7	30.5	33.2	36.0
1.8	3.2	15.4	18.5	21.6	24.7	27.8	30.9	34.0	37.0	40.1
1.7	2.9	17.3	20.8	24.2	27.7	31.1	34.6	38.1	41.5	45.0
1.6	2.6	19.5	23.4	27.3	31.3	35.2	39.1	43.0	46.9	50.8
1.5	2.3	22.2	26.7	31.1	35.6	40.0	44.4	48.9	53.3	57.8
1.4	2.0	25.5	30.6	35.7	40.8	45.9	51.0	56.1	61.2	66.3
1.3	1.7	29.6	35.5	41.4	47.3	53.3	59.2	65.1	71.0	76.9
1.2	1.4	34.7	41.7	48.6	55.6	62.5	69.4	76.4	83.3	90.3
1.1	1.2	41.3	49.6	57.9	66.1	74.4	82.6	90.9	99.2	107.4

height (meters)	height squared	140	150	160	170	180	190	200	210	220
2.0	4.0	35.0	37.5	40.0	42.5	45.0	47.5	50.0	52.5	55.0
1.9	3.6	38.8	41.6	44.3	47.1	49.9	52.6	55.4	58.2	60.9
1.8	3.2	43.2	46.3	49.4	52.5	55.6	58.6	61.7	64.8	67.9
1.7	2.9	48.4	51.9	55.4	58.8	62.3	65.7	69.2	72.7	76.1
1.6	2.6	54.7	58.6	62.5	66.4	70.3	74.2	78.1	82.0	85.9
1.5	2.3	62.2	66.7	71.1	75.6	80.0	84.4	88.9	93.3	97.8
1.4	2.0	71.4	76.5	81.6	86.7	91.8	96.9	102.0	107.1	112.2
1.3	1.7	82.8	88.8	94.7	100.6	106.5	112.4	118.3	124.3	130.2
1.2	1.4	97.2	104.2	111.1	118.1	125.0	131.9	138.9	145.8	152.8
1.1	1.2	115.7	124.0	132.2	140.5	148.8	157.0	165.3	173.6	181.8

What Causes Obesity

- 3 major factors contribute to the development of obesity:

  - **Genetic background**
  - **High Dietary intake**
  - **Low Physical activity**

- ❑ Psychic disturbances
- ❑ Endocrine & metabolic disturbances are rare

Biochemical Alterations

- Increased stores of TAG in adiposecytes
- Increased biosynthesis of Endogenous Lipids
- Derangements in Insulin activity
- Increased risk of Diabetes mellitus
- Biochemical Derangements in Lipid Profile
- Increased Risk of Atherosclerosis , CAD , Stroke

Clinical Manifestations:

- Fine facial features on a heavy-looking stout child
- Larger upper arms & thighs
- Genu valgum common
- Relatively small hands & fingers tapering
- Adiposity in mammary regions

- Pendulous abdomen with Striate
- In boys, external genitalia appear small though actually average in size
- In girls, external genitalia normal & menarche not delayed
- Psychologic disturbances common
- Bone age advanced

Treatment of Obesity

1st principle: Decrease energy intake

Initial medical exam to diagnose pathological causes

Plan the right diet

a. Avoid all sweets, fried foods & fats
b. Limit milk- intake not >2 glasses/day
c. For 10-14 yrs, limit to 1100-1300 cal diet for several months

2nd principle: Increase energy output

I. Obtain an activity history
II. Increase physical activity
III. Involve in hobbies to prevent boredom

Complication of Obesity

Pickwickian Syndrome/
Obesity Hypoventilation Syndrome

- **Pickwickian syndrome** is a condition in which **severely overweight people**
- **Fail to breathe rapidly enough or deeply enough,**
- Resulting in **low blood oxygen levels and high blood carbon dioxide (CO_2) levels**

- **Rare complication of extreme exogenous obesity**

Signs And Symptoms

- ✓ **Severe cardio respiratory distress & alveolar hypoventilation**
- ✓ Includes polycythemia, hypoxemia, Cyanosis, CHF
- ✓ Low Metabolic rate
- ✓ Lethargic and Fatigue

- **Obesity Hypoventilation Syndrome have:**
- Concurrent obstructive sleep apnea, **a condition characterized by snoring**.
- **Interrupted sleep**
- **Excessive Daytime Sleepiness**

Lets Fight For Malnutrition

Questions

- **Short Notes**

- Food Groups ,their constituents and their role
- Basal Metabolic Rate (B.M.R.) & its importance.
- Calorific value of food and its calculations.
- Respiratory Quotient.(R.Q)
- Specific Dynamic Action (S.D.A.)
- Balanced diet
- Factors affecting BMR

- Biological value of Proteins.
- Nitrogen Balance & types.
- Role of Fiber in diet/Significance of dietary fibers.
- Protein Energy Malnutrition (PEM) /
- Differentiate between Kwashiorkor and Marasmus.

THINK AND EAT

Eat Natural Foods