PROTEIN ENERGY MALNUTRITION

(1) Kwashiokor -

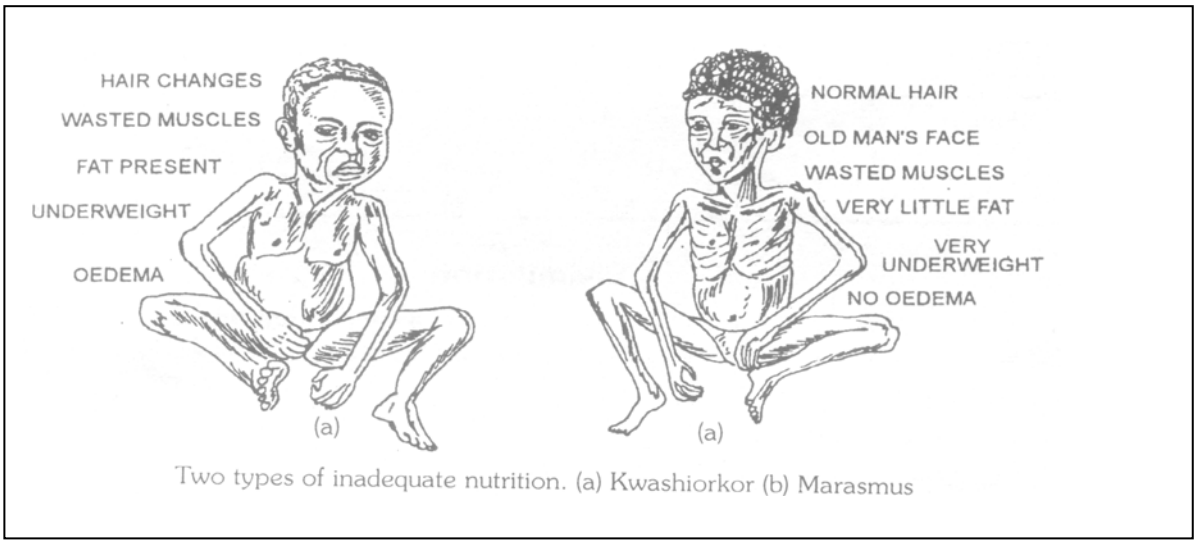
- It is a protein deficiency disease.
- It commonly affects infants and children between 1 to 3 year of age.

Symptoms – Underweight, stunted growth, poor brain development loss of appetite anemia, oedema on lower leg and face.

Cure – Proteins are necessary for growth, repair of tissue and for body defense therefore adequate amount of proteins must be present in the diet.

Daily requirement – 1 gm protein per kg. body weight in adult.
2gm protein per kg body weight in growing children.

Sources in food – Cereals pulses, meat, fish, milk, groundnut, peas leafy vegetables etc.



Two types of inadequate nutrition. (a) Kwashiorkor (b) Marasmus

(2) Marasmus – It is caused by protein-energy – malnutrition(PEM) or deficiency of protein and total food caloric value.

Symptoms – Impairs physical growth , subcutaneous fat diseappears, ribs become very prominent, limbs become thein and skin becomes dry, thin & wrinkled. There is no oedema on leg and face but loss of weight occurs.

Cure – Diet with adequate proteins and proper caloric value should be given to the infants. Source in food – Same as kwashiorkor.

(3) Hypercholesterolemia – It is caused due to intake of excess of saturated fat such as butter, ghee, red meat, egg. Cholesterol level in blood rises abnormally (hypercholesterolemia) this may cause thrombosis and heart attack.

(4) Obesity – It is caused by excessive intake of high caloric nutrients such as sugar, honey and saturated fat. Fat accumulates in the tissue. This may cause high blood pressure, diabetes and heart diseases. Regular exercise and taking of green leafy vegetable are recommended to such persons.

(5) Hypervitaminosis – It is caused by excessive intake of vitamin. Such as excess of vitamin D causes deposition of calcium in soft tissue. Excess of vitamin A causes lack of appetite, itching rash etc. Hypervitaminosis of 'D'. Nausea , a anorexia, hypercalcaemia, hyperphosphetemia, calcification of soft tissue.

(6) Fluorosis – It is caused by excessive intake of fluorine. It is characterized by mottled (brownish discolouration) teeth.

(7) Constipation – Because of show reaching of excreta into the large-intestine hard and dry excreta deposits in the colon.

(8) Diarrhoea – Fast and rapid removal of excreta from the large-intestine is called Diarrhoea. It may be due to viral or bacterial infection in the intestine.

Types of food Relative to their Nature of Nutrients and Basic Functions

Major Food	Nutrient	Function
Sugar, glucose, sugarcane, honey and milk	**Carbohydrates**	
	Sugars	
Wheat, bread, maize, corn, rice and potatoes	Starch	
Butter, sunflower oil, seeds and vegetable oils,	**Lipids**	Energetic
Nuts, almonds, cheese, liver oils and egg-yok	Fats and oil	
Flesh (meat, chicken, fish), milk, pulses, cereals,	**Proteins**	
Egg (albumen and yolk) and cheese	Amino acids	
Table salts, pickles and butter	**Minerals**	
	Sodium	
Table salts, pickles and butter	Chlorine	**Constructive**
Jaggary, banana, date and potato	Potassium	
Milk, cheese, curd, fish, eggs, pulses, carrot, cabbage and dark green leaves	Calcium	
Meat, fish, milk, cheese, egg, pulses and cereals	Phosphorus	
Meat, liver, egg-yolk, fish, green leaves, nuts, fig, and pulses	Iron	
Sea-fish, sea-weed, onion and iodised table salt	Iodine	
Cod and shark liver oil, liver, kidneys, egg-yolk, green and yellow vegetables, (carrot, mango, lettuce, cabbage,) tomato, yeast milk and butter	**Vitamins**	
	A (Retinol)	
Whole cereals, dried beans, pork meat, egg-yolk yeast	B_1 (Thiamine)	
Meat, liver, fish, milk, egg, cheese, legumes and green leafy vegetables	B_2 (Riboflavin)	
Pulses, cereals, meat, liver, fish, intestinal bacteria and yeast (Also synthesized in the human body from the amino acid, tryptophan)	PP (Pellagra preventing or nicotinamide	**Protective**
Citrus fruits, vegetables, tomato, and peppers	C (Ascorbic acid)	
Cod and shark liver oil, chicken, egg-yolk, milk butter, etc. (Also synthesized in human skin in presence of sunlight.)	D (Calciferol)	

SOME IMPORTANT MINERAL AND THEIR FUNCTIONS

Mineral	Function
Calcium	Component of bone and teeth; essential for normal blood clotting; needed for normal muscle and nerve function.
Chlorine	Principal anion of interstitial fluid; important in fluid and acid-base balance.
Copper	Component of enzymes for melanin synthesis; essential for haemoglogin synthesis.
Iodine	Component of thyroid hormone. Its deficiency causes goiter.
Iron	Components of respiratory pigments (like haemoglobin and myoglobin). Respiratory enzymes (like cytochromes) and oxygen transport enzymes. It's deficiency causes anemia.
Phosphorus	Important structural component of bones, DNA and RNA; essential energy transfer, storage of energy (ATP) and other metabolic activities; maintains normal blood pH (buffer action.)
Potassium	Principal cation in the cytoplasm; controls nerve excitability and muscle contraction. Dietary deficiency causes rickets among children.
Sodium	Principal cation of interstitial fluid; maintains fluid balance; essential for conduction of nerve impulse.
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Sulphur	Components of hormones (e.g. insulin); necessary for normal metabolism.
Zinc	Component of at least 70 enzymes, like carbonic anhydrase, and some peptidases.

NUTRITIONAL DISORDERS DUE TO DEFICIENCY OF DIETARY COMPONENT PROTEIN

Nutrient	Name of Disease	Deficiency symptoms
Protein	Kwashiorkor	Wasted muscles, thin limbs, retarded growth of body and brain, oedema, pot belly and diarrhoea.
Protein and calorie	Marasmus	Impaired growth and replacement of tissue proteins, thin limbs and prominent ribs (emaciated body), dry, wrinkled and thin skin, diarrhea.

MINERALS

Nutrient	Name of Disease	Name of Disease
Iodine	Goitre	Swelling of the thyroid gland, reduced mental function, increased risk of stillbirths, abortions and infant deaths.
Iron	Anemia, failure to mature RBC	Low haemoglobin condition, weakness, tireadness, reduced learning ability, increased risk of infection and even death during childbirth.

VITAMINS

Nutrient	Name of Disease	Name of Disease
Retinol (A)	Night blindness	Dry, keratinized epithelia of skin, respiration and urinogenital tracts, especially among children,
Calciferol (D)	Rickets (Osteomalacia)	Weak and soft bones, distorted skeleton, poor muscular development.
Tocopherol (E)	Anemia	RBC devoid of haemoglobin or maintains erythrocytes.
Menadione (K)	Severe bleeding	Slow or delalyed blood clotting and haemorrhage (blood loss)
Ascorbic acid (C)	Scurvey (failure to form connective tissue)	Bleeding, gums, Loose teeth, anemia, painful and swollen joints, delayed healing of wounds, and emaciation.
Thiamine (B_1)	Beriberi	Loss of appetite, fatigue, muscle atrophy, paralysis, mental confusion, cardiac oedema.
Riboflavin (B_2)	No specific disease	Digestive disorder, burning sensation of the skin and eyes, lesions at the corners of the mouth, headaches, mental depression.
Pyridoxine (B_6)	No specific disease	Dermatitis, impairment of antibody synthesis.
Cyanocobalamine (B_{12})	Pernicious anemia	Large, immature and nucleated RBC devoid of haemoglobin.
Folic acid (Pterglutamic acid)	Macrocytic anemia, malformed RBC	Impairment of antibody synthesis, stunted growth.
Niacin (nicotinic acid, nicotin-amide)	Pellagra and canine (dog) disease (black tongue)	Scaly, pigmented skin, irritation of the GI tract (diarrhoea).
Biotin (Vit-H) or (B_4 or B_7)	Dermatitis	Scaly skin, muscle pains and weakness.

SOME IMPORTANT VITAMINS AND THEIRR FUNCTIONS

FAT SOLUBLE VITAMINS	
Vitamin	**Functions**
Retinol (A)	Principal component of retinal pigments; promotes normal vision, growth of bones and teeth and maintenance of epithelial tissue.
Calciferol (D)	Absorption of Ca2+ from small intestine, needed for growth and maintenance of bone (synthesized in human skin in presence of sunlinght)
Tocopherol (E)	Inhibits oxidation of unsaturated fatty acids and vitamin A.
Naphthoquinone (K)	Essential for coagulation of blood (produced by intestinal bacteria).
WATER SOLUBLE VITAMINS	
Vitamin	**Functions**
Ascorbic Acid (C)	Synthesis of collagen, bone matrix, tooth dentine and other extracellular materials, metabolism of many amino acid; helps body to with stand injury from burns and toxicity and acts as antioxidant.
Cyanocobalamine (B_{12})	Important for nucleoprotein synthesis and formation of RBC (produced by intestinal bacteria).
Biotin (B_7)	Coenzyme needed for protein and fatty acid synthesis, CO_2 fixation and transamination.
Folic acid (folacin, pteroglutamic acid)	Coenzyme needed for nucleoprotein synthesis and formation of RBC.
Niacin	Coenzyme in hydrogen transport (NAD, NADP).
Pantothenic Acid	Componet of coenzyme A (CoA).
Pyridoxine (B_6)	Coenzyme for amino and fatty acid metabolism.
Riboflavin (B_2)	Flavoproteins in oxidative phosphorylation.
Thiamine (B_1)	Formation of carboxylase enzyme involved in decarboxylation (citric acid cycle).

VITAMINS

The study of vitamins is called as vitaminology.

- Vitamins were discovered by "Lunin".
- The tern "Vitamin" was given by "Funk" and "Hopkins" (B_1 from unpolished rice- 1912)
- Vitamins are micronutrients, biological regulators and metabolic regulators (Vitamin theory)
- Vitamins are important to maintain health, but cannot synthesize in the body.
- Earliest known vitamin = vitamin 'C' (James Lind – Scottish naval surgeon - 1747)
- Earliest extracted vitamin = Vitamin- B_1

Vitamins are following types -

(1) Fat soluble vitamin

(2) Water soluble vitamin

FAT – SOLUBLE VITAMIN

Vitamin – 'A' (Retinol) -

- Can be synthesized in liver from yellow and red carotenoid pigment.
- It is also known as anti-infectious and anticancer vitamin.
- It is also known as anti-xeropthalmic vitamin.
- Isomer of vitamin 'A' are -

(i) A_1- Retinol for vision.

(ii) A_2-Dehydro retinol which is essential for epithelial lining, gland and tear production.

Deficiency diseases-

(1) Night blindness – Due to deficiency of A_1

It is also known as Nyctolopia (Inability to see in dark)

(2) Xeropthalmia - due to deficiency of A_2

Tear formation is absent.

In this disease conjunctiva & cornea become dry due to kerathinization of conjunctiva & cornea.

It is the main problem of blindness in children throughout the world.

Source -Good source is carrot, other sources are Guava, papaya, Mango, spinach etc.

(3) Vitamin - "D" (Calciferol)

It is also known as "Sunshine vitamin" or "Anti Ricket" vitamin.

Snythesized in skin from cholesterol by UV light. It is necessary for bone & teeth

Deficiency disease-

Rickets in children and osteomalacia in adult.

Source- Good source cod liver oil and shark liver oil for both 'A' & 'D', Other source are meat, liver, egg, milk etc.

Vitamin 'E' (Tocopherol) -

- It is also known as "antisterility" vitamin or "beauty" vitamin.

This vitamin removes scar & wrinkles from skin.

Deficiency disease – Sterility.

Source - Egg. Meat, cotton, seed oil

Vitamin 'K' (Naphthoquinone)

- It is also known as "antihaemorrhagic" vitamin.
- Essential for synthesise of prothrombin.

Menadiane is the important source of the synthetic vitamin K.

Deficiency disease – Bleeding or delayed blood clotting.

Source – Carrol, tomato, liver, cabbage etc.

WATER-SOLUBLE VITAMIN

Vitamin B_1 (Thiamine) -

- It is also known as "anti beri-beri" factor or antineuritic factor.
- Beri-Beri affects peripheral nervous system, alimentary canal & cardiovascular system.

Defi. Disease – Beri-Beri, Wernicke's encephalopathy.

Source – Rice, wheat, egg and fish etc.

Vitamin B_2 (Riboflavin)

- It is also known as vitamin 'G' or lactoflavin or yellow enzyme.
- It is essential for formation of FMN & FAD

Defi. Disease – Cheliosis (Cracked lips at the corner of mouth) sore mouth and uleceration, digestive disorder, Pellegra like, beri-beri like.

Source – Cow's milk, egg, liver, yeast etc.

Vitamin B_3 (Niacin or Nicotinic acid) -

It is also known as "antipellagra" factor or vitamin PP (Pellagra preventing factor)

It forms essential component of NAD & NADP

Defi. Disease – Pellagra in human beings (diarrhoea, dermatitis, dementia) and black tongue (hyper pimentation) disease in dogs.

Source – Kidney, liver, milk, yeast, egg etc.

Vitamin B_5 (Pantothenic acid) – greek word panthothen = everywhere

- It is also known as yeast factor or chick antidermatitis factor.
- It is help in formation of acetylcholine ad Co enzyme A.

Defi. Disease – Burning feet syndrome, fatigue & paralysis of muscles.

Source – Kidney, liver, yeast milk, egg, meat etc.

Vitamin B_6 (Pyridoxine)

Function as co-enzyme. It is also known as rat antidermatits factor.

Defi. Disease – Dermatitis, Anaemia, nervousness.

Source – Liver, meat yeast, egg etc.

Vita B_7 (Biotin)

It is also known as vitamin 'H' or antiegg white injury factor (egg white contain avidin protein which is antagonist to vit. B_7 – dermatitis, hair loss, nervous symptom).

It is essential for fat synthesis

Defi. Disease – Dermatitis

Source – Vegetables, yeast, wheat egg etc.

Vitamin B_{12} (Cyanocobalamine) – Extrinsic factor of castle

It is also known as "antipernicious anemic" factor or "RBC maturing" factor

It promotes DNA synthesis & Maturation of RBCs.

Defi. Disease – Pernicious anemia.

Source – meat, liver etc.

Folic Acid -

It is also known as folacin or Vitamin M.

It is needed for formation of RBC & synthesis of DNA

Deficiency disease – Anemia.

Source – Green foliage of plant – cabbage, cauliflower

Vitamin 'C' (Ascorbic Acid)

It is also known as 'anti-scurvy" or anti-viral, anti-cancer vitamin.
It is necessary for healing of the wound
Deficiency disease – Scurvy (deficient formation of collagen fibres).
Source – Amla, Tomato, orange, Guava, Lemon (citrus fruit).

SOME IMPORTANT POINT

1. Citrin is also known as vitamin 'P' and controls vascular permeability.
2. Vitamin B_{17}- It is recently disovered anticancer vitamin.
3. Vitamin Q- helps in blood clotting.
4. Vita B_{15} – It is also known as pogonic acid, deficiency causes disorder in liver.
5. Vitamin B_6 also used in the treatment of tuberculosis.
6. Thecodont teeth are also found in crocodile.
7. One pair of vomerine teeth is found in the palate of frog.
8. Fangs are the poison teeth of snakes, these are the maxillary teeth.
9. Upper incisor teeth are modified in tusk in elephant.
10. Upper canine teeth are modified in tusk in walrus.
11. Homodon type dentition are found in toothed whale.
12. Enamel is absent in Sloth and Armadillo.
13. Salivary glands are absent in whale.
14. The tongue is non-motile in whale.
15. Gall bladder is absent in lamprey, whale, rat and horse.
16. The main pancreatic duct is also known as duct of wirsung while assessory pancreatic duct is known as duct of santorini.

Comparative Study of digestive system of Rabbit & Human

Rabbit	Human
1. It is herbivorous animal, depends cellulose based food.	It is omnivorous, and depends on vegetarian and non-vegetarian food.
2. A small cleft is present in mid part of upper lip.	Cleft is absent.
3. Canine teeth are absent.	Canine teeth are present.
4. Dental formula: $i-\frac{2}{1}c\frac{0}{0}pm\frac{3}{2}m\frac{3}{3}\times 2=28$	Dental Formula: $i-\frac{2}{2}c\frac{1}{1}pm\frac{2}{2}m\frac{3}{3}\times 2=32$
5. Infraorbital, Parotid, Sublingual and Submaxillary glands are present.	Parotid, Sublingual, Submaxillary glands are present but infraorbital is absent.
6. Caecum and vermiform appendix are present where digestion of cellulose takes place.	Caecum & Vermiform appendix are vestigial.
7. Rectum is beaded.	Rectum is non-beaded.
8. Faeces are ejected outside in form of pelletes.	Faeces are ejected out side in form of semi Solid stool.
9. Coprophagy nature is present.	Coprophagy nature is absent