Vitamins and Nutrition

These notes are your ultimate revision weapon to revise Vitamins and Nutrition. We've distilled years of previous exam questions (PYQs) into one powerful, concise resource. Everything you need to know, nothing you don't.

- **PYQs, Decoded:** All key concepts from past exams, organized and simplified.
- **Revise in Record Time:** Short, precise, and designed for last-minute review.
- **Focus on What Matters:** Master high-probability topics and boost your confidence.

I. Fundamental Nutrients: Categories and Functions

A. Macronutrients (Required in large quantities)

1. **Proteins**
    - **Function:** Essential for body growth, tissue repair, and healing.
    - **Sources:** Beans, peanuts, dairy products (cheese), eggs, grains.
    - **Additional Facts:**
        - Amino acids (protein building blocks) are not stored in the body.
        - A deficiency leads to slow growth.
        - **Complete Proteins** (contain all essential amino acids): Eggs, milk, fish, meat, soybeans.
        - **Biological Value (BV) Examples:** Whole Egg (94), Milk (90), Fish (76), Soybeans (73).
        - **Specific Proteins:**
            - **Gluten** in wheat gives dough its bread-making quality (elasticity).

        - **Casein** is the main protein in milk and gives it its white color.
2. **Carbohydrates**
    - **Function:** Major fuel source for the body, especially during intense exercise.
    - **Composition:** Composed of Carbon, Hydrogen, and Oxygen (Nitrogen is *not* a constituent).
    - **Storage Form in Body:** Glycogen.
    - **Types:**
        - **Starch:** A polysaccharide of plant origin; turns blue-black with iodine.
        - **Cellulose:** A polysaccharide in plant cell walls; does *not* react with iodine.
    - **Sources:** Rice (highest among common grains), bananas.
3. **Fats**
    - **Function:** Stored energy, insulation, protection.
    - **Caloric Density:** 9.3 kcal/gram (vs. 4.0 kcal/gram for proteins/carbs).
    - **Types:**
        - **Unsaturated Fats:** More reactive (due to double bonds); heart-healthy (e.g., Sunflower oil, fish oil).
        - **Saturated Fats:** Less reactive (only single bonds).
        - **Trans Fats:** Unhealthy; increase LDL and decrease HDL; found in hydrogenated oils.
    - **Chemical Structure:** Fats are **triglycerides** (one glycerol + three fatty acids).
    - **Sources:** Groundnut (48.1% fat), butter, oils.
    - **Essential Fatty Acids:** Must be obtained from diet (e.g., Omega-3 in linseed, walnut).

B. Micronutrients (Required in small quantities)

1. **Minerals**
    - **Macrominerals:** Required in major quantities (e.g., Potassium, Sodium, Magnesium, Calcium).

        - **Potassium:** Found in apples; important for maintaining a regular heartbeat.
        - **Calcium & Magnesium:** Absorption is aided by Vitamin D.
        - **Phosphorus:** Helps maintain pH balance.
    - **Microminerals:** Include Iron, Zinc, Manganese, Boron, Copper.
    - **Muscle Contraction:** Requires minerals like Calcium, Iron, and Sodium.
    - **Iron-Rich Sources:** Spinach (highest among listed options), Karonda fruit, green vegetables.
2. **Vitamins (Detailed in Section II)**
3. **Special Categories**
    - **Probiotics:**
        - Contain live "good" bacteria.
        - Maintain healthy gut flora (microbiome).
        - Strengthen the immune system and aid in vitamin/mineral absorption (e.g., Calcium, Iron, Vitamins A, D, E, K).
    - **Nutraceuticals:**
        - Products providing both nutritional and medicinal effects.
        - Help prevent or treat diseases.
    - **Antioxidants:**
        - Neutralize free radicals produced during metabolism, protecting cells from damage.
        - Found abundantly in fresh fruits and vegetables (e.g., Vitamin C, Vitamin E).

II. Vitamins: Comprehensive Guide

A. General Properties of Vitamins

- **Definition:** Organic compounds needed in small amounts ("accessory dietary factors").
- **Discovery:** Concept proposed by Kazimierz (Casimir) Funk.

- **Synthesis in the Body:**
  - **Generally, it cannot be synthesized** and must be obtained from the diet.
  - **Exceptions:**
    - **Synthesized by intestinal bacteria:** Vitamin K, Vitamin B7 (Biotin), Vitamin B12.
    - **Synthesized by skin:** Vitamin D (upon sunlight exposure).
    - **Produced from precursors:** Beta carotene to Vitamin A, Tryptophan to Vitamin B3.
- **Solubility:**
  - **Fat-Soluble (A, D, E, K):** Stored in the body.
  - **Water-Soluble (B-Complex, C):** Not stored in the body; excess is flushed out.

B. Specific Vitamins: Sources, Functions, and Deficiencies

Vitamin	Chemical Name(s)	Solubility	Key Functions	Deficiency Diseases	Key Sources	Special Notes
Vitamin A	Retinol	Fat	Normal vision (forms rhodopsin for night vision), healthy skin.	Night Blindness, Xerophthalmia	Carrot, mango, milk, butter, egg, green vegetables (beta-carotene).	Stored in the liver.
Vitamin B1	Thiamine	Water	Nerve function, metabolis	Beriberi (affects nerves &	Rice bran, whole	-

			m.	heart)	grains.	
Vitamin B2	Riboflavin	Water	Metabolism, cell function.	Cheilosis (sores at mouth corners)	Eggs, green vegetables, milk, meat, mushrooms, almonds.	Not rich in cod-liver oil.
Vitamin B3	Niacin	Water	Metabolism.	Pellagra	-	-
Vitamin B6	Pyridoxine	Water	Metabolism, brain function.	Mental illness	Rice bran.	Reported to help in remembering dreams.
Vitamin B12	Cobalamin / Cyanocobalamin	Water	Red blood cell formation, nervous system.	Pernicious Anemia	Animal products.	Contains Cobalt; stored in liver for 3-5 years.
Vitamin C	Ascorbic Acid	Water	Antioxidant, collagen production, wound healing, immune function, iron absorption, and	Scurvy (bleeding gums)	Richest: Indian Gooseberry (Amla), Orange. Other: Guava, chilies, tomatoes, papayas, lemons,	Not stored; flushed out quickly.

			sperm production.		peas.	
Vitamin D	Calciferol (D2: Ergocalciferol, D3: Cholecalciferol)	Fat	Bone health (aids Calcium/ Magnesium absorption).	Children: Rickets Adults: Osteomalacia/Osteoporosis	Primary: Sunlight. Dietary: Cod-liver oil, butter, egg yolk, liver.	Converted to active hormone Calcitriol.
Vitamin E	Tocopherol	Fat	Antioxidant.	Sterility/Infertility	Wheat germ oil.	Stored in the body.
Vitamin K	-	Fat	Blood clotting (anti-hemorrhagic factor).	Bleeding disorders	Primary: Synthesized by gut bacteria. Dietary: Alfalfa.	Used as an antidote for anticoagulant poisons.

III. Specific Foods and Their Properties

A. Milk and Dairy

- **Composition:** A rich source of proteins (Casein, Lactoglobulin, Lactalbumin), carbohydrates (Lactose), Calcium, Potassium, Vitamins A, B1, B2, B6, B12.
- **Poor Source of** Iron and Vitamin C.
- **Color:**
  - White color due to **Casein**.
  - Cow's milk is yellow due to **Carotene**; buffalo milk (higher fat: 7.2%) is whiter.

- **Conversion to Curd:** By **Lactobacillus** bacteria, which produces lactic acid.
- **Digestion:** Enzyme **Rennin** digests milk protein; its production decreases with age, leading to lactose intolerance.

B. Legumes, Grains, and Fruits

- **Soybean:** Excellent source of protein (~40%); also an oilseed; a complete protein.
- **Groundnut:** Rich in both protein (25.3%) and fat (48.1%).
- **Rice:** Highest carbohydrate content among common grains.
- **Banana:** High in carbohydrates (116 Kcal/100g).
- **Basmati Rice:** High **Amylose** starch content makes it fluffy and non-sticky.
- **Karonda Fruit:** A very rich source of Iron; also contains Vitamin C.
- **Spinach:** Rich source of Iron and Calcium.

IV. Human Nutrition and Requirements

A. Daily Requirements

- **Energy:** A hard-working man needs ~4000 kcal/day.
- **Protein:**
  - **Lactating/Pregnant Women:** 65-70 grams
  - **Adult Men:** 56 grams
  - **Adult Women (Moderate Activity):** 46 grams
  - **Teenagers:** 46-52 grams
  - **Children:** 19-34 grams
  - **Babies:** 10 grams
- **Fat:** A normal diet should contain about 75 grams of fat.

B. Breast Milk and Infant Nutrition

- **Composition:** ~4.2% fat, 1.1% protein, 7.5% carbs, 0.2% minerals. Contains antibodies, Zinc, Calcium, Vitamins A, B6, and B12.
- **Key Deficiency:** Poor source of **Iron**.

- **Benefits:** Breastfed babies are less obese, more disease-resistant, and experience normal growth compared to bottle-fed babies.

C. Malnutrition

- Results from an imbalanced diet include:
    1. **Undernutrition:** Not enough nutrients.
    2. **Overnutrition:** Too many nutrients.
    3. **Imbalanced Nutrition:** Incorrect proportion of nutrients.
- **Elements in Molecules:**
    - **Cobalt:** Vitamin B12
    - **Iron:** Haemoglobin
    - **Magnesium:** Chlorophyll

Know More About Vitamins and Nutrition:

- Vitamins and Nutrition – Old Year Questions
- Vitamins and Nutrition One Liner Questions & Answers