

Macronutrients and Micronutrients in Human Nutrition

Course Code	Title of Course	Credit Hours
HND-227	Macronutrients and Micronutrients in Human Nutrition	3(3-0)

Learning Outcomes:

Students will be able to:

- Develop an understanding of the digestion, absorption, and utilization of macronutrients in the human body
- Explain the mechanisms by which the body maintains homeostasis, and understand the role of hormones and enzymes
- Explain the health consequences of over/ under-consumption of macronutrients
- Describe different types of vitamins based on their chemical properties and significant functions in the human body
- Explain the role of individual vitamins in metabolism and regulation of the body's homeostasis
- Describe and identify the deficiency diseases related to each vitamin
- Describe different types of minerals based on their chemical properties and significant functions in the human body
- Explain the role of individual minerals in metabolism and the regulation of the body's homeostasis

Course Contents:

Introduction to Nutrients and Classification (macro vs. micro): Overview of nutrient functions and interrelationship; Energy-yielding vs. non-energy nutrients; Dietary Reference Intakes (RDA, AI, UL, EAR); Factors affecting nutrient requirements; Carbohydrates: Classification and structure: mono-, di-, oligo-, polysaccharides, food

sources and dietary fibers, Functions and roles in energy metabolism, Glycemic index and glycemic load, Nutritional disorders: lactose intolerance, diabetes mellitus, excess sugar intake, Recommended carbohydrate and fiber intake; Lipids: Overview of Classification of fatty acids (saturated, unsaturated, trans, essential) and lipids, Food sources and hidden fats, Functions: energy provision, insulation, essential fatty acids, cell structure, Dietary recommendations for fats, Health implications: CVD, omega-3/6 balance, trans fats, rancidity; Proteins: Amino acids (essential vs. nonessential), Protein synthesis and organization, Evaluation of protein quality (biological value, PDCAAS), Nitrogen balance and protein requirements, Overview of digestion and absorption, Functions: enzymes, hormones, transport, immunity, energy, Health concerns: PEM, food allergies, high-protein diets, Vegetarian and vegan protein considerations; Fat-Soluble Vitamins: General characteristics and absorption of fat- soluble vitamins; Vitamin A: forms, functions, deficiency (xerophthalmia), toxicity; Vitamin D: sources, synthesis, calcium regulation, rickets/osteomalacia; Vitamin E: antioxidant role, deficiency, toxicity; Vitamin K: coagulation, deficiency risk, sources, Vitamin interactions and storage patterns; Water-Soluble Vitamins: General characteristics and coenzyme roles; B-complex vitamins: Thiamin (B1), Riboflavin (B2), Niacin (B3), Pantothenic acid (B5), Biotin (B7), Vitamin B6, Folate (B9), Vitamin B12: functions, deficiency disorders; Vitamin C: antioxidant properties, collagen synthesis, deficiency (scurvy); Enrichment and fortification of foods; Stability and cooking losses; Water and Major Minerals; Water balance: functions, and hydration regulation; Electrolytes: Sodium, Potassium, Chloride: roles and hypertension link, Calcium, Phosphorus, Magnesium, Sulfur: Sources, functions, absorption, deficiency/toxicity; Role in bone health and muscle function; Factors affecting mineral bioavailability; Trace Minerals, Iron: forms, absorption (heme/non-heme), anemia, overload, Zinc, Copper, Manganese, Iodine, Selenium, Chromium, Fluoride: Functions, sources, deficiency, and toxicity, Interaction among trace minerals, Global perspective: micronutrient malnutrition, fortification programs, supplementation strategies.

Suggest readings Text books:

1. Wardlaw, G. M. and Kessel, M. W. (2002). *Perspectives in Nutrition*. McGraw-Hill.
2. Sareen S. Gropper, Jack L. Smith, and James L. Groff (2009). *Advanced Nutrition and Human Metabolism* (5th ed.). Wadsworth Cengage Learning, USA.

Reference Books

1. David L. Nelson, Lehninger A. L., and Michael M. Cox (2008). *Lehninger Principles of Biochemistry*. W. H. Freeman & Company.
2. Lindsay A., Benoist B-de., Dary O., and Hurrell R. (Eds.). (2006). *Guidelines on Food Fortification with Micronutrients*. FAO / WHO.