

SYLLABUS

COURSE: DENF 1931 Basic and Applied Nutrition
SEMESTER: Fall
CREDIT HOURS: 1.0

REVISED: 2003
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COURSE DIRECTOR: Saroj M. Bahl, Ph.D.

GOAL

The goal of this course is to help students acquire a basic understanding of human nutrition in the context of oral health and disease. It is recognized that the oral cavity is part of the total body system, and as such many fundamental concepts which apply to overall health must be considered in the context of this course. The student is expected to be able to apply the concepts learned in this course to patient diagnosis and treatment planning taught later in the curriculum.

The concepts taught in nutrition are directly related to fundamental processes taught in both biochemistry and physiology. For this reason, the topics selected for this course are sequenced to integrate with similar topics in DENF 1521 Biochemistry and DENF 1541 Physiology. The dental professional is expected to develop a working vocabulary in nutrition, to understand the link between nutrition and health and disease, and to apply this knowledge to later make valid clinical judgments based upon sound understanding of fundamental nutritional concepts.

The topics in this course include the basics of nutritional assessment, nutrients as an energy source, carbohydrates, lipids and proteins in food, weight control, vitamins and minerals, and the application of basic nutrition to clinical treatment. An explosion of new information concerning the role of human genetics in nutrient utilization is in progress. New genes are being identified which control basic metabolism, and which may account for much of the individual variation in body form and metabolism. Students are encouraged to develop the habit of lifelong learning, and as health professionals to continue to incorporate new discoveries into their daily practices.

OBJECTIVES

I. INTRODUCTION TO NUTRITION

1. Define nutrition and related terms (nutrients, nonnutrients, essential nutrients, etc.).
2. Classify nutrients into six classes.
3. List the energy nutrients.
4. Define an organic compound and list the four classes of organic nutrients and their functions.
5. Distinguish between essential nutrients and nonnutrients.
6. Discuss how personal, cultural, social and psychological factors influence food choices.
7. Define food fad, natural food, organically grown food, and megadose.
8. List three ways in which food faddism may adversely affect a person.
9. Discuss Recommended Dietary Allowances (RDA) and Dietary Reference Intakes (DRI).

II. ENERGY BALANCE AND BODY COMPOSITION

1. Define and state the unit for measurement of energy in nutrition.
2. Describe how the total energy value of food is determined.
3. Explain why the net energy of food is different from available energy; physiological fuel value.
4. Distinguish between positive and negative energy balance and the result when there is a deficit or surplus of 3,500 kcal.
5. List factors that control food intake and define hunger, appetite and satiety.
6. Define basal thermogenesis, exercise-induced thermogenesis, diet-induced thermogenesis and adaptive thermogenesis.
7. Describe how each of the following components contributes to the total energy expenditure:
 - 7.1 basal metabolism
 - 7.2 physical activity
 - 7.3 thermic effect of food
 - 7.4 adaptive thermogenesis
8. List the various factors that influence basal metabolic rate (BMR).
9. Describe one formula for estimating energy requirements.
10. Define the terms "Healthy Body Weight" and "Body Mass Index" (BMI).

11. Discuss the health risks associated with inadequate body weight and body fat.

III. CARBOHYDRATES: SUGAR, STARCH AND FIBER

1. Discuss simple and complex carbohydrates.
2. List the names of the monosaccharides commonly found in food.
3. List the disaccharides found in foods and their monosaccharide components.
4. Discuss the nutritional significance of fiber and distinguish between insoluble and soluble fiber.
5. Describe the digestion of carbohydrate in terms of location, enzymes and products.
6. Explain lactose intolerance and lactase deficiency.
7. Describe in general terms how carbohydrate is metabolized.
8. Describe maintenance of glucose homeostasis in terms of insulin, glucagon and epinephrine.
9. Discuss the nutritional significance of sugars, starch and fibers.
10. Identify the major artificial sweeteners and discuss their potential risks and benefits.

IV. LIPIDS: TRIGLYCERIDES AND STEROLS

1. Define the terms monoglyceride, diglyceride and triglyceride.
2. Distinguish between saturated and unsaturated fatty acids and list the common polyunsaturated and monounsaturated fatty acids.
3. Discuss the nutritional significance of lipids.
4. Distinguish between essential and nonessential fatty acids. Discuss the nutritional significance of Omega-3 and Omega-6 fatty acids.
5. Identify the structure of a cholesterol molecule and name the origin of the majority of cholesterol in the body.
6. List the functions of cholesterol.
7. Explain the role of bile in lipid digestion. Describe enterohepatic circulation of bile.
8. Explain what happens to glycerol and fatty acids when they pass into intestinal wall cells.
9. Distinguish between chylomicrons, very low-density lipoproteins (VLDL), low density lipoproteins (LDL) and high density lipoproteins (HDL) in terms of their functions and important implications for health.
10. Discuss the utilization of triglycerides by the liver, cardiac and skeletal muscle cells.
11. Describe the roles of adipose tissue, lipoprotein lipase and hormone sensitive lipase in the storage and break down of triglycerides.

12. List the carbohydrate, protein and fat-based fat replacements.
13. Discuss recommended intakes and health effect of lipids.

V. PROTEIN: AMINO ACIDS

1. Define the terms protein, essential and nonessential amino acids and conditionally essential amino acids.
2. Define complete and incomplete proteins.
3. Discuss the nutritional significance of proteins.
4. Identify the major steps and enzymes involved in digestion of proteins.
5. Discuss the role of the liver, kidney and skeletal muscle in protein metabolism.
6. Discuss the various measures of protein quality – amino acid scoring, biological value (BV), net protein utilization (NPU), protein efficiency ratio (PER), and protein digestibility – corrected amino acid score (PDCAAS).
7. Discuss food protein quality in terms of limiting amino acids, complete protein, mutual supplementation, complementary proteins, protein digestibility and reference protein.
8. Discuss the health benefits and risks associated with vegetarian diets.
9. Discuss the recommended intake of proteins for various population groups.
10. Describe the term protein-energy malnutrition (PEM). Differentiate between kwashiorkor and marasmus.

VI. WEIGHT CONTROL: OVERWEIGHT AND UNDERWEIGHT

1. Discuss the current standards for assessing the prevalence of obesity.
2. Discuss the various causes of obesity.
3. Distinguish between the recommended and controversial treatments of obesity.
4. Discuss the functions of leptin.
5. Define the terms underweight, anorexia and bulimia nervosa.
6. List the major characteristics of bulimia nervosa. Discuss the treatment of these eating disorders.

VII. FAT SOLUBLE VITAMINS: VITAMINS A AND D

1. Describe the primary characteristics of fat-soluble vitamins.
2. Describe the relationship between carotenes and vitamin A.
3. Describe the functions of vitamin A in:
 - 3.1 vision

- 3.2 epithelial differentiation
 - 3.3 bone remodeling
 - 3.4 reproduction
 - 3.5 health of oral tissues
4. Describe how vitamin D is formed in the skin and is metabolized to 1,25- dihydroxyvitamin D₃.
 5. Discuss the nutritional implications of deficiency and excess of vitamins A and D.
 6. Describe the clinical applications of vitamins A and D.

VIII. FAT SOLUBLE VITAMINS: VITAMINS E AND K

1. Discuss the primary function of vitamin E as an antioxidant.
2. Identify the symptoms associated with vitamin E deficiency.
3. Discuss other possible roles of vitamin E such as prevention of cardiovascular disease and other chronic degenerative diseases.
4. Describe the primary role of vitamin K in blood clotting.
5. Describe the role of vitamin K in the biosynthesis of bone proteins.
6. Discuss the implications of vitamin K deficiency and possible toxicity.
7. Identify food sources and requirements for all fat-soluble vitamins.

IX. WATER SOLUBLE VITAMINS: B COMPLEX

1. Define the following terms:
 - 1.1 coenzyme
 - 1.2 apoenzyme
 - 1.3 holoenzyme
2. Describe the main metabolic functions of the B-complex vitamins:
 - 2.1 thiamin
 - 2.2 riboflavin
 - 2.3 niacin
 - 2.4 B₆ (pyridoxal phosphate)
 - 2.5 pantothenic acid
 - 2.6 biotin
 - 2.7 folate
 - 2.8 B₁₂ (cobalamin)
3. Describe the nutritional basis and symptoms of the following deficiency diseases:
 - 3.1 beri beri
 - 3.2 pellagra
 - 3.3 megaloblastic anemia
 - 3.4 pernicious anemia

4. Explain why a diet high in the amino acid tryptophan (a high protein diet), reduces the dietary need for niacin.
5. Describe the oral manifestations of vitamin B-complex deficiencies.
6. Describe the nutritional implications.
7. Explain why abnormal blood cells are formed in folate and/or vitamin B₁₂ deficiency.
8. Explain how folate supplements could mask an underlying vitamin B₁₂ deficiency.

X. VITAMIN C

1. Describe the primary function of ascorbic acid in the maintenance of connective tissue and wound healing.
2. Relate vitamin C deficiency to the symptoms of scurvy.
3. Describe how vitamin C affects the structure and function of gingival and periodontal tissues.
4. Discuss the dietary recommendations for vitamin C.
5. Discuss the clinical applications of vitamin C in health and disease (including the possible role in prevention and/or treatment of cardiovascular disease and cancer).

XI. WATER AND MAJOR MINERALS

1. Discuss the significance of water in human nutrition (water balance, body fluids, and recommended intakes).
2. Discuss the nutritional significance of major minerals – calcium, phosphorus, magnesium, sodium, potassium, and chloride for human health.
3. Explain the role of calcium in bone and tooth formation.
4. Discuss recommendations and various food sources of essential minerals.
5. Identify the primary symptoms of deficiency diseases associated with major minerals.
6. Discuss the potential of toxicity associated with ingestion of mineral supplements.

XII. TRACE ELEMENTS

1. Discuss the nutritional significance of zinc, selenium, copper, manganese and chromium.
2. Identify the symptoms associated with deficits of these trace minerals.
3. Discuss the above-mentioned trace elements.

XIII. IRON: MAJOR FUNCTIONS AND HEALTH AND DISEASE

1. Describe the primary functions of iron in human nutrition.
2. Describe the major factors that influence iron absorption.

3. Discuss the transport, storage and metabolism of iron.
4. Compare and contrast the causes and symptoms of iron deficiency anemia and megaloblastic anemia (folate and vitamin B₁₂ deficiency).
5. Discuss the interrelationship of iron deficiency and human behavior.
6. Discuss relationships of iron overload (toxicity) with heart disease and cancer.

XIV. FLUORIDE AND IODINE

1. Discuss the primary relationship of fluoride and human health.
2. Describe the main features of fluoride metabolism (gastric and renal absorption).
3. Describe the tissue fluoride distribution after ingestion.
4. Describe the mechanisms of chronic and acute fluoride toxicity.
5. Describe the metabolic function of iodine.
6. Identify the food sources of iodine.
7. Describe the symptoms associated with iodine deficiency and toxicity.

XV. APPLIED NUTRITION

1. Discuss the purpose of the food pyramid.
2. Discuss the nutritional significance of each group in the food pyramid.
3. List representative foods from each group in the food pyramid.
4. List serving sizes for each group in the food pyramid.
5. Describe a balanced diet.
6. Describe the relationship between diet and health.

XVI. CLINICAL NUTRITION

1. Describe the chemoparasitic theory of caries development.
2. Describe the Stephen curve.
3. State the pH below which dental enamel will dissolve.
4. Describe the significance of the Vipeholm Study.
5. Define exposure time.
6. Discuss the three F's: food type, form of food, frequency of eating.
7. Define detergent food.
8. Define retentive food.

9. Define non-retentive food.
10. List sugars in order of cariogenicity.
11. Distinguish between intrinsic and extrinsic sugars.
12. List foods which may be sources of hidden sugars.
13. Discuss the effect of artificial sweeteners on dental health.
14. Describe two major eating disorders: anorexia nervosa and bulimia.
15. Describe the dental problems associated with anorexia nervosa and bulimia.
16. Define perimolysis.
17. Discuss the dental management of patients with eating disorders.

RESOURCES

I. Media Resources

1. Required textbook

Whitney, E.N. and Rolfes, S.R.
Understanding Nutrition, 10th ed.
West Publishing Co., 2004

2. Supplemental texts (for clinical and applied nutrition)

Harris, N.D. and Christen, A.G.
Primary Preventive Dentistry, 4th ed.
Appleton and Lange, 1995

Rugg-Gunn, A.J. and Nunn, J.H.
Nutrition, Diet and Oral Health
Oxford University Press, 1999

3. Lecture handouts prepared by instructors

4. Supplemental reading distributed by instructors (some of these may be kept on reserve in the Dental Branch Library, or may be provided electronically).

5. Your biochemistry and physiology texts also contain much information that will be useful in your study of nutrition. Students are encouraged to integrate the complementary information provided in biochemistry, physiology and nutrition as much as possible.

II. Human Resources

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Course Director

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STUDY PLAN AND REQUIREMENTS

All students are expected to attend scheduled lectures, read the textbook assignments given by the instructors, read supplemental reading provided in class, and ask questions when you are curious. Class discussion is encouraged.

The lecture schedule is provided separately, and students will be notified of any changes in class or via e-mail. Suggestions for improvement of the course should be directed to Dr. Bahl, preferably via e-mail (Saroj.M.Bahl@uth.tmc.edu). All input is appreciated. This is your course, and we wish to make it the best it can be.

We highly recommend that students read the textbook sections relating to the lectures prior to coming to class. This text is very easy to read and is quite informative. Course objectives are derived from the textbook and from additional material provided in class. Reading before class will allow you to follow the material and ask good questions.

DENF 1931 BASIC AND APPLIED NUTRITION 2009 Fall Semester Schedule

All sessions: Tuesday, 3-4:50 pm

DATE	SESSION TOPICS	PRESENTER
Aug 18	Introduction to Nutrition Carbohydrates: Sugar, Starch and Fiber	Bahl
Aug 25	Lipids: Triglycerides and Sterols Proteins and Amino Acids	
Sep 1	Energy Balance and Body Composition Weight Control	Bahl
Sep 8	Vitamins: An Overview Vitamins: B-Complex and Vitamin C	
Sep 15	Case Study Review	Bahl
Sep 22	Exam I Room 207	
Sep 29	Fat-soluble vitamins Water and major minerals	Bahl
Oct 6	Course Evaluation Introduction to Applied Nutrition Applied Nutrition II	Franklin
Oct 13	Iron: Role in Nutrition Trace minerals: Iodine and Fluorine	Bahl
Oct 20	<i>No class</i>	
Oct 27	Exam II Room 207	Bahl

EVALUATION METHODS

There will be two, one-hour exams and a take-home project for this course. The exam material will be based on the objectives for the course as covered in the previous lectures. The exam questions will be of the objective type (true/false, multiple choice, matching). Exam I will take place approximately half way through the course, and Exam II at the end of the course. The take-home project will be designed to increase your involvement in nutrition. It will utilize principles covered in the lectures. This project will be explained in detail during the first week of class and will be due near the end of the semester. Exact dates will be announced in class.

The course grade will be made up as follows:

Attendance*	15%
Exam I	35%
Exam II	35%
Take-home project	15%

* Attendance at each class session will be worth two points. However, *four* points will be awarded for the case-study session.