UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Nutritional Biochemistry

2324-1-F0601Q098

Aims

The biochemical bases of nutrition will be discussed in this course. The classification of nutrients and their metabolism will be presented, together with the action of toxic substances. A particular emphasis will be given on the role of diet in disease prevention.

1. Knowledge and understanding – nutrients and their metabolism will be analyzed during the course, together with the action of common toxic substances; different diets will be discussed, with particular regard to the relation between food and human diseases.

2. Applying knowledge and understanding – students will learn about the metabolic fate of nutrients; the acquired knowledge about nutrients and their metabolism, as well as some common toxicants, will enable students to understand the link between diet and human health.

3. Making judgements - students will be able to apply the knowledge acquired in experimental research in the field of nutritional biochemistry, as well as in the evaluation of different diets.

4. Communication skills - students will acquire a specific scientific language (both in English and in Italian), as well as the ability to orally describe the topics discussed in the course

5. Learning skills - this course will provide students with the ability to read and critically discuss scientific literature on nutrition.

Contents

The course will focus on: nutrition; energy in nutrients; water; micronutrients (elements and vitamins). Antioxidant compounds, Macronutrients: carbohydrates, lipids and proteins; food (requirement and uptake). Alcohol and nervine drinks. Nutrition and health; diets, fasting and calorie restriction. Non nutrients and xenobiotics

Detailed program

Nutrition and diet: body weight and calorie requirement; BMI and its use in body under- and overweight estimation; the food pyramid. Nutrients and antinutrients: classification of nutrients, macronutrients and micronutrients. From nutrients to food: different kinds of food.

Energy in food: free energy; ATP hydrolysis and synthesis; exoergonic and endoergonic reactions: metabolism.

Water: exogenous and endogenous water. Water requirement and alterations in water balance. Water as a food.

Micronutrients: vitamins; hydrosoluble and liposoluble vitamins: recommended intake and sources of vitamins; drugs and vitamins; hypo- and hyper- vitaminosis. Macroelements: calcium, phosphorus, magnesium, sulfur, sodium, potassium and chlorine; microelements: iron, zinc, copper, manganese, selenium, chromium, iodine, fluorine. Dietary sources and bioavailability, recommended intake and deficiences; toxicity.

Oxygen and its reactive species: endogenous and exogenous defense systems: antioxidant food.

Carbohydrates: simple and complex carbohydrates: digestion and uptake: dietary sources and energy value. Glucose, galactose and fructose metabolism; lactose intolerance. Role of dietary carbohydrates, minimal and recommended intake. The glycemic index and its biochemical significance. Soluble and insoluble dietary fibers.

Lipids: standard and alternative(?) lipid nomenclature. Essential fatty acids (?-3 and ?-6 series). Dietary and endogenous cholesterol: total body cholesterol. Lipid and cholesterol trasport through plasma lipoproteins: enterohepatic circulation. Control of cholesterolemia. Eicosanoids; endocannabinoids. Common dietary phytosterols: their structure and role in reducing cholesterolemia. Gene expression regulation of enzymes involved in lipogenesis and lipolysis induced by diets rich in highly unsaturated fatty acids (SREBP-SCAP and PPAR nuclear receptors). Dietary fatty acids: oils and fats; lipid requirements.

Proteins: functional, nutritional and metabolic classification. Aminoacids: L-aminoacids and D-aminoacids. Nutritional value of proteins; dietary protein sources. Aminoacids and peptides transport in enterocites. Proteolytic enzymes in digestion. Energy production from aminoacid backbone. Other nitrogenous compounds. Malnutrition: Kwashiorkor and Marasmus as models of biochemical injury.

Alcohol: ethanol toxicity, intake and detoxyfication pathways; ethanol induced alterations in sugar and fatty acids metabolism. Nervine drinks: coffee, tea and chocolate, composition and metabolic effects.

Metabolic alterations in feeding-fasting cycle; diets and calorie restriction; nutrition and health.

Xenobiotics: toxicants in food; toxic compounds produced by cooking; pesticides; drug residues; heavy metals.

Prerequisites

Acquaintance with the contents of the course in General Biochemistry (graduation course in Biological Sciences) is recommended, particularly as regards glycolysis, Krebs cycle, pentose phosphate shunt, fatty acids synthesis and degradation, ketogenesis and urea cycle. Essential knowledge of General Biochemistry will be summarized before addressing each metabolic disease. Considering the impossibility to provide a single reference textbook for the course content, attendance is strongly recommended.

Teaching form

Front lectures with powerpoint presentations; interactive lessons and discussions

Textbook and teaching resource

Leuzzi, Bellocco, Barreca “Biochimica della nutrizione” Zanichelli

Cozzani, Dainese “Biochimica degli alimenti e della nutrizione” Piccin

Pignatti "Biochimica della nutrizione" Casa Editrice Esculapio

Scientific papers and text will be available on the Moodle platform, as well as the slides shown during the lessons.

Semester

second semester

Assessment method

Students will be evaluated through both a written and an oral examination. The written exam will consist of 5 open questions with a length limit. The oral exam, consisting of a discussion of the written exam followed by 1 or 2 short questions, aims at assessing the students’ ability to critically discuss common features in different topics. No in itinere evaluations are scheduled.

Office hours

upon email request (paola.fusi@unimib.it)

Sustainable Development Goals

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