

Volume 69, Number 2, February 2011

Lead Article

65 Mitochondrial response to controlled nutrition in health and disease

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Mitochondria exert crucial physiological functions that create complex links among nutrition, health, and disease. While mitochondrial dysfunction with subsequent impairment of oxidative phosphorylation (OXPHOS) is the hallmark of the rare inherited OXPHOS diseases, OXPHOS dysfunction also plays a central role in the pathophysiology of common conditions such as type 2 diabetes and various neurodegenerative disorders. Dietary interventions, especially calorie restriction, have been shown to improve the course of these diseases and to extend the lifespan. Few data are available on the impact of nutraceuticals (macronutrients, vitamins, and cofactors) on primary inherited OXPHOS diseases. This review presents recent knowledge about the impact of nutritional modulation on mitochondria and lifespan regulation and about the development of potential treatments for mitochondrial dysfunction diseases.

Special Articles

76 Early postnatal nutrition and programming of the preterm neonate

Julia E Wiedmeier, Lisa A Joss-Moore, Robert H Lane, and Josef Neu

Early postnatal nutrition is a vital determinant of adult health; this is particularly true for the infant born prematurely and cared for in a hospital setting such as the neonatal intensive care unit. Human and animal studies support the contribution of postnatal dietary composition and the rate of extrauterine growth to long-term metabolic outcomes. One mechanism by which postnatal nutrition affects long-term outcome is via developmental programming. Programming, or the modulation of gene expression to impart a short-term advantage accompanied by a long-term cost, may be achieved by epigenetic modifications to chromatin. This review summarizes the details of postnatal nutritional content and rate of growth on the development of metabolic disease. The role of epigenetics in developmental programming of the preterm infant is also discussed, with an emphasis on animal models of dietary manipulation and directions in which the field must move in order to formulate effective feeding strategies for the preterm infant.

83 School feeding programs in developing countries: impacts on children's health and educational outcomes

Lamis H Jomaa, Elaine McDonnell, and Claudia Probart

School feeding programs (SFPs) are intended to alleviate short-term hunger, improve nutrition and cognition of children, and transfer income to families. The present review explores the impact of SFPs on nutritional, health, and educational outcomes of school-aged children in developing countries. Peer-reviewed journal articles and reviews published in the past 20 years were identified and screened for inclusion. Analysis of the articles revealed relatively consistent positive effects of school feeding in its different modalities on energy intake, micronutrient status, school enrollment, and attendance of the children participating in SFPs compared to non-participants. However, the positive impact of school feeding on growth, cognition, and academic achievement of school-aged children receiving SFPs compared to non-school-fed children was less conclusive. This review identifies research gaps and challenges that need to be addressed in the design and implementation of SFPs and calls for theory-based impact evaluations to strengthen the scientific evidence behind designing, funding, and implementing SFPs.

99 Fermentation potential of the gut microbiome: implications for energy homeostasis and weight management

Tulika Arora and Rajkumar Sharma

Energy homeostasis is regulated by twin factors, energy intake and energy expenditure. Obesity arises when these two factors are out of balance. Recently, the microflora residing in the human gut has been found to be one of the influential factors disturbing energy balance. Recent interest in this field has led to use of the term "gut microbiome" to describe the genomes of trillions of microbes residing in the gut. Metagenomic studies have shown that the human gut microbiome facilitates fermentation of indigestible carbohydrates to short-chain fatty acids that provide excess energy to the body, thus contributing to the obese phenotype. Alteration in the ratio of Bacteroidetes and Firmicutes drives a change in fermentation patterns that could explain weight gain. Therefore, changes in the gut microbiome (induced by antibiotics or dietary supplements) may be helpful in curbing the obesity pandemic. This review provides information on the expansive role the gut microbiome is believed to play in obesity and other related metabolic disorders.

Nutrition in Clinical Care

107 Celiac disease, gluten-free diet, and oats

Premysl Fric, Dana Gabrovska, and Jiri Nevoral

Oats in a gluten-free diet increase the diet's nutritional value, but their use remains controversial. Contamination with prolamins of other cereals is frequent, and some clinical and experimental studies support the view that a subgroup of celiac patients may be intolerant to pure oats. Thus, this issue is more complex than previously suggested. In order to produce oats that are safe for all celiac patients, the following topics should be addressed: selection of oat cultivars with low avenin content, research on such recombinant varieties of oats, development of assay methods to detect avenins in oat products, guidelines for the agricultural processing of oats and the manufacture of oat products, as well as guidelines for following up with celiac patients who consume oats.

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