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Vitamins and their derivatives in the prevention and treatment of metabolic syndrome diseases

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Abstract

Dyslipidemia and the consequent insulin resistance form the basis of all the ensuing metabolic syndrome diseases. The roles of various vitamins in the control and amelioration of disturbances in carbohydrate metabolism will be discussed. Apart from its calcitropic effect, vitamin D is a regulator of gene expression, cell proliferation and differentiation. Various studies have indicated an association between vitamin D deficiency and Type 2 Diabetes Mellitus. The roles of vitamin D in the synthesis and secretion of insulin as well as its effect on the regulation of the insulin receptor gene contribute to insulin sensitivity. Binding of retinol (vitamin A)-bound retinol-binding protein (RBP4) to a membrane bound protein STRA6 results in the activation of JAK/STAT signaling cascade and the induced expression of STAT target genes which suppress insulin signaling. All-trans retinoic acid (ATRA), a derivative of vitamin A, leads to the reversal of these effects on the signaling cascade resulting in increased insulin sensitivity in tissues and also the suppression of the PEPCK gene in the liver. Vitamin A is also involved in the induction of the glucokinase gene. Glucokinase, a key glycolytic enzyme and phosphoenolpyruvatecarboxykinase, a key gluconeogenic enzyme are regulated in opposite directions by the vitamin biotin, acting at the transcriptional level. The effects of biotin starvation and replenishment are seen across three phylogenetically distant eukaryotes. Biotin has significant therapeutic potential. The increase in advanced glycation end products (AGEs) is implicated in the initiation and progression of diabetes-associated microvascular diseases. Benfothiamine, a synthetic S-acyl derivative of thiamine and pyridoxamine, a vitamer of vitaminB6, both have anti-AGE properties making them valuable therapeutic adjuvants in the treatment of diabetic complications such as neuropathy, nephropathy and retinopathy. Thus, various vitamins and their derivatives have profound therapeutic possibilities in the treatment of metabolic syndrome diseases.

Biography

Krishnamurti Dakshinamurti, biochemist and molecular biologist, received hisPh.D in 1957. After post-doctoral stints at the University of Illinois and at the Massachusetts Institute of Technology, Cambridge, MA, he was appointed Associate Director of the Research Institute, St. Joseph Hospital, Lancaster, PA. He moved to the University of Manitoba Faculty Of Medicine as Associate professor of Biochemistry and Molecular Biology in 1964, becoming Full Professor in 1973. He spent 1974 – 75 as Visiting Professor of Cell Biology at the Rockefeller University, New York. He received the Borden Award of the Canadian societies of Biological Sciences in 1973. He was elected to Emeritus professorship of the University of Manitoba in 1998.He was Co-Director of the Centre for Health Policy Issues at the St. Boniface Hospital Research Centre. Currently he is the Senior Advisor of the Research Centre.