

Micronutrients

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Minerals and trace elements are micronutrients that are essential to the human body but present only in traceable amounts. Nonetheless, they exhibit well-defined biochemical functions. Deficiencies in these micronutrients are related to widespread human health problems such as diabetes, insulin resistance, improper immune function, bone health and brain development. The levels of trace elements may vary considerably among different populations, contingent on the composition of the diet and location. Local differences in selenium, zinc, copper, iron, chromium and iodine in the diet can affect physiological functions leading to malnourishment. Inadequate supply of a number of minerals and trace elements including iodine, selenium, zinc, calcium, chromium, cobalt, iron, boron and magnesium and in a few cases, excess of essential trace elements may lead to imbalances in glucose homeostasis and insulin resistance. Changes in these micronutrient levels in the serum and urine of subjects may signal towards metabolic changes, oxidative stress and other disease-related complications. Adequate supplement of the micronutrients may eliminate or protect against certain diseases such as heart disease.

micronutrient

trace element

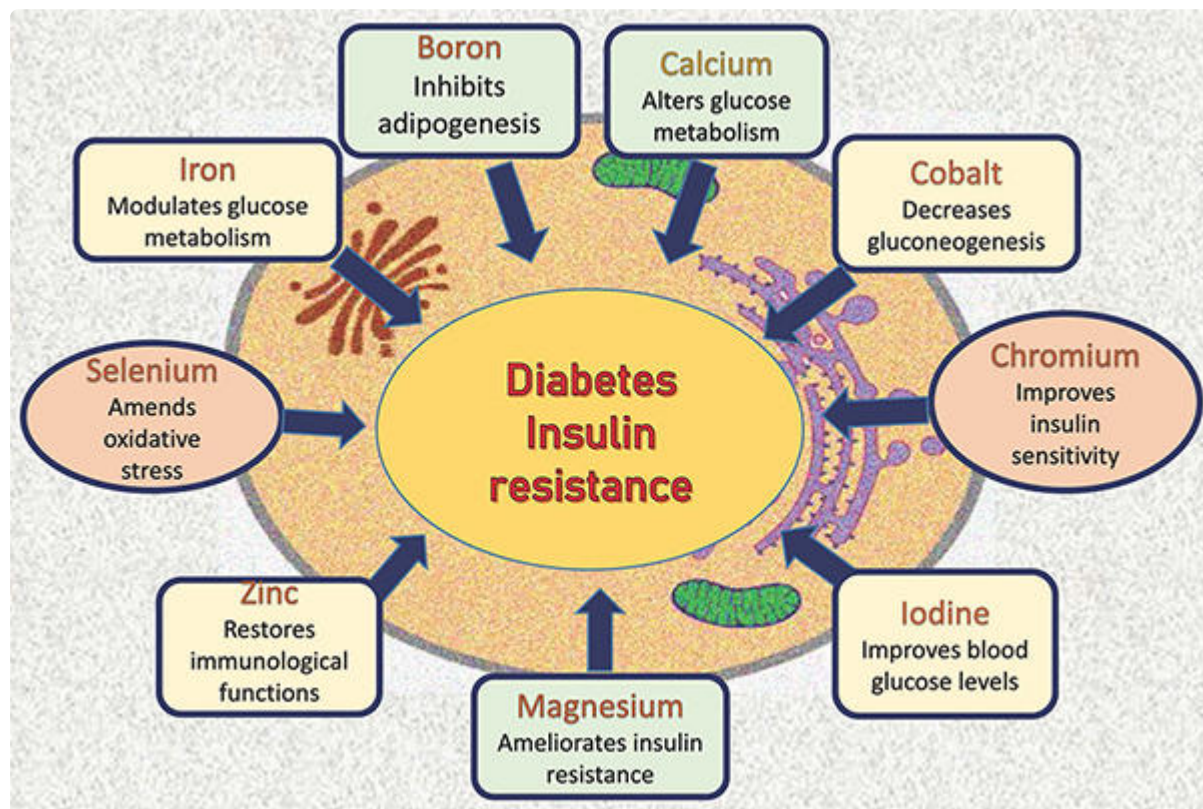
minerals

1. Definition

Minerals, vitamins and trace elements are essential micronutrients required for the normal functioning of the body including homeostasis, enzyme regulation, growth and development ^{[1][2]}. These elements are particularly beneficial for physiological functions ^[3]. Minerals and trace elements present as stabilizing components of enzymes and proteins and function as co-factors for many enzymes. Certain trace elements regulate crucial biological processes by binding to the receptor site of the cell membrane or by changing the shape of the receptor to prevent entry of particular molecules into the cell ^[4]. Micronutrients serve dual roles: they maintain the stabilization of the cellular structures at their optimal levels, but their inadequacy proceeds to alternate pathways and may cause ailments ^[5]. These essential micronutrients have important physiological implications and exhibit direct associations with many diseases ^{[6][7]}. Macro elements, vitamins, trace elements and organic acids are the four major classes of micronutrients. Macro elements primarily include chloride, calcium, phosphorous, magnesium, sodium, potassium and iron, whereas certain trace elements like cobalt, boron, chromium, copper, sulfur, iodine, zinc and molybdenum enhance anti-oxidant potential in organisms.

2. Introduction

Micronutrients are identified as vital nutrients that are required for the normal functioning of the body and are valuable for physiological functions. The first significant minerals discovered in early- and mid-1800 as beneficial aspects of the health of animals were iodine, iron and zinc. Over time, due to nutritional imbalances, micronutrient malnutrition was identified and the vitamins were acknowledged. The initial vitamins identified as important components in the health of human beings were vitamins C, A and D in early to mid-1900s. During that time, dietary requirements of the different micronutrients started to be recognized. The levels of micronutrients vary considerably among different populations, contingent on the composition of the diet. In different parts of the world, large proportions of the population are affected by a number of micronutrient deficiencies. Local differences in selenium, zinc, copper, iron, chromium and iodine in the diet occur in both developed and developing countries, largely due to malnutrition and dependence on indigenous nutrition. These overall deficiencies and, in a few cases, excess of essential trace elements may lead to imbalances in glucose homeostasis, metabolic changes, oxidative stress, insulin resistance, growth and development^[8].



3. Influences

Minerals and trace elements are essential for many biochemical reactions, present as stabilizing components of enzymes and proteins and function as co-factors for many enzymes. Certain trace elements regulate crucial biological processes by binding to the receptor site of the cell membrane or by changing the shape of the receptor to prevent entry of particular molecules into the cell ^[1]. Micronutrients serve dual roles: they maintain the stabilization of the cellular structures at their optimal levels, but their inadequacy proceeds to alternate pathways and may cause ailments ^[2]. These essential micronutrients have important physiological implications

and deficiencies may directly or indirectly be associated with oxidative stress that ultimately precedes to various diseases [\[9\]](#)[\[10\]](#)[\[11\]](#)[\[12\]](#).

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