Chapter 1

Introductory Chapter: B-Group Vitamins

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Additional information is available at the end of the chapter

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1. Introduction

Vitamins are organic micronutrients, which are substances that must be present in small quantities and that are essential for the growth and development of the human body and are required in numerous metabolic reactions to maintain homeostasis. The 13 vitamins that are required by human metabolisms are divided as either being fat-soluble vitamins (such as vitamins A (retinols and carotenoids), D (cholecalciferol), E (tocopherols and tocotrienols), and K (quinones)) or water-soluble vitamins (which include vitamin C (ascorbic acid) and the B-group vitamins). In the latter group (B-group), these include: vitamin B1 (thiamine), vitamin B2 (riboflavin), vitamin B3 (niacin), vitamin B5 (pantothenic acid), vitamin B6 (pyridoxine), vitamin B7 (biotin), vitamin B9 (folic acid or folate), and vitamin B12 (cobalamins).

2. Vitamin deficiencies

Although only a very small amount of vitamins is required to avoid deficiencies, and that all 13 vitamins are found in a wide variety of foods, deficiencies are still very common in all parts of the world. There are numerous factors that can explain this problem; one of the most frequent causes is malnutrition, which not only includes the inadequate intake of foods for socioeconomic or psychological reasons, but also includes people that consume unbalanced diets. In this sense, a person can be obese and still not consume enough vitamins to avoid deficiencies, not because of an inadequate consumption of food, but because they might not be consuming a variety of foods that are essential to make sure that the recommended daily intakes are obtained. There are is no magic food that contains all the vitamins, the only way to avoid deficiencies is to consume a variety of foods, which is the base of all the nutritional

guidelines. In addition to malnutrition, certain diseases and treatments have been shown to affect vitamin absorption or bioavailability. Furthermore, pregnant women and children have a greater need for vitamins because of their increased metabolism during cell replication.

3. Vitamin fortification programs

The consumption of a variety of foods might not be sufficient to meet the recommended intakes of vitamins; food preparation methods and storage conditions can also affect their contents. An example is the case of water-soluble vitamins that are lost during the boiling/cooking of foods. Because vitamin deficiencies are generalized in most populations, some governing bodies have adopted mandatory fortification of foods so that all consume sufficient amounts to avoid deficiencies. These types of programs consist of adding vitamins to foods of mass consumption, which can vary from region to region. In western diets, flours are used for fortification because they are the basis for most prepared foods, whereas in some Nordic countries, milk is fortified due to its high consumption rates, whereas in oriental countries, rice and its derivatives are used for micronutrient fortification.

Although there are numerous beneficial effects that have been demonstrated to result from these mandatory fortification programs, there are concerns that people who consume normal balanced diets might be exposed to elevated and potentially dangerous levels of vitamins. The chemical form of vitamins used in fortification programs has also been questioned by many. A good example is the case of folic acid fortification to decrease folate (vitamin B9) deficiencies, the excessive intake of folate cannot be adequately metabolized in the liver and thus causes an increased concentration of this substance in the blood stream and can cause several undesirable side effects such as masking vitamin B12 deficiencies and have even been associated with increased risks for colon, pancreatic, and breast cancers. These problems are becoming more frequent, not only because of mandatory food fortification programs, but also due to the increased consumption of food supplements such as multivitamin preparations, which can be very dangerous if the right doses are not consumed.

4. Alternatives to fortification programs

Food technologists and biotechnologists have been looking for methods to increase or preserve vitamins in foods by different methods. Reducing the exposure to light for the storage of milk using plastics or nontransparent bottles is an early method to reduce the loss of riboflavin (vitamin B2). Biotechnologists have been able to genetically modify crops so that these contain more elevated concentrations of vitamins, but because of current views by most that foods should not be genetically modified, these are not options that could easily be adopted in most countries. Another method of increasing B-group vitamin concentrations in foods is by fermentation. It has been shown that certain strains of fermentative microorganism have the ability to produce B-group vitamins; thus, the adequate selection of strains and fermentation conditions could lead to the development of novel bioenriched foods that contain elevated concentrations of natural forms of vitamins.

5. Conclusions

Even though the term "vitamin" was first coined by Casimir Funk in 1912 and that most research on vitamin requirements was made between the early ninetieth until the mid-twentieth centuries, there are many groups that are actively studying and demonstrating that the role of vitamins in human health, especially in diseases, is still widely misunderstood and need to continue so that our understanding of their roles can evolve from the initial period of discovery.

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Conflict of interest

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