



# Complex foods versus functional foods, nutraceuticals and dietary supplements: differential health impact (Part 1)

**KEYWORDS:** Complex foods, functional foods, nutraceuticals, food structure, synergy, human studies, health potential.

**Abstract** What differentiates natural complex foods from nutraceuticals and dietary supplements is food structure, this latter involving nutrient interaction and synergism, and a complex mixture at nutritional doses. Scientific evidence showed that functional foods, nutraceuticals and dietary supplements (FND) have failed stopping chronic diseases epidemics: most conclusions of recent meta-analyses and systematic reviews are lack of significant health effect and needs for further studies. Why such disappointing results? Probably because FND results from a curative and reductionist nutritional approach while complex foods participates in a preventive and holistic approach. Indeed, reductionism has led to fractionate foods, isolating compounds from them for use at supra-nutritional doses in FND. Holism considers foods as complex systems in which the whole is more than sum of the parts leading to more sustainable health effects, and technological treatments more respectful of food structure.

## INTRODUCTION: DEFINITIONS

Except water, all foods are a mix of several macro-, micro- and/or phyto-nutrients and are therefore complex systems. Thus, milk is a complex food and complex foods are not only solid foods. Generally, two categories of complex foods are distinguished: natural and processed. Among processed foods, those processed directly from the natural matrix (e.g., cooked meat), and re-combined foods from isolated ingredients issued from fractionation and refining processes (e.g., white bread) are distinguished. Processed food matrices may be classified as: 1) Colloidal dispersions like emulsions (butter, mayonnaise) and foams (chocolate mousse); 2) amorphous or crystalline phases (most food solids, e.g., starch); and 3) gel networks (e.g., some dairy foods).

Complex foods may be also classified in food groups like dairy products, cereals, legumes, etc. But, from a nutritional point of view, it seems that it is more useful to rank complex foods according to their degree of processing. This classification has been proposed by the research team of Monteiro et al. in Sao Polo and has led to the release of a new Brazilian food guide pyramid (1). Authors distinguish: 1) Natural and minimally-processed foods; 2) ingredients for culinary purposes, either at home or in food industry; 3) processed foods, and 4) ultra-processed foods, notably snacks, ready-to-eat meals and sweetened drinks. What is interesting with such a classification is that risk for main chronic diseases is associated with high and regular consumption of foods from group 4, not really with usual plant- and animal-based food groups (2-4).

Functional foods "are defined as products that resemble traditional foods but possessed demonstrated physiological

benefits", and nutraceuticals "are commodities derived from foods, but are used in the medicinal form of pills, capsules or liquids and again render demonstrated physiological benefits" (5). According to the Dietary Supplements Health and Education Act, a dietary supplement is a "product other than tobacco that is taken by mouth, that contains one or more vitamins, minerals, herbs or other botanicals, amino acids, substances supplementing the diet by increasing the daily dietary intake, or a concentrate, constituent, metabolite, extract, or combination of these, that is not represented as a food or as constituting a meal or the sole item of the diet, and that contains as part of its labeling the words dietary supplement" (6). Contrary to functional foods, nutraceuticals and dietary supplements are therefore made of refined ingredients, isolated nutrients, and/or herb extracts.

Because complex foods, functional foods, nutraceuticals and dietary supplements are very different in nature, the aim of this opinion paper is to discuss their respective health benefits within the perspective of holistic versus reductionist approaches as applied in human nutrition researches.

## THE NUTRITION TRANSITION AND THE REDUCTIONIST PARADIGM

It is important to consider why functional foods, nutraceuticals and dietary supplements have been developing more and more during these last decades. According to me, there are two main reasons for this:

1) The Nutrition Transition that has led to unbalanced diets: it is characterized by the transition from traditional foods, very few