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Functional Foods

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SUMMARY

In recent years, functional foods have gained popularity within health and wellness circles. Also known as nutraceuticals. Functional foods are foods that offer health benefits beyond their nutritional value. In addition to nutrient-rich ingredients like fruits and veggies, the category also includes foods fortified with vitamins, minerals, probiotics, and fibers. Functional foods may help prevent nutrient deficiencies, protect against disease, and promote proper growth and development. Functional foods can be used to boost your intake of important nutrients, fill any gaps in your diet, and support overall health.

INTRODUCTION

Functional foods are defined as products that resemble traditional foods but possess demonstrated physiological benefits. However, nutraceuticals are commodities derived from foods, but are used in the medicinal form of pills, capsules or liquids and again render demonstrated physiological benefits. In Canada, the latter group has now been integrated under a new category as natural health products that promote health. This category includes both nutraceuticals and herbal as well as other natural products. In some countries, however, functional foods and nutraceuticals are used interchangeably. Regardless, the main focus of such products is to improve health and reduce disease risk through prevention. The main difference of this category with pharmaceuticals is that they are multi-targeted mixtures and present at low concentration while pharmaceuticals are uni-targeted pure compounds with high dose use. There are many functional foods and nutraceuticals that are becoming increasingly available in the marketplace, but there is a challenge for the functional food producers because such products should address the issue of sensory acceptability which is not necessary for the nutraceutical or pharmaceutical products. The commodities that have so far reached the market are mainly those belonging to the antioxidants and also omega-3 oils, as well as probiotics, among others. The antioxidant category is primarily composed of phenolic/polyphenolic compounds, but carotenoids as well as phytates, certain vitamins, uric acid and minerals are also included. In addition, phytosterols or plant sterols have found their way to the market, first in Finland over a decade ago and now in many other countries. In more recent work, conjugation of different groups of bio-actives or their physical mixtures have been studied in order to examine their additive or possible synergistic as well as unusual effects. The following sections of this overview provide examples to demonstrate the benefits of nutraceuticals and functional foods in health promotion and in reducing the risk of chronic diseases.

Examples of functional foods

Here are some examples of conventional functional foods:

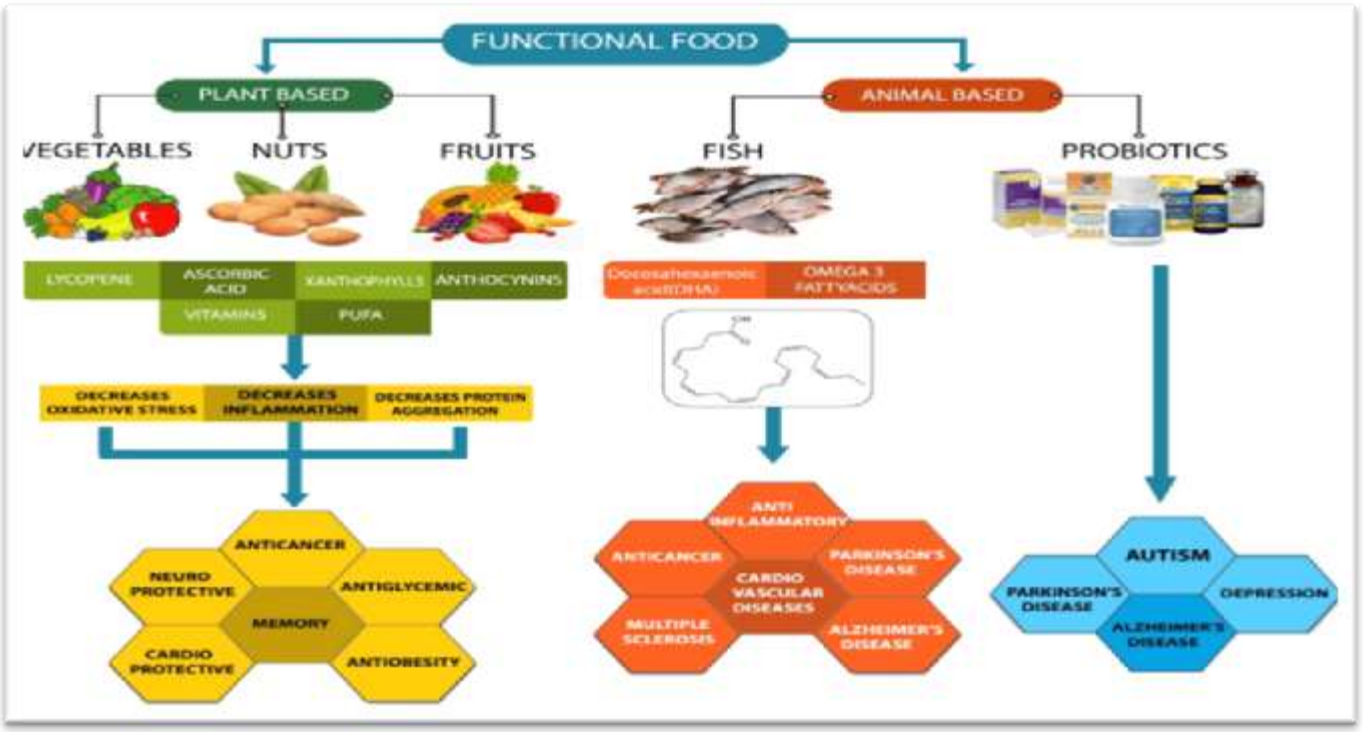
Fruits: berries, kiwi, pears, peaches, apples, oranges, bananas
Vegetables: broccoli, cauliflower, kale, spinach, zucchini
Nuts: almonds, cashews, pistachios, macadamia nuts, Brazil nuts
Seeds: chia seeds, flax seeds, hemp seeds, pumpkin seeds
Legumes: black beans, chickpeas, navy beans, lentils
Whole grains: oats, barley, buckwheat, brown rice, couscous
Seafood: salmon, sardines, anchovies, mackerel, cod
Fermented foods: tempeh, kombucha, kimchi, kefir, sauerkraut
Herbs and spices: turmeric, cinnamon, ginger, cayenne pepper
Beverages: coffee, green tea, black tea

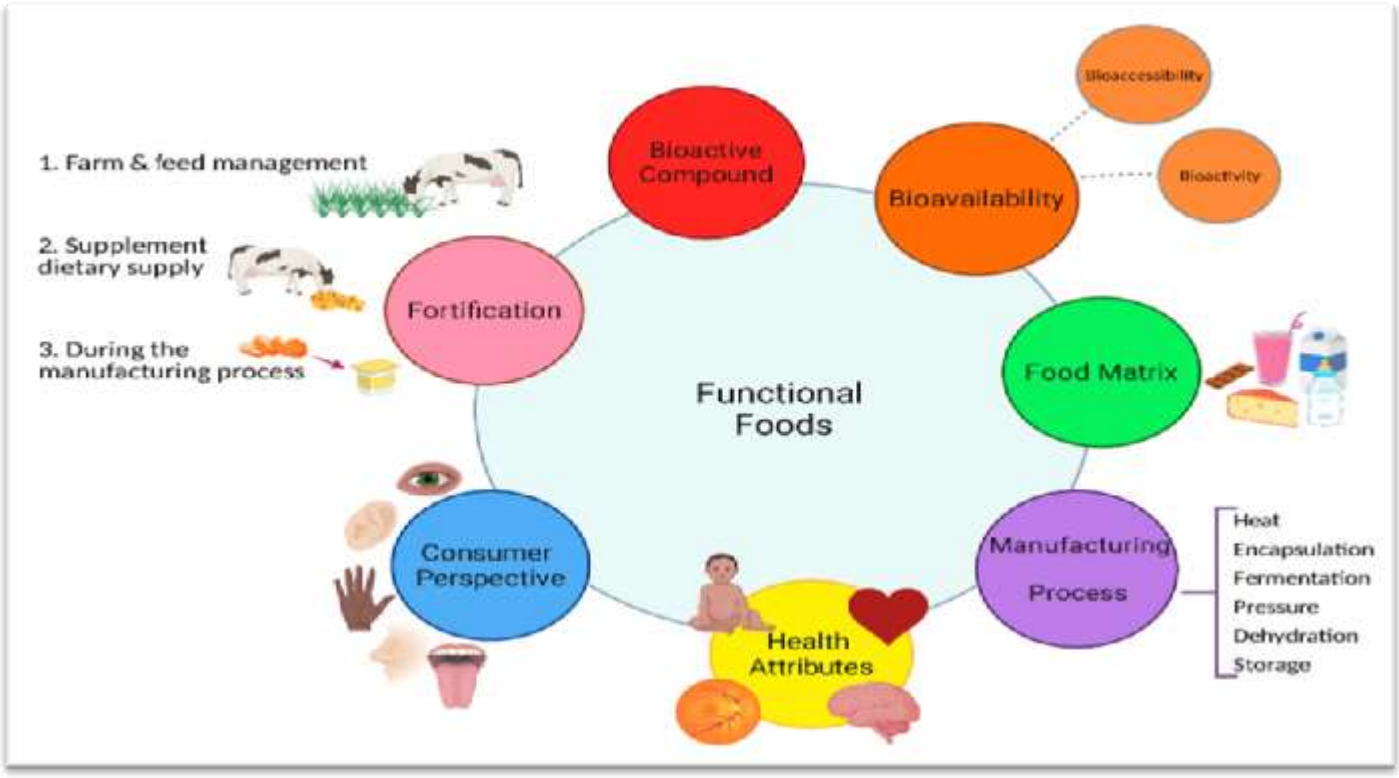
Here are some examples of modified functional foods:

- Fortified juices
- Fortified dairy products, such as milk and yogurt
- Fortified milk alternatives, such as almond, rice, coconut, and cashew milk
- Fortified grains, such as bread and pasta

- Fortified cereal and granola
- Fortified eggs

Functional Foods;





Importance of Functional Food:

Phenolics and Polyphenolics as antioxidants:

Plant foods serve as a rich source of phenolic and polyphenolic compounds. The concentration of phenolics and polyphenolics is mainly in the skin and seeds of fruits, but leaves often provide a richer source of phenolics. An example for this is blueberry leaves that are excellent sources of antioxidants . The leaves were more recently found to suppress the expression of hepatitis C virus RNA. In cereals and legumes, the bran portion is also dominant in phenolics as compared to the endosperm. The antioxidant potential of cereals follows a similar trend as is exemplified in pearled barley. Although the term antioxidant is frequently used by the public to describe the

health benefits of phenolic and polyphenolic compounds, the mechanism(s) by which these effects are rendered is (are) not limited to their antioxidant potential which may be described as their efficacy in scavenging free radicals, chelating pro-oxidant metal ions or acting as reducing agents. the different mechanisms by which phenolic and polyphenolic antioxidants confer their benefits, once consumed. It should also be noted that certain flavonoids may exert their beneficial effects via a pro-oxidant effect. In addition, advanced glycation endpoints (AGEs) responsible for diabetes, cataract, neuropathy and alike are among the other mechanisms by which phenolics/polyphenolics are known to promote health. The phenolics occurring in foods may occur in the free, soluble esters and glycosides or insoluble-bound forms. In carrying out extraction operations, the latter group may not be easily procured, if proper procedures to release them are not followed. This may then lead to the underestimation of the reported results. Thus release of the insoluble-bound phenolics is essential. The correspondence of total phenolics with antioxidant potential as well as the contribution of insoluble-based phenolics to the total phenolics in several cases. These bound phenolics are released during colonic fermentation and hence are of paramount importance in reducing the risk of colon cancer.

Omega-3 Oils and Their Health Benefits:

Edible marine algae, sometimes referred to as seaweeds, are of interest as good sources of nutrients including protein, long-chain polyunsaturated fatty acids (PUFA), dietary fibres, vitamins and minerals. More recently, many researchers have focused on marine algae and their constituents as nutraceuticals and functional foods for their potential health-promotion mostly attributed to their ω3 fatty acids, antioxidants, and other bioactives. Although the majority of marine algae have low lipid contents, ranging from 0.3% in U. lactuca to 7.2% in Caulerpa lentillifera, algal lipids are rich in PUFA such as C20 : 5ω3 (eicosapentaenoic acid, EPA) and C22 : 6ω3 (docosahexaenoic acid, DHA). The proportions of EPA and DHA in oils from Skeletonemacostatum and Crypthecodiniumcohnii were 41 and 37%, respectively(8). While marine algae are primarily used for production of single-cell oil rich in DHA, and other ω3 PUFA , the leftover material after processing contains a variety of antioxidative substances that can potentially be utilized as a source of natural antioxidants.

Bioactive Conjugates:

In efforts to examine the additive, synergistic or unusual effects of conjugates of different bioactives, Kralovec et al. prepared chromium (III) complex of DHA in order to take advantage of its constituent components. Later, we prepared, for the first time, conjugates of major green tea polyphenol or phytosterols with a number of fatty acids, particularly long-chain omega-3 fatty acids . Polyphenols in green tea, known as catechins, account for 30% of the dry weight of tea leaves with epigallocatechin gallate (EGCG) being the most abundant (59% of total polyphenols). EGCG has a multitude of bioactivities and is highly hydrophilic with poor solubility in lipophylic media, hence its absorption in-vivo is some-what hindered. Acylation of EGCG with selected fatty acids was found to improve its lipophibicity, thus leading to its potential expanded application in more diverse systems such as fats and oils, lipid-based foods and cosmetics as well as biological systems, including better cellular absorption and bioefficacy under physiological conditions. Moreover, additional perspectives exists using health beneficial omega-3 (PUFA). The esters of EGCG with omega-3 PUFA, especially DHA significantly improved the antioxidant and anti-inflammatory activities of EGCG. Moreover, the EGCG-DHA esters totally arrested colon tumourigensis in mice and exhibited anti-HCV (hepatitis C virus) activity which was 1700-folds greater than that of embelin as a positive control. These findings strongly suggest that modified EGCG products are of great potential as novel ingredients for food and cosmetics and as nutraceutical/pharmaceutical applications. These findings have now been protected through a patent The esters of phytosterols with omega-3 fatty acids as well as a number of phenolic acids have also been prepared. While most of the research and commercial interest has so far been on phytosterol esters with vegetable oils, this research has successfully used enzymatic or chemoenzymatic preparation of novel phytosterol esters with DHA and other long-chain omega-3 fatty acids as well as for the synthesis of phytosteryl caffeates, ferulates, sinapates and vannilate. We have also found that phytosteryl oleates to have cholesterol lowering effects that exceed those with DHA. The antioxidant potential of phytosteryl phenolates in a number of in-vitro systems have been shown to be system-dependent and being influenced by a number of mechanisms involved in rendering their effects. Phytosteryl phenolates, especially phytosteryl caffeates, ferulates and sinapates, provide an excellent opportunity for their future use as food antioxidants. The cholesterol and triacylglycerol lowering effects of phytosteryl oleates and docosahexeanates is also of much interest as the components of latter products may render combined effects of their constituent moieties. In an apo-E deficient mice, the cholesterol lowering effects of products and in nearly removing atherosclerotic lesion has already been demonstrated.

CONCLUSION:

Functional foods and nutraceuticals play a vital role in promoting health and preventing diseases by providing benefits beyond basic nutrition. These foods, rich in bioactive compounds such as phenolics, omega-3 fatty acids, and probiotics, help reduce the risk of chronic illnesses like cardiovascular diseases, diabetes, and certain cancers. The growing research on bioactive conjugates and their synergistic effects further highlights the potential of functional foods in enhancing bioavailability and therapeutic efficacy. As consumer awareness increases, the demand for functional foods continues to rise, emphasizing the need for innovative formulations that balance health benefits with sensory appeal. Future advancements in this field will likely focus on optimizing bioactive delivery, expanding functional food categories, and ensuring regulatory compliance to maximize their impact on public health.

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