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CEREAL BASED FUNCTIONAL FOODS AND NUTRACEUTICALS

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Abstract. Wheat, buckwheat, oat, barley, flaxseed, psyllium, brown rice, soy and products are notified the most common cereal based functional foods and nutraceuticals. In this paper, these cereals and their beneficial effects to improve the health, to prevent and reduce the risk factors for several diseases are reviewed.

Key words: functional food, nutraceutical, cereal, wheat, buckwheat, oat, barley, flaxseed, psyllium, brown rice

INTRODUCTION

In the last decade, preventive medicine has undergone a great advance. Research has demonstrated that nutrition plays a crucial role in the prevention of chronic diseases [López-Varela et al. 2002]. A functional food should provide health benefits and enhance performance above its nutritional values [Kwak and Jukes 2001]. It is defined that a food can be regarded as functional if it has beneficial effects on target functions in the body as a source of mental and physical well-being, contributing to the prevention and reduction of risk factors for several diseases or enhancing certain physiological functions, beyond adequate nutritional effects. Resembling this definition; nutraceutical is that any substance that may be considered a food or a part of a food and provides medical or health benefits including the prevention and treatment of disease [DeFelice 1992, Andlauer and Fürst 2002]. In recent years, cereals and its ingredients are accepted as functional foods and nutraceuticals because of providing dietary fibre, proteins, energy, minerals, vitamins and antioxidants required for human health. Cereals include dietary fibre such as β-glucan and arabinoxylan, carbohydrates such as resistant starch and oligosaccharides (galacto- and fructo-oligosaccharides). Also, cereals can be used as fermentable substrates for the growth of probiotic microorganisms [Charalampopoulos et al. 2002]. Wheat, buckwheat, oat, barley, flaxseed, psyllium, brown rice, soy and products are notified the most common cereal based functional foods and nutraceuticals.

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Preventing cancer and cardiovascular disease, reducing tumor incidence, lowering blood pressure, risk of heart disease, cholesterol and rate of fat absorption, delaying gastric emptying and supplying gastrointestinal health are the protective effects of the cereals. Several of the nutrients in cereals have known potential for reducing risk factors for coronary heart disease; the linoleic acid, fibre, vitamin E, selenium and folate. Cereals also contain phytoestrogens of the lignan family and several phenolic acids with antioxidant properties. Processing generally reduces the content of these nutrients and bioprotective substances [Truswell 2002].

CEREALS AS FUNCTIONAL FOODS AND NUTRACEUTICALS

Wheat

Whole wheat and wheat bran based cereals could be important sources of dietary antioxidants. Free and esterified phenolic acids have the greatest potential to be beneficial to health in wheat. Phenolic acids in cereals effect strong antioxidant activity in vitro at concentrations that obtained from a normal serving of whole wheat cereal. Acid conditions and enzymatic hydrolysis increase the solubility and activity of wheat phenols [Baublis et al. 2000]. And also insoluble fibre in wheat bran may contribute to maintenance of a healthy digestive tract.

Buckwheat

Buckwheat has been and will be used as an important raw material for functional food production because of its functionalities and properties like proteins, flavonoids, flavones, phytosterols, thiamine-binding proteins, and other compounds. Buckwheat proteins have unique amino acid composition with special biological activities of cholesterol-lowering effects, antihypertensition effects, and improving the constipation and obesity conditions by acting similar as to dietary fiber and interrupting the in vivo metabolisms. The trypsin inhibitors isolated from buckwheat seeds are heat stable and can cause poor digestion if they are not suitably cooked before consumption [Li and Zhang 2001]. Buckwheat is approved as an antihaemorrhagic and hypotensive drug [British... 1990]. It is used against circulatory disorders and as vasculoprotector, and could be effective, together with other plants like lime against hemorragic retinopathy [Iserin et al. 1997]. Buckwheat leaves contain 3-8% rutin [Bruneton 1999] and a potential source for industrial extraction of this compound. Rutin and its hemisynthetic derivatives exert different pharmacologically demonstrated effects that are normalisation of increased vascular permeability and fragility, oedema protection, hyaluronidase inhibition [Ihme et al. 1996], antioxidant [Wojcicki et al. 1995 b, Van Acker et al. 1996], and antiinflammatory effects and are efficient against leg oedema [Ihme et al. 1996], in chronic venous insufficiency, as demonstrated by clinical data [Koscielny et al. 1996]. They protect against diabetical retinopathy as well [Archimowicz-Cyrylowska et al. 1996] and reduce atherosclerosis. The main responsible components of these extracts or plant parts are phenolics like rutin. Among numerous properties, many polyphenolics prove antioxidative properties, especially oxygen species scavenging [Wojcicki et al. 1995 a].

Oat

Oat has long been recognized as a healthful and nutritious food, containing high concentrations of well-balanced protein and soluble fiber, energy in the form of carbohydrate and oil, and several vitamins and minerals [Peterson 1992, Welch 1995] and is a good source of antioxidants, such as Vitamin E (tocols) [Peterson and Qureshi 1993], phytic acid, various phenolic compounds and avenanthramides. These antioxidants are concentrated in the outer layers of the kernel. Antioxidants function is also helping to maintain the stability of processed oat products, and oat can stabilize oils and fats against rancidity [Peterson 2001]. In addition to the well-known effects of reducing blood cholesterol and affecting glycaemic response, dietary fibre of oat bran has been shown to have numerous other physiological effects. It delays gastric emptying, diminishes absorption of nutrients, affects the motility in the small bowel, and prolongs satiety after the meal. In the large bowel, soluble dietary fiber increases the fermentation activity, especially production of butyric acid, enhances growth and colonization of some probiotic bacterial strains, increases production of microbial mass and thereby aids the removal of nitrogen via faces and also increases wet weight of stools, thereby alleviating constipation. Short-chain fatty acids formed enhance cell proliferation of the colonic mucosa so this reduces the risk of colon cancer. Against to these effects of the viscosity of the intestinal contents and colon fermentation, the physiological effects are in part mediated via insulin and gastrointestinal hormone secretion [Mälkki and Virtanen 2001]. Human experiments have clearly shown that oat fibre tends to lower plasma total and LDL cholesterol but wheat fibre does not and cereal foods with low glycaemic index such as pasta and oats are beneficial for people with diabetes and might lower plasma lipids [Truswell 2002].

Barley

In human nutrition, barley has a high acceptance when its new functional and nutritional properties recognized. Several hull-less barley cultivars containing low or high β-glucan, variation degrees of extract viscosity, and waxy or normal starch are found. β-glucan is a major component of soluble fiber implicated in hypocholesterolemia, hypoglycemia, and in reducing incidence of chemically induced colon cancer in experimental animals. Hull-less barley may also be used as a feed stock for fuel alcohol production, for the preparation of food malt with low or high enzyme activities, and for brewer's and distiller's malts [Bhatty 1999]. Barley and rice bran may also lower cholesterol but most people do not eat enough barley to have an effective effect [Truswell 2002].

Flaxseed

Flaxseed is a good source of phytochemicals and alpha-linolenic acid, which is converted to long-chain omega-3 fatty acids in the functional food area. Being one of the richest sources of linolenic acid oil and lignans, flaxseed is an essential source of high-quality protein and soluble fiber and has considerable potential as a source of phenolic compounds. Like fish oils it may help to correct deficiency of these fatty acids and

could be useful for those wishing to supplement their diets with a plant source of these nutrients [Oomah 2001, Rapport and Lockwood 2001].

Psyllium

Psyllium, a plant-based laxative found in Metamucil, promotes regularity and has an antidiarrheal effect and includes a lowered risk of heart disease and weight. Psyllium seed increases the water content and weight of the stool because of its rich fiber content. Psyllium is a useful substance for treating chronic constipation, and to restore and maintain intestinal regularity, and advised when soft bowel movements are desired, such as when a person has hemorrhoids, anal fissures, or during pregnancy. Also is preferred over wheat bran for treating irritable bowel syndrome. In addition to these benefits, soluble fibers such as found can augment the cholesterol-lowering effect of a low-fat diet. The FDA recently authorized the use of a health claim on food products containing psyllium and fibre is associated with a decreased risk of heart disease. Psyllium seeds also contain small amounts of phytosterols, known to lower cholesterol levels. The consumption does not affect either the serum HDL cholesterol or triglyceride levels. According to this view, psyllium in the diet appears to be safe, is well tolerated, and may improve the blood glucose and lipid levels of certain individuals as well as ensuring regularity [Winston 2000].

Brown rice

Rice bran has phytonutrients which have shown promising disease-preventing and health-related benefits [Jariwalla 2001]. Brown rice and bran contain compounds with putative cancer chemopreventive properties; like phenols (tricin), and these phenols are present at much lower levels in white than in brown rice. In this way, the consumption of rice bran or brown rice instead of milled white rice may be advantageous with respect to cancer prevention [Hudson et al. 2000]. In addition, rice-bran products may have potential applications as nutritional ingredients in the context of their utility in functional foods [Jariwalla 2001].

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ŻYWNOŚĆ FUNKCJONALNA POCHODZENIA ZBOŻOWEGO

Streszczenie. W pracy przedstawiono rodzaje żywności funkcjonalnej pochodzenia zbożowego, ich wpływ na poprawę zdrowia oraz na możliwości redukowania czynników przyczyniających się do niektórych chorób.

Słowa kluczowe: żywność funkcjonalna, zboża, pszenica, gryka, owies, jęczmień, siemię lniane, babka płesznik, ryż brązowy

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