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**Functional Food and Natural Health Product Issues:  
The Canadian and International Context**

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## **Functional Food and Natural Health Product Issues: The Canadian and International Context**

### **Executive Summary**

Consumer awareness of the relationship between diet and health has increased considerably in recent years, based on emerging evidence that a healthy diet can contribute to reduced risk of chronic diseases such as coronary heart disease, diabetes and cancer. Functional foods and natural health products have become a promising avenue to enhance health and well-being alongside broader dietary changes, both as a means to reduce the negative health effects of existing health conditions (for example hypertension) and to reduce the risk of future disease.

The development of the functional food and natural health product sector critically depends on consumer acceptance of these products. In this context, a substantial literature review and analysis of consumer attitudes and preferences towards functional foods and natural health products has been conducted to inform industry and policy decision-makers about market trends and consumer preferences, which can help in the development of market strategies and policies. This literature review includes leading and emerging countries as well as the Canadian context, in order to identify cross-country similarities and differences and gain key knowledge for the development of the Canadian functional food and natural health product sector. The main findings are summarized below.

The market for functional foods and natural health products has exhibited consistent growth over the last decade, and it is expected that this trend will continue in the coming years. The main markets are the United States, Europe and Japan, with Canada as an important secondary market. Emerging markets such as China, India, Russia, Eastern Europe, and Latin America have great growing potential. The Canadian functional food and natural health product sector has grown significantly in recent years, both in terms of the size of the domestic market and number of firms that are engaged, while export sales have also increased substantially.

Consumer attitudes towards functional foods and natural health products are largely influenced by the perceived risks and benefits of these products, which in turn are associated with the technology used in their production. Certain production technologies, for example genetic modification, are seen as risky by consumers and mitigate acceptability. Although some consumers are willing to accept products containing genetically-modified ingredients in order to obtain health-related product benefits, the majority of consumers prefer 'natural' products and conventional/familiar technologies. European consumers in particular are concerned about genetic modification and exhibit low rates of acceptance of related products. Canadian consumers generally perceive functional foods and natural health products as safe, although few, if any, are based on genetically-modified ingredients to date.

A significant proportion of consumers are aware of the role that diet plays in health and the prevention of chronic diseases, however, this does not necessarily translate into changes in dietary behaviour. This may be partially explained by the fact that many consumers think that they have good nutrition knowledge. Thus, Canadian consumers typically self-rate highly their nutritional knowledge and awareness of chronic diseases. However, this self-perception may be questionable because their real knowledge is often actually rather weak. Further, higher levels of nutritional knowledge are not always associated with greater acceptance of functional foods and natural health products.

Own and family perceptions and experiences of health risks can be a critical influence on the acceptance of functional foods and natural health products. When consumers perceive threat, and are aware of the existence of health-enhancing products to cope with this threat, they may be willing to accept these products. Canadian consumers are typically very concerned about the risk of chronic diseases such as cancer, cardiovascular diseases, obesity and high cholesterol, suggesting high levels of perceived threat to health. Similarly, the majority of Canadian

consumers perceive there is a relationship between diet and health, which provides some inducement towards dietary change.

Consumer access to, use and understanding of information regarding functional foods and natural health products can contribute to acceptance of these products. Information about such products is generally available through labels. However, many consumers may ignore this information, read it but disregard the message because of lack of trust and/or misunderstand the information that is being made available. The majority of Canadian consumers claim that they always or usually read food product labels. At the same time, a large proportion of these are sceptical about the information provided in nutrition labels, especially when the information is provided by manufacturers, and even by government. The credibility of information provided on labels and particularly through health claims is a key factor in the development of the functional food and natural health product sector in Canada.

In many product markets, functional foods compete with conventional foods. Thus, the functional product should ideally be as similar as possible to the conventional alternative, for example in terms of price, taste and convenience, to gain the acceptance of consumers. There is little empirical evidence that consumers are willing to compromise taste and convenience in order to switch to functional products. Although Canadian consumers pay great attention to the nutrition properties of food, most admit that the predominant issue is food that the family enjoys.

The carrier and the ingredients of functional foods and natural health products are also important issues influencing consumer acceptability. Dairy products, non-alcoholic beverages and bakery and cereal products are the most frequent carriers of functional ingredients at the current time. The functional ingredients most widely used in food products are antioxidants, lycopene, omega-3 fatty acids, probiotics and isoflavones. Of these, calcium and omega-3 fatty acids have the highest rate of consumption. The most widely consumed natural health products are vitamins, echinacea, herbal remedies and glucosamine.

Evidence on the influence of socio-economic and demographic variables on the acceptance of functional foods and natural health products is mixed, while suggesting significant heterogeneity of consumer preferences. Broadly, however, there is the tendency that being female, having children at home, and being middle-aged are positively associated with greater acceptance of functional foods and natural health products. Conversely, higher education tends to be negatively associated with the acceptance of functional foods and natural health products. In these regards, Canadian consumers are quite similar to those in other high-income countries.

Functional foods and natural health products usually have premium prices, both reflecting higher input costs and also an attempt to capture the value that consumers attach to their purported health properties. Consumers are generally willing to pay a higher price for health-enhancing products, especially when they are free of genetically-modified ingredients. There are also niche markets for organic products. However, in certain cases the 'willingness to pay' of consumers for such properties may be less than the price premiums that are charged at the retail level, acting to curtail purchases and consumption.

Across consumer groups there is evidently considerable heterogeneity in consumer acceptance of functional foods and natural health products, creating scope for, and even requiring, market segmentation. The success of marketing strategies and policies aimed at promoting the consumption of such products must take account of variations in levels of acceptability and the relative role of particular determining factors. To date, a variety of statistical techniques have been used to capture such heterogeneity including multivariate analysis techniques and qualitative studies. A challenge for researchers is to improve theoretical models and research methodologies to integrate perceptions, attitudes and values in analysis of consumer preferences.

Regulation of the functional food and natural health product sector is important to safeguard the safety of such products, ensure product efficacy, and facilitate effective domestic marketing and international trade. In many jurisdictions, however, regulatory regimes are under-developed and have not kept pace with changes in the sector and the underlying science. Japan is considered to have the most developed regulatory system, with the implementation of the FOSHU system since 1991. Next is probably the United States, although there are considerable controversies over the latitude given to product manufacturers in making claims about their products. In the European Union efforts are underway to harmonise regulations across the 27 Member States. The most significant advances so far have been the FUFOSE and PASSCLAIM initiatives which provide guidelines for the regulation of 'enhanced function' and 'risk reduction' claims on the basis of scientific support. Further, the Council of Ministers recently approved regulations on nutrition and health claims on foods. These regulations came into effect in July 2007. Among the emerging markets, China and Brazil appear to have the most developed regulatory systems.

The regulatory environment in Canada has changed considerably in recent years. In 2003, five health claims were permitted on food products, some of which are relevant to functional foods. Further, in January 2004 the Natural Health Product Regulations implemented an innovative regime for regulation of natural health products; arguably the first of its kind internationally. Recent studies indicate that these changes are having positive impacts on the functional food and natural health product sector in Canada, although considerable frustrations remain, for example over the rate of approval of novel foods and the ability to make product-specific claims. Such concerns are voiced by all sections of the sector, but by small and medium-sized enterprises (SMEs) in particular.

The functional food and natural health product sector offers the opportunity to reduce the direct and indirect health costs associated with a number of prevalent chronic diseases, alongside broader changes in diet. However, there are lingering concerns about the efficacy, quality and safety of these products. In many cases, the scientific evidence of their health benefits remains weak. There also concerns about adverse side effects and potential interactions with other drugs. Further, some health professionals are sceptical about the efficacy of these products, especially where they are seen as substitutes for broader dietary improvements. Thus, while health professionals in Canada may have a relatively good opinion of functional foods and natural health products, few physicians actually recommend them to their patients.

Markets for functional foods and natural health products are potentially of great benefit to the agri-food sector in Canada, for example providing opportunities for value addition and de-commodification. Current examples include the enrichment of dairy products with conjugated linoleic acid (CLA) and soy proteins in bakery products to reduce the risk of certain cancers. In Canada, raw materials for firms engaged in the production of functional foods and natural health products are largely sourced domestically, which represents opportunities in turn for primary producers. Further, there has been interest in the potential to develop 'new' health-enhancing ingredients that can be grown domestically using genetic-modification. The issue of consumer acceptability is clearly of critical importance here.

The complex issues faced by the functional food and natural health product sector worldwide, and in Canada particularly, call for public policies and business strategies that provide an appropriate regulatory, research and innovation environment. In the case of policy, however, the considerable number and diversity of stakeholders, including consumers, producers of raw materials, manufactures and retailers, makes the development and implementation of appropriate regulatory and other frameworks problematic. In the case of business decisions, firms need to adapt to a new 'model' of innovation and commercialisation; arguably many functional foods and natural products are more akin to pharmaceuticals than they are foods in terms of the economics of the innovation and commercialisation process!

## **I. Introduction:**

It is evident that consumer demand for food products in high-income countries such as Canada is facing dynamic changes (Blaylock et al., 1999; Pelupessy and van Kempen, 2005; Malla et al., 2007). Increasingly, consumers are looking at food beyond its nutritional purpose (Blaylock et al., 1999; Rozin et al., 1999; West et al., 2002) and considering a more broad set of attributes when making their food choices (Blaylock et al., 1999; Labrecque et al., 2006). One attribute that is drawing increasing attention is the health-enhancing benefits that foods can provide beyond nutrition. In turn, this has translated into demand, both actual and latent, for functional foods. While there is no generally-accepted definition of functional foods (Roberfroid, 2002; Frewer et al., 2003a), here we make reference to the descriptor employed by Health Canada (1998, p. 3):

“A functional food is similar in appearance to, or may be, a conventional food, is consumed as part of a usual diet, and is demonstrated to have physiological benefits and/or reduce the risk of chronic disease beyond basic nutritional functions.”

Beyond functional foods, the demand for health-enhancing products is also been expressed through complementary and alternative medicines, nutraceuticals, supplements, vitamins and natural products (Halsted, 2003; Health Canada, 2005). As with functional foods, these nomenclatures vary across countries and there are no universal definitions. Here our interest is in nutraceuticals and again we make reference to the definition employed by Health Canada (1998, p. 3):

“A nutraceutical is a product isolated or purified from foods that is generally sold in medicinal forms not usually associated with food. A nutraceutical is demonstrated to have a physiological benefit or provide protection against chronic disease.”

Nutraceuticals come under the broader category of Natural Health Products (NHPs), defined by the Natural Health Product Regulations implemented on January 1, 2004 as including:<sup>1</sup>

- Vitamins and minerals.
- Herbal remedies.
- Homeopathic medicines.
- Traditional medicines such as traditional Chinese medicines.
- Probiotics.
- Other products, like amino acids and essential fatty acids.

Perhaps understandably, consumer interest in functional foods and natural health products is associated with concerns over the increasing prevalence of chronic diseases such as diabetes, cancer and cardiovascular disease, and their relationship with diet (Chadwick, 2003; Cash et al., 2006). Results of recent surveys of consumer attitudes to nutrition, diet and health suggest that a large proportion of consumers have made dietary changes with the aim of improving their health (Decima Research, 2004; 2006). In this context, the use of functional foods and natural health products is seen as providing opportunities to reduce the prevalence of a number of chronic diseases, resulting in the enhanced health and well-being of consumers as well as well as

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<sup>1</sup> In this document the terms of functional foods and natural health products will be used whenever possible, according to the definitions given above. However, in certain cases other terms, such as supplements and nutraceuticals, may be used as appropriate to the references cited.

commensurate reductions in health care costs (Gray et al., 1998; Lutter and Tucker, 2002; Malla et al., 2007).

In the last decade the global market for functional foods and natural health products has experienced substantial growth, predominantly in high-income countries (Datamonitor, 2004; Nutritional Business Journal, 2004; 2007a; Euromonitor International, 2006). Those data that are available suggest that the global functional food market grew 68 percent from 2000 to 2006, according to one estimate (see below) reaching a value of US\$85.0 billion (NBJ, 2004; 2007a). Similarly, the market for supplements<sup>2</sup> is estimated to have grown 33 percent over the same period, reaching a value of US\$68.3 billion in 2006 (NBJ, 2004; 2007a). It is expected that the functional food and natural health product market will sustain an average growth rate of between seven and 10 percent in the coming years. The main markets for these products are, and are expected to continue to be, the United States, Europe and Japan.

The growth and wider dynamics of the market for functional foods and natural health products is seen as presenting business opportunities for food and health product manufacturers in Canada, both in domestic and export markets (West and Larue, 2004; Cash et al., 2006). In turn, there are prospects for suppliers of raw materials, including primary producers and ingredient manufacturers, in the form of differentiation of agricultural and food commodities on the basis of their functional properties (Hobbs, 2002; West and Larue, 2004; Maynard and Franklin, 2003; Chema et al., 2006).

The development of the functional food and natural health product sector is seen as offering a win-win scenario for consumers and the agri-food sector, as well as wider benefits for public health expenditure. The successful development of markets for such products is dependent, however, on consumer acceptability. This requires that we have a good understanding of the factors influencing acceptability of particular functional ingredients and the products in which they are incorporated. While there is an emerging literature in this area, it is evident that considerable gaps exist in our understanding, making related business decision-making and policy formulation problematic. The aim of this literature review is to provide a snap-shot of our current understanding of consumer attitudes towards functional foods and natural health products and relations with actual or intended choice behaviour. It covers not only Canada but other high-income countries with the aim of identifying cross-country similarities and differences.

The paper is organized as follows. The next section provides an overview of leading and emerging markets for functional foods and natural health products, namely, the United States, Canada, Europe, Japan, Asia and Latin America. Section 3 then focuses on the nature and role of consumer acceptability and its role in the development of markets for functional foods and natural health products. This includes attitudes towards technology applied to food in general, nutrition knowledge, perceptions of risks to health, trust in the quality and safety of food products, taste and enjoyment of food, socio-economic and demographic factors influencing choice behaviour and willingness to pay and intention to purchase and/or consume functional foods and natural health products. Throughout, there is an underlying focus on heterogeneity in consumer attitudes, preferences and choice behaviour, and the scope for market segmentation. Considering the role that regulations play in the production and marketing of functional foods and natural health products, Section 4 reviews prevailing regulatory regimes in the main international markets. Section 5 then considers the potential impacts of the functional food and natural health product sector on public health and opportunities for value addition to primary agricultural products. It also considers the challenges faced by the agri-food sector for the successful exploitation of opportunities in markets for functional foods and natural health products. Finally, Section 6 presents the main conclusions. To enable readers to follow-up areas of interests a

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<sup>2</sup> According to the Nutrition Business Journal, supplements include vitamins and minerals, herbs/botanicals and sport, homeopathic, meals and specialty supplements. The majority of these products fall under the Canadian definition of natural health products.

comprehensive list of references and a listing of Canadian researchers with an interest in consumer aspects of functional foods and natural health products are provided at the end of the document

**II. Market for functional foods and natural health products:**

As noted above, given the lack of consistent and generally-recognised definitions, it is difficult to provide precise estimates of the size of the market for functional foods and natural health products, both across and within countries. According to the Nutritional Business Journal (NBJ, 2007a), the broader global nutrition sector, which encompasses supplements (including vitamins and minerals, herbs/botanicals and sport, homeopathic, meal and specialty supplements), natural and organic foods, natural personal care products and functional foods, was valued at US\$228.3 billion in 2006. The annual rate of growth is estimated to be around seven percent. Of this, sales of functional foods are estimated to account for US\$ 85.0 billion or 37.2 percent and natural health products for US\$68.3 billion or 29.9 percent (Table 1).

Other estimates, however, suggest that the market for functional foods, for example, is smaller. According to Just-Foods (2006), the global market for functional foods was valued at US\$73.5 billion in 2005. Euromonitor International (2006), present a proximate estimate of US\$70 billion in 2004, while Verbeke (2005) suggests the market was considerably smaller in 2004 at US\$50 billion in 2004. All of these sources agree, however, that demand for functional foods, and for natural health products, will increase significantly into the near future. For example, Datamonitor (2004) forecasts that the global market for functional foods will grow to US\$89.8 billion by 2008.

**Table 1. Global Market for Functional Foods and Supplements (US\$ billion):**

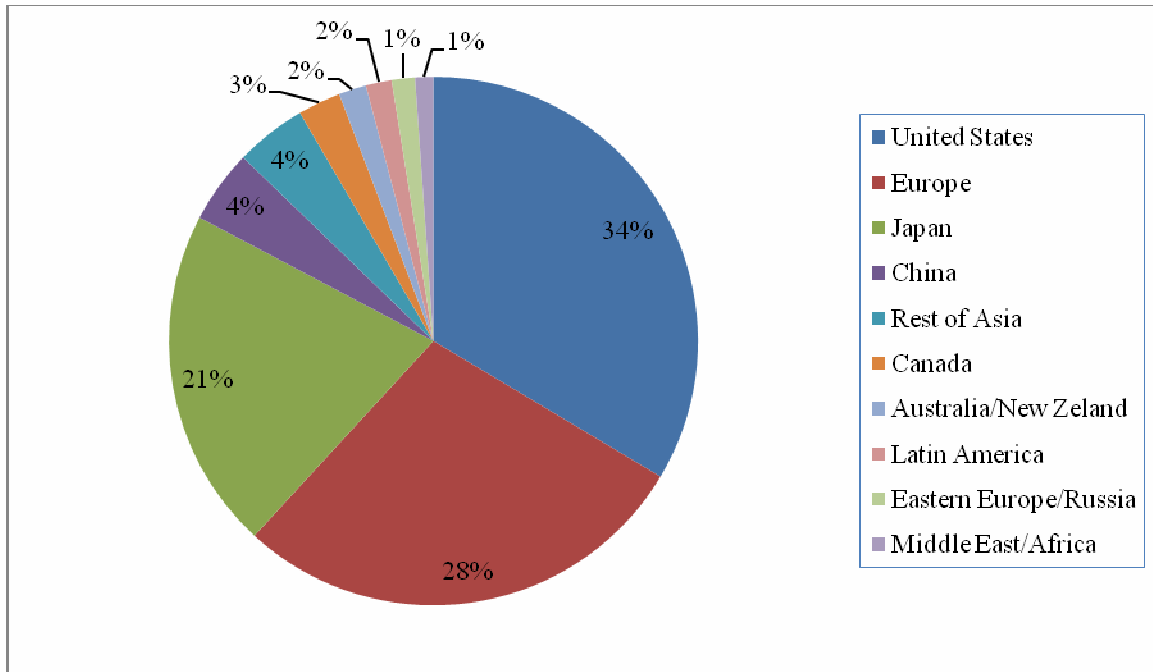
<b>Category</b>	<b>2000</b>	<b>2003</b>	<b>2005</b>	<b>2006</b>
Supplements*	51.46	60.19	65.30	68.27
Functional Foods	50.63	66.53	79.40	85.01
Total	102.09	126.72	144.70	153.28

Source: Nutrition Business Journal (2004; 2007a)

\* Includes natural health products, but may also include other supplements not included under this definition according to Canadian legislation.

At the current time, the largest markets for functional foods and supplements (taken here to be a proxy for natural health products) are the United States, Europe and Japan, accounting for 33.6 percent, 28.2 percent and 20.9 percent of sales in 2003, respectively (Figure 1). The Canadian market is estimated to have been valued at US\$3.3 billion in 2003, accounting for 2.6 percent of global sales. We now review each of the major markets in turn below.

**Figure 1. Market Share of Functional Foods and Natural Health Products by Sales, 2003:**



Source: NBJ (2004)

#### 2.1 Canada:

Given regulatory changes in Canada, in particular the implementation of the Natural Health Product Regulations (2004), assessing the evolution of the market for functional foods and natural health products is problematic. According to KPMG (2002), the nutrition industry in Canada was valued at US\$3.98 billion in 2000. Of this, functional foods accounted for US\$1.62 billion or 40.7 percent and natural health products US\$1.2 billion or 31.1 percent (Table 2). Provinces accounting for the largest proportion of firms engaged in the nutrition industry were Ontario (25%), Quebec (23%) and British Columbia (22%). Saskatchewan and Alberta accounted for 12 percent and seven percent of firms engaged in the nutrition sector, respectively.

**Table 2. Functional Foods and Natural Health Products Sales in Canada (US\$ billion\*)**

Category	2000	2003	2004***	2006
Natural Health Products (NHP)**	1.24	1.31	1.62	1.82
Functional foods (FF)	1.62	2.01	0.83	-
FF/NHP	-	-	0.44	-
Total FFNHP	2.86	3.32	2.89	-
Total nutrition industry****	3.98	4.83	-	6.15

Source: KPMG (2002); Nutrition Business Journal (2004; 2007a); Palinic (2007)

\* 2000, 2003 and 2006 values are in US\$ dollars; 2004 in CAN\$ dollars

\*\* 2000, 2003 and 2006 values include natural health products, but it may also include supplements not considered natural health products under the pertinent regulations in Canada.

\*\*\* Values reported in 2004 are according to current Canadian definitions

\*\*\*\* Includes all the categories used by the Nutrition Business Journal

In 2003, the estimated size of the Canadian nutrition sector was US\$4.83 billion (NBJ, 2004). Of this, supplements (vitamins and minerals, herbs/botanicals and sport/meal supplements) accounted for US\$1.31 billion and functional foods for US\$2.01 billion. By 2006, the value of the

nutrition sector is estimated to have reached US\$6.15 billion, of which US\$1.82 was natural health products (NBJ, 2007a).

Palinic (2007) reports results from the 2005 Functional Foods and Nutraceuticals Survey undertaken by Statistics Canada on behalf of Agriculture and Agri-Food Canada (AAFC). According to this survey, nearly 400 firms in Canada were involved in the production of functional foods and natural health products in 2004. Over the period 2002-2004, the number of firms producing functional foods and natural health products is estimated to have increased by 32 percent, sales revenue by 15 percent and the value of exports by 43 percent, indicating the vibrant growth of the industry. The total revenue of these firms was estimated at CAN\$2.9 billion, of which CAN\$823.91 million was accounted by firms engaged in the production of functional foods, CAN\$1.6 billion by firms producing natural health products and CAN\$442 million by firms producing both functional foods and natural health products. The total number of functional food and natural health products on the Canadian market was estimated to be 9,175, of which 6,327 products, or 69 percent, were natural health products.

## 2.2 United States:

The nutrition sector in the United States has grown rapidly over the last 15 to 20 years, from an estimated value of US\$20.0 billion in 1990 to US\$ 84.9 billion in 2006 (Table 3) (NBJ, 2006; 2007a). In 2006, functional food was the largest nutrition sub-sector, followed by organic foods and supplements. Collectively, functional foods and supplements accounted for 63.4 percent of the nutrition sector. Further, sales of functional foods and supplements are exhibiting significant rates of growth annually at six to eight percent and three to five percent, respectively. Functional food also accounts for a significant share of the 'healthy' food market in the United States, comprised of organic, functional and nutritionally adapted food products (for example low fat). Of total sales of US\$120 billion, functional foods are estimated to account for 26.2 percent (NBJ, 2007b).

**Table 3. Nutrition Sector in the United States (US\$ billion):**

Category	2003	2004	2005	2006
Supplements	19.82	20.39	21.32	22.46
Natural and organic foods	16.24	18.38	20.84	23.60
Functional foods	22.73	24.46	26.66	31.40
Natural and organic personal care	4.92	5.72	6.56	7.49
Total nutrition industry	63.71	68.95	75.38	84.95

Source: Nutrition Business Journal (2004; 2006; 2007a)

## 2.3 Europe:

After the United States, Europe is the main nutrition market in the world. In 2003, this market reached US\$56.73 billion, from which US\$6.22 billion corresponded to herbal/botanical products and US\$20.71 billion to functional foods. Other important categories of this market were vitamins and minerals with US\$5.90 billion and natural and organic food with US\$16.29 billion. Within Europe, Germany, the United Kingdom, and France are the leading nutrition markets. The functional food market value in 2003 in these countries was US\$4.46, US\$4.67, and US\$4.01 billion respectively. Additionally, Germany was the absolute leader in Europe in 2003 in the herbs/botanical category, with US\$3.2 billion in sales (NBJ, 2004). In 2006 the nutrition industry in Europe reached US\$64.24 billion (NBJ, 2007a).

## 2.4 Japan:

The Japanese market for functional foods and natural health products is one of the most sophisticated and dynamic (see for example Shimizu, 2003; Ohama et al., 2006). According to Euromonitor International (2003), the market for functional food was valued at US\$12 billion in 2000, and was projected to reach US\$15 billion by 2005. Per capita expenditure on functional foods was predicated to increase from US\$84 in 1998 to US\$105 in 2003 and \$126 in 2006. More recent estimates suggest the functional food market was valued at US\$19 billion in 2004 (Euromonitor International, 2006).

The total nutrition sector is estimated to have been US\$31.52 billion in 2003, of which functional foods accounted for US\$16.42 billion, or 52.1 percent (NBJ, 2004). By 2006, the value of the nutrition sector is estimated to have reached US\$36.62 billion (NBJ, 2007a), a growth of 16.1 percent over only two years.

## 2.5 Other Asia:

While Japan is the leading functional food and natural health product market in Asia, other Asian countries such as China and India are gaining significance (Benkouider, 2005; Kotilaine et al., 2006). According to Sun (2006) the health food sector in China was valued at about US\$6.0 billion in 2003, with projected growth of 100 percent by 2010. A similar trend is observed in India

(Ismail, 2006). One potential key advantage for Chinese firms engaged in this sector is that a unique system for the approval of functional foods is being implemented (Arai, 2002).

According to NBJ (2004), the total nutrition sector in China and the rest of Asia (excluding Japan) in 2003 was valued at US\$6.94 billion and US\$7.64 billion, respectively. Within this, sales of functional foods accounted for US\$790 million in China and US\$1.36 billion in the rest of Asia and herb/botanical products for US\$2.4 billion in China and US\$1.76 billion in the rest of Asia. By 2006, the total nutrition industry sales in China and in the rest of Asia reached US\$9.71 and US\$10.68 billion, respectively (NBJ, 2007a).

#### 2.6 Latin America:

Latin America is considered an emerging functional food and natural health product market where cultural factors, low levels of nutrition knowledge and income constraints may limit the penetration of such products. Nevertheless, in large urban areas there are considerable numbers of health conscious consumers with the effective demand required to purchase functional foods (Lajolo, 2002). In this context, Brazil and Mexico are the markets considered to have the greatest potential (Benkouider, 2005). Estimates of the nutrition sector in Latin America value sales was at US\$3.67 billion in 2003, of which US\$530 million, or 14.4 percent, was functional foods and US\$1.47 billion, or 40.1 percent, was supplements (NBJ, 2004). By 2006, the value of the nutrition sector is estimated to have grown to US\$5.79 billion (NBJ, 2007a).

#### 2.7 Other markets:

With growth in per capita incomes in emerging and transition economies, for example Hungary, Poland and Russia, there is recognised to be potential for the establishment of markets for functional foods and natural health products (Benkouider, 2005; Kotilaine et al., 2006). Indeed, these markets are considered to have some of the greatest potential for growth in coming years (NBJ, 2004). In 2003, the total nutrition sector in Eastern Europe and Russia was valued at US\$2.25 billion, of which US\$550 million, or 24.4 percent, was functional foods and US\$290 million, or 12.9 percent, was herbs/botanicals.

Among the other markets with growth potential for functional foods and natural health products are Australia and New Zealand. The nutrition sector in these countries is estimated at US\$3.21 billion in 2003, of which US\$840 million (26.8%) was functional foods (NBJ, 2004).

### **III. Consumers' role in the functional food and natural health product market**

A large number of factors may affect the consumption of functional foods and natural health products (see for example Frewer et al., 2003a; Sadler, 2005; Verbeke, 2005). So far, research on the motivation to purchase and/or consume such products has focused on beliefs, nutritional knowledge and attitudes, as well as the socio-demographic characteristics of consumers (Bogue et al., 2005; Teratanavat, 2005; Verbeke, 2005; Labrecque et al., 2006). Given the complexity of the determinant factors, however, remains great uncertainty about which factors are the dominant drivers and/or that act as constraints on acceptability. We review a range of these particular factors in turn below.

#### 3.1 Attitudes towards technology, innovation and new products:

The development of the functional food and natural health product sector is closely associated with technological innovations in food and other products. In this context, understanding consumer attitudes towards new technologies and products becomes relevant. Several studies have looked at related consumer perceptions (see for example Bredahl, 2001; Frewer et al., 1997; Frewer et al., 1998; Frewer, et al., 2003b; Henson et al., 2007).

Frewer et al. (1997) analyze consumer attitudes towards different processing technologies in cheese production in the United Kingdom. The results reveal that while consumers are concerned about production methods (for example negative attitudes towards genetic modification), the tangible benefits of novel food products seem to be given greater importance.

Subsequently, Frewer et al. (1998) found a negative relationship between the perceived risks and perceived benefits of a range of food and non-food technologies. For technologies that are widely accepted, for example canning and pasteurisation, the perceived benefits are generally much higher than the perceived risks. Conversely, perceived risks tend to outweigh the perceived benefits in the case of technologies that are less accepted, for example food additives, food irradiation and genetic engineering applied to plants and animals for food.

A more in-depth study by Frewer et al. (2003b) analyzes consumer perceptions of the risks and benefits of genetically-modified beer and yoghurt in Denmark, Germany, Italy and the United Kingdom. The results suggest that attitudes towards genetic modification are mainly driven by trust in institutions engaged in the promotion or regulation of the technology, although the relationship between the source of information and perceived risks or benefits is not straightforward. Indeed, prior consumer attitudes play a critical role in attitude change. The results of this study show the difficulties faced in changing consumer attitudes towards genetically-modified foods even when a range of information strategies are used. In this case, information provision was found to have little impact on attitudes towards genetically-modified foods, while the degree of trust in different sources of information was influenced by pre-existing attitudes towards such foods.

Bredahl (2001) presents further analysis of data from the study of consumer attitudes towards genetically-modified beer and yoghurt benefits in Denmark, Germany, Italy and the UK. The results suggest low levels of acceptance of genetically-modified foods in all four countries. Even though the perceived benefits of the technology are found to have a significant effect on attitudes, these benefits are offset by perceived risks. Furthermore, perceived benefits and risks are embedded in wider attitudes, for example attitudes towards technology and nature, levels of food neophobia, alienation towards the market place, and perceived knowledge. Analysis of cross-country differences reveals that attitudes are similar among Danish, German and British consumers, where perceived risks seem to out-weigh perceived benefits. Italian consumers show distinct attitudes towards genetically-modified foods, in that perceived risks and benefits seems to be in balance.

Baker and Burnham (2001) employ conjoint analysis to evaluate consumer attitudes towards genetically-modified breakfast cereal in the United States. Generally, consumers are found to have a negative attitude even when the sample is segmented into three clusters; these negative attitudes towards genetic modification persist across all three clusters. For 30 percent of the sample, the relative importance of genetic modification on product acceptance is around 70 percent, showing very strong negative attitudes. The acceptance of the genetically-modified cereal was negatively associated with the perceived risk of the technology. Conversely, Chema et al. (2006), finds that US consumers of foods containing soybeans may accept genetic modification foods if such foods have positive functional characteristics, such as higher protein, increased calcium content or act to lower cholesterol. In this case it seems that there is scope for perceived benefits to out-weigh perceived risks. At the same time, however, there is significant heterogeneity in the sample studied such that a significant minority favour organic and genetically-modified-free food products.

While the level of concern about technologies used in the production of functional foods may have a strong influence on consumer perceptions, the choice of such products is not made in isolation of other factors, notably the other characteristics of the product. Thus, consumers may be willing to accept otherwise undesirable technologies if there are offsetting benefits. Thus, Cardello (2003) suggests that providing information on the safety of these technologies and the potential health benefits, alongside exposure to visual product characteristics, can improve the liking of novel products among consumers.

The perceived health benefits and other rewards from consuming functional foods are key determinant factors of the acceptance of functional foods and natural health products. Verbeke

(2005) finds a positive and statistically-significant relationship between beliefs about health benefit on the acceptance of functional foods in Belgium. Similarly, Urala and Lähteenmäki (2004) find that reward perceptions of the rewards from consuming functional foods have positive and statistically-significant impact on the willingness to use functional foods in Finland, including juices enriched with probiotics and calcium, milk with enhanced calcium, cholesterol-lowering spreads, blood pressure lowering milk drinks, energy drinks and meat products with added fibre.

A broader array of attitudes also plays a role in mitigating consumer acceptance of technologies used in food production, for example neophobia (Cardello, 2003; Bäckström et al., 2004). Cardello (2003) assesses the impact of a range of novel processing technologies on product liking. The existence of many of these new technologies, as well as more general attitudes towards things that are new, is found to have a significant impact, especially among women. Particular concerns are revealed for technologies such as genetic engineering, use of bacteriocins, irradiation and pulsed X-ray technologies. Bäckström et al. (2004) use social representations that are socially constructed and encompass values, ideas and practices to understand the attitudes of consumers towards novel foods. Employing 27 social representation statements the authors identified five distinct consumer constructs, namely, 'resistance to and suspicion of novelties', 'adherence to technology', 'adherence to natural foods', 'food as 'enjoyment' and 'food as a necessity'. Consumers are more likely to try familiar foods (such as pineapple, ham, fat-free yoghurt, organic bread and functional yoghurt), but less likely to try novel foods (such as snails and genetically-modified foods). Suspicion of things new negatively affects the consumption of new products. At the same time, adherence to technology positively affects the consumption of genetically-modified foods, adherence to nature positively affects the consumption of organic products and enjoyment and change-seeking positively affects the consumption of snails.

Several studies analyze the importance of new technologies on consumer preferences towards food products in Canada (West et al., 2002; Larue et al., 2004; West and Larue, 2004; Labrecque et al., 2006; Henson et al., 2007). For example, Henson et al. (2007) report a study of consumer attitudes towards a range of food and non-food technologies. Consistent with previous studies in other countries, the trade-off between perceived risks and perceived benefits is found to be a critical influence on acceptability. Respondents perceive higher risks and lower benefits for the use of pesticides, hormones, irradiation, and genetic engineering (especially for animals) in food production. In the case of functional foods and nutraceuticals, however, consumers perceive low risks and high benefits, suggesting higher levels of acceptability.

West and Larue (2004) study the likelihood of consumers adopting novel foods with health-enhancing properties. They find that negative attitudes towards genetic modification significantly reduce the likelihood that consumers are early adopters of novel foods. Indeed, their study results suggest that only 27 percent of consumers fall into this category. Conversely, 47 percent of the participants in the study were late adopters. West et al. (2002) had previously found that around 40 percent of consumers appear to be somewhat or very opposed to genetic modification of foods.

The value attached by consumers to functional properties in food is explored by West et al. (2002) and Larue et al. (2004), specifically in tomato sauce, potato chips and chicken. Consumers attached a positive and significant value on the functional property in all of these products. After controlling for price and functional property, around 83 percent of study participants preferred regular tomato sauce rather than the genetically-modified variant. An even greater proportion preferred the non genetically-modified variant in the case of chicken. These results suggest that the technologies employed in the production of functional foods and nutraceuticals can have a critical mitigating effect on the propensity of consumers to accept these products. In only a product, potato chips, is there a positive interaction between genetic modification and the presence of functional properties, suggesting that the negative value attached to the fact that the product is genetically-modified is more than offset by the value of the

functional property. Overall, however, there is significant variation in the value attached to the product variants and attributes, suggesting considerable heterogeneity across consumers.

As suggested by previous studies outside of Canada, attitudes towards innovation and levels of neophobia can play a significant role in determining the acceptance of functional foods. Labrecque et al. (2006) analyze the acceptance of functional foods among French, American and French-Canadian students. The results reveal that, while innovativeness has an insignificant effect on general attitudes towards functional foods, neophobia also has a significant and negative effect among French students, but not on French-Canadians and Americans. Perceptions of benefits from the functional ingredient, as well as the product as a whole, were found to be significant determinants of general attitudes towards functional foods.

In the case of natural health products there has been much less research on consumer attitudes, perhaps reflecting the very great diversity of products. However, survey data from Health Canada suggests that consumers feel less at risk from such products, while being sceptical of the reliability of the claims made by product manufacturers (Health Canada, 2005). Indeed, in the survey sample, only 14 percent of respondents considered such products harmful, perhaps reflecting the fact that the term 'natural' is associated with safety. At the same time, the vast majority (around 84%) considered that such products should be regulated by government, while 69 percent wanted more information on their safety and/or efficacy.

Broadly, existing studies suggest that the acceptability of functional foods and natural health products is closely tied to perceptions of risks and benefits. Thus, to gain broad consumer acceptance, these products should provide tangible benefits and offer low risks. In turn, this implies that they are perceived to be 'natural' and emanate from technologies that are known and familiar. The simple fact that these products, and the associated technologies are new, acts to mitigate acceptance. Overlaid, on all of these factors is the fact that genetic modification is broadly perceived as a negative product attribute that can be valued so negatively that it wipes out the positive value attached to any functional property that a product may offer.

### 3.2 Nutrition knowledge, disease/diet awareness and use of information:

Hypothetically, nutrition knowledge and disease awareness are key determinants of consumer attitudes towards functional foods and natural health products. For example, we might reasonably expect a positive relationship between a consumer's knowledge and nutrition and awareness of links to health and the propensity to consume functional foods and nutraceuticals. Conversely, Blaylock et al. (1999) pose the question: "why Americans with an abundance of nutrition information, high incomes, and low food prices don't eat better?" (p. 271). In spite of the fact that the nutrition knowledge of US consumers has increased over time, diets broadly remain out of synch with official nutritional recommendations.

Variyam and Blaylock (1998) suggest that most US consumers are able to identify foods that have high levels of fat, fibre and/or cholesterol. Similarly, the majority of consumers are aware of the potential health problems associated with certain nutrients such as fat, salt, cholesterol and sugar. In this study, a Healthy Eating Index (HEI) was developed with values of one to 100, with higher levels of knowledge being associated with a greater index value. Most sub-groups of consumers according to age, level of education, income, gender, race, ethnicity and smoking habits have an average HEI of between 51 and 80, with the value being positively related to age, income, education, being female and not smoking.

Bogue et al. (2005) analyse the dietary behaviour of a representative sample of Irish consumers. A Knowledge Index is created to assess awareness of ten nutrition knowledge items, with a maximum score of 13. The mean score across the sample as a whole is 8.5, with higher levels found among women, people in the age group 35-54 and among respondents with higher levels of education and/or income. Consumers with higher values for the knowledge index were more likely to have adopted health-enhancing diets.

Verbeke (2005) suggests a more complex relationship between nutrition knowledge and consumption of functional foods in a study of Belgian consumers. Consumers with higher levels of knowledge are found to have a lower and statistically significant propensity to consume functional foods, while having medium rather than little nutrition knowledge is not a statistically significant determinant of purchase behaviour. There is also found to be a significant interaction between age and higher levels of knowledge, indicating that older consumers with better nutrition knowledge of functional foods are more likely to consume functional foods.

Nutrition knowledge and awareness of the relationship between diet and health are important factors more broadly in determining the food choices of consumers. However, enhancing knowledge is not a panacea (Blaylock, et al., 1999); we cannot assume that educating people about the benefits of a more healthy diet will promote dietary change. As an example, Alston et al. (2006) show how rates of obesity in the United States have increased steadily over recent decades despite the fact that consumers are evidently informed about the relationship between obesity and health. Indeed, Munene (2006) finds relatively high levels of nutrition knowledge among US consumers, as well as relatively high awareness and knowledge of functional foods. In this study, however, nutrition knowledge and knowledge of functional foods had no significant effect on the willingness to pay for functional foods associated with prevention of cardiovascular disease and cancer.

In Canada, several studies evaluate the level of awareness and knowledge of nutrition and/or impacts on acceptance of functional foods. Broadly, Canadians self-rate themselves as having good knowledge of nutrition. According to NIN (2004), 29 percent consider that they are 'very knowledgeable' while a further 60 percent considering that they are 'somewhat knowledgeable'. Similar surveys in 1997 and 2002 had comparable results. Higher levels of self-assessed knowledge are found among women, older consumers and those with higher levels of education. According to NIN (2004) there is a high level of awareness of the link between nutrition and certain diseases, for example that consumption of fibre reduces the risk of colon cancer (80%), reducing the consumption of fat can lower cholesterol levels (81%) and that fibre consumption can help reduce cholesterol levels (76%). Similarly, the majority of Canadians consider that consumption of vegetables, fruits and fish is an effective way to improve health (Decima Research, 2004; 2006).

There is some evidence that the awareness and knowledge of Canadians regarding functional foods has increased significantly over time, as reflected in the ability of survey respondents to match health-enhancing foods with diseases in a series of surveys of AAFC over the period 2000 to 2006 (Decima Research, 2004; 2006). At the same time, there is evidence that consumers are not aware of the specific health benefits of a number of functional foods. Thus, the 2006 survey indicates that around 70 percent of respondents could not identify any food that was associated with the prevention of arthritis, Alzheimer's disease, prostate cancer and ailments associated with the menopause. A smaller but still significant group (48%) were not aware of any foods that could aid in the prevention of diabetes, mental performance or colon cancer (Decima Research, 2006). This suggests that, while Canadians may have quite good broad knowledge of nutrition and links to health, relatively few (probably around 20%) have specific knowledge of the role that particular foods might play in prevention of particular diseases. Such specific knowledge is positively associated with being female, being aged 45 to 54 years and having higher levels of education and/or income.

It is also evident that self-assessment of knowledge may be an unreliable indicator of what consumers really know. Indeed, West et al. (2004) find that the knowledge of Canadian consumers regarding food production processes is generally very low. For example, only five percent of respondents could correctly answer six knowledge questions about the nature of conventional and organic methods of production and genetic modification. The highest level of awareness is found to be in British Columbia, where eight percent of respondents answered all

questions correctly, and the lowest in Quebec where only 1.5 percent answered all six questions correctly. Thus, as West et al. (2004, p. 549) state: “people who think they know and people who actually do know may not be the same.”

Labrecque et al., (2006) explore the knowledge of university students regarding functional foods in Quebec, France and the United States. The results indicate that 45.8 percent and 56.9 percent of Canadian and US respondents are knowledgeable about functional foods, respectively. The comparable proportion of French university students is 10.6 percent. The knowledge variable is sub-divided into low, medium and high categories and found to be a statistically significant determinant of attitudes towards functional foods in the entire sample, but not in the Quebec, US and French sub-samples, suggesting that other factors are at play.

In conclusion, nutrition knowledge and awareness of links to health is hypothesised to have a positive impact on attitudes towards functional foods and natural health products and on the propensity to consume. Put simply, we might expect that consumers who recognise the importance of nutrition to health will try to ‘do something about it’. If you are not aware that diet matters, will you attempt to make any changes? The findings of this sub-section, however, suggest that the influence of knowledge is far from straightforward. Generally, consumers are aware of the positive relationship between diet and health. Nevertheless, this awareness does not always translate into the adoption of a healthy diet, or the consumption of functional foods, for example. Broadly, Canadian consumers consider themselves to be very knowledgeable about nutrition and of the role of diet in preventing chronic diseases. However, empirical evidence suggests that their real knowledge of Canadian consumers can be quite limited, perhaps explaining why perceived knowledge does not always translate into action.

### 3.3 Perception of health risks:

The propensity of consumers to use functional foods and nutraceuticals is closely related to perceptions of the personal risk of disease and of the efficacy of functional foods and nutraceuticals to offset this risk (Frewer et al., 2003a). Consumers can be prone to over optimism, perceiving that their own risk is lower than that for the general population, which acts to discourage consumption. However, if consumers have an adverse experience, or observe such an event in a relative or friend, their perception may change, in turn bringing about shifts in attitudes towards functional foods and natural health products (Frewer et al., 2003a; Verbeke, 2005). Nevertheless, understanding perceptions of the risk of disease is far from straightforward, especially where there are large differences in relative and absolute frequencies. As an illustration, Frewer et al. (2003a) provide the example of a disease that occurs among one in 10,000 individuals. If a functional food can potentially reduce the risk of this disease by 50 percent, it means that the disease will now occur in one in 20,000. Compare this scenario to one in which the disease initially occurred in one in ten individuals. Here, a 50 percent risk reduction would result in one case in 20 people. Reasonably, the language used to communicate with consumers about the risk of disease can have profound impact on the degree and nature of attitudinal changes (van Kleef et al., 2005).

It is recognised that perceptions of risk and related health concerns may not always lead to the same dietary behaviour. Rozin et al. (1999) analyses the food attitudes of adults and university students from the United States, Japan, Belgium and France. Consumers from all countries have almost identical perceptions regarding the link between diet and health, specifically related to heart disease, obesity and cancer. However, there are distinct differences in the reported frequency of consuming reduced salt and reduced fat foods across the four countries, with the lowest frequency in France and the highest in the United States. While US consumers show the highest concern and worry about diet and health, they have the lowest self-assessment of diet healthiness across the four countries. Paradoxically, although the French respondents in the study had the lowest self-reported frequency of consuming reduced fat and reduced salt foods, they considered themselves to have the healthiest diets.

To explore the impact of risk perceptions and health concerns on the propensity to consume functional foods and natural health products, alongside perceptions of the efficacy of these products, Cox et al. (2004) and Cox and Bastians (2007) employ Protection Motivation Theory (PMT). In one study, the intention to consume functional foods to offset memory loss is explored, suggesting that the perceived efficacy of the product and the ability of consumers to use the product as instructed (self-efficacy) are significant determinants of propensity to consume, while all variables related to the threat of disease and its health consequences are insignificant (Cox et al., 2004). In a similar study on selenium-enriched foods, fear of disease and perceived vulnerability and severity are significant determinants of propensity to consume, alongside product efficacy and self-efficacy (Cox and Bastians, 2007).

Information on the perceptions of Canadians about health risks and diet are available from consumer surveys undertaken for AAFC by Decima Research over the period 2000 to 2006. In the 2004 survey, the majority of respondents considered that they had good health; around 84 percent indicated their health to range from 'good' to 'excellent' (Decima Research, 2004). A similar study Reported by NIN (2004) indicates that 89 percent of Canadians consider their health to be good or better. In both studies, positive perceptions of health are positively associated with higher levels of education and income, and being female. Further, in the repeated surveys by Decima Research, the majority of respondents consider that they have a great deal of control over their own health (Decima Research, 2006).

Alongside perceptions that their own health is good, there is evidence that Canadians have considerable concerns about a range of potential health problems and diseases. Thus, Decima Research (2004) indicates that a significant proportion of people are concerned about cancer (38%), cardiovascular/heart disease (37%), obesity (35%) and high cholesterol (34%). In the repeated survey in 2006, the main health concerns are heart problems (32%), prostate cancer (26%), and colon cancer (19%). Broadly, older, less educated and lower income consumers exhibit the most concern (Decima Research, 2006). Further evidence on the health concerns of Canadians is provided by Krewski et al. (2006), providing a quite different perspective on how consumers view the risks they face. Thus, the chief health concerns are obesity, fast foods and genetically-modified foods. Conversely, natural products are considered to pose low risks. Similar to the Decima surveys, however, risk perceptions are greatest among those with lower levels of education, older age groups and women.

There is also evidence that Canadian consumers consider food and nutrition to play an important role in overall health. Thus Decima Research (2006) reports that 92 percent of respondents agreed that some foods contain components that can help reduce the risk of diseases as well as improve long term health. Further, 85 percent agreed that some foods can be used to decrease the use of medications. Although a large proportion of respondents were of the view that consuming fortified foods (69%) and taking vitamins/supplements (60%) on a daily basis was potentially beneficial to health, there was less agreement on this than in the comparable survey in 2004 (Decima Research, 2004; 2006).

One of the key concerns here is whether the health concerns of consumers in Canada get translated into lifestyle changes, specifically related to diet. Decima Research (2004) reports that 73 percent of Canadians claimed to have made lifestyle changes to enhance health in the last two years. Of this, 29 percent reported having increased their consumption of fruits and vegetables, 25 percent having reduced their consumption of fat and 14 percent having reduced their consumption of sugar.<sup>3</sup> While the results of the 2006 survey (Decima Research, 2006) indicate a similar proportion of consumers having made lifestyle change to promote health, there are significant differences in the frequency of making specific dietary changes. A higher proportion of respondents claimed to have increased their consumption of fruit and vegetables

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<sup>3</sup> NIN (2004) reports very similar findings.

(34%), while a lower proportion reported having reduced their consumption of fat (18%) and sugar (10%).

Cranfield et al. (2007) use PMT to assess the factors influencing health-related dietary change among Canadian consumers. Both perceived threat of disease and response efficacy are statistically significant determinants, having a positive influence on the propensity to make dietary changes. This suggests that consumers are motivated to change their diet for reasons of health if they perceive that diet can contribute to reductions in health risk (response efficacy) and when they feel at risk of disease (threat).

Existing studies, in Canada and internationally, suggest that an important factor mitigating diet change, and consumption of functional foods and nutraceuticals, is the level and nature of perceptions of health risk. Consumers are motivated to adjust their eating patterns when they perceive to be at risk of a disease, even though they may consider themselves to be in good health at the current time, and perceive that dietary change can contribute to reductions in this risk. Clearly, such perceptions may not bear much resemblance to reality; the actual risk that individuals face may be higher/lower than they are aware. The way such perceptions are formed is complex, and difficult to change, reflecting among other things personal and family health histories.

#### 3.4 Role of information and trust:

A critical factor underlying many of the issues discussed above is the flow of information to consumers that influences perceptions and is critical to attitudinal change. Not all information is treated equally; some information may be freely attended to and given credence, while other information is ignored. Key factors here include the source of the information, message content, vehicle of the information, trust in the information source, etc.

While consumers typically declare considerable interest in information related to diet and health, this does not always translate into levels of usage. Thus, Sadler (2005) reports that between 74 and 87 percent of European consumers want nutritional information on food product labels, while only a small proportion of consumers pay attention to this information when it is provided. Instead, greater attention is given to the brand, expiry date, size and price. Indeed, there is evidence that consumers may not attend to the information on food product labels, even where they have concern about a product attribute. Thus, Noussair et al. (2002) explore the impact of information on the propensity of French consumers to choose genetically-modified foods, specifically a chocolate bar. It is found that, passive provision of information on the product - in this case the fact that it is genetically-modified - has only a marginal impact on choice behaviour. It is only when this information is actively drawn to the attention of consumers that a significant change in choice behaviour occurs.

Of particular relevance to functional foods and natural health products is the impact of health claims on product choice. Bech-Larsen and Grunert (2003) study the perceived healthiness of functional foods among Danish, Finnish and American consumers. While the response to physiological claims is positive in all three countries, the response to prevention claims is lower among Danish and Finnish consumers than among US consumers. This result perhaps reflects the fact that US consumers have had greater exposure to prevention claims. There was also variation in the response to specific claims across the study countries. For example, while Finnish consumers reacted positively to enrichment with oligosaccharides, Danish and US consumers had negative perceptions

The manner that information is provided to consumers is a critical influence on their acceptance of functional foods and natural health products. Thus, while the attractiveness, credibility and uniqueness of functional foods products are significant drivers of consumer intention to purchase (van Kleef et al., 2005), the influence of these factors is mitigated by health claims and how these are delivered. For example, Roe and Teisl (2007) explore how differences in message and the

source of information influence perceptions of genetically-modified food products in the United States. The wording of the labels is found to affect both the credibility and accuracy of the message to consumers. The credibility of the message is also closely associated with the source. In this case, the most trusted source is the US Food and Drug Administration (FDA).

Urala and Lähteenmäki (2004) analyse the role of claims and other information, alongside other factors, consumer attitudes towards functional foods in Finland. Confidence in claims and other information is found to have a positive effect on the willingness to try juices enriched with probiotics or calcium, milk enriched with calcium and meat products with added fibre. Similarly, van Trijp and van der Lans (2007) find that consumer perceptions of functional foods in Italy, Germany, the United Kingdom and the United States are driven by claims, including the purported health impacts, consumer appeal and claim comprehension. Significant cross-country differences are observed in these factors, and also in the impact of claims on consumer perceptions according to the message and type of claim.

The credibility of information regarding functional foods and natural health products is recognised to be a key factor in consumer acceptance of these products as well as for the development of the industry (Veeman, 2002; Herath et al., 2006; 2007a). The relationship between trust in information and change in attitudes more generally is, however, far from straightforward (Frewer et al., 2003b). According to Sadler (2005), only 53 percent of European consumers trust the information provided on food product labels. At the same time, however, there is considerable variation across countries, from a high of 70 percent in Germany to 33 percent of consumers in Denmark. Indeed, Beijboom (2006) contends that, as the relationship between food and health becomes more intertwined, trust among different stakeholders is central. As consumers cannot completely assess all the information that is available to them regarding foods and their relationship with health, other actors such as scientists, dieticians, physicians, and public health institutions play a key role in safeguarding the interests of consumers and in promoting trust in functional foods and natural health products.

In the Canadian context, there is evidence that consumers have become more interested in information on food and health. In 2004, 69 percent of Canadians reported that they always/usually read labels on food products (Decima Research, 2006). Research reported by NIN (2004) suggests a slightly higher proportion (75%) of consumers reading labels, which compares with only 61 percent in 1989. Besides product labels, other important sources of information on diet and health include health professionals (42%), health related books (39%), internet (37%) and the media (28%). Across these sources there are significant differences in perceived credibility, with the highest for doctors (79%), dietician/nutritionist (74%) and pharmacists (66%). Conversely, product labels are generally not regarded as credible (38%), despite being one of the most consulted sources of information (Decima Research, 2004; 2006).

While there is evidence that Canadian consumers are willing to consume foods that have positive health benefits, including functional foods, trust in the information provided on these foods is a critical factor influencing the willingness to consume particular food products (West et al., 2002). In this study, around 44 percent of Canadian consumers are found to be sceptical about the information provided in nutrition claims. Rates of scepticism vary by province, with the highest rates of scepticism in British Columbia and the lowest in Atlantic Canada. Consumers have the greatest confidence in the information provided by consumer/environmental groups and are least confident about that provided by food manufacturers and then government. This could have a significant impact on the efficacy of efforts to promote functional foods on the part of the food industry and of public health campaigns on the part of government.

While there is evident scepticism of information and diet and health among Canadian consumers, there is some indication that such information is regarded as more credible than in the United States and France (Labrecque et al., 2006). There are also differences in the impact that the perceived credibility of information has on attitudes towards functional foods. Credibility of

information was found to have a positive and statistically significant impact on attitudes towards functional foods among French Canadian and French consumers, but is insignificant in the case of the US sample.

Despite the fact that consumers generally profess a demand for information on diet and health, there are significant variations in the degree to which this information is actually used and the influence on attitudes towards functional foods and natural health products and the propensity to consume. Critical here is the message being presented and the nature of the mode of delivery. Cutting across all such factors, however, is the credibility of the information source. This suggests that the ability to communicate the potential benefits associated with functional foods and natural health products reflects not only the message being delivered, but also the form such communication efforts take and who drives them. While personal and/or expert sources of information are seen as most credible, most notably doctors, these are not amenable to mass communication. On the other hand, while food labels are reported to be used frequently, they lack credibility!

### 3.5 Compromising taste, enjoyment and convenience for health benefits:

To enter the choice set of consumers, functional foods must compete with conventional food products that are available in the marketplaces (Frewer et al., 2003a; Mark-Herbert, 2003). If consumers do not have strong incentives to switch to functional foods they are likely to continue consuming non-functional alternatives. Key factors here are the taste and other organoleptic properties and convenience of functional foods as perceived by the consumer. Thus, Blaylock et al. (1999) suggest that while food prices are generally not a constraint on the consumption of health-enhancing foods in the United States among middle and high income consumers, convenience in the face of time constraints is often a critical factor. Further, consumption of functional foods represents a trade-off between immediate gratification from consuming a food product and longer-term, health effects that may only be experienced at some distant and indeterminate time in the future (Blaylock et al., 1999).

Sadler (2005) report the results of a 2004 survey of US consumers through which three types of consumer are defined in terms of their propensity to engage in behaviours that bring about health benefits in the future. Firstly, 'instant gratifiers' (31%) are concerned about health but look for benefits in the short term. Secondly, 'planners' (35%) are prepared to engage in behaviours that may only bring about health improvements in the longer term. Finally, 'regulars' (34%) are not actively engaged in behaviour that enhances health in either the short or long term. The subgroup to which consumers belong does not appear to be influenced by age, but gender plays a significant role, with women more likely to be 'planners' and men more frequently found within the 'instant gratifiers' group.

Across and within countries there are evidently differences in the importance given to the pleasure associated with food. In turn, we might expect such differences to be reflected in the trade-off that consumers are willing to make between immediate gratification and health benefits in choosing functional foods over non-functional alternatives. Rozin et al. (1999) compare the value attached to the pleasure from food among US, Japanese, Flemish-Belgian and French consumers. French consumers are found to put the highest valuation on the association between food and pleasure, with US consumers attaching the least value. Conversely, Munene (2006) report that 45 percent of US consumers consider taste/flavour as the most important factor in making a food purchase decision, Thus, if a functional food tastes different than a traditional food, we might expect that consumers will reject it in spite of the potential health-enhancing properties.

The evidence on the degree to which consumers are willing to compromise taste in order to derive the potential health benefits of functional foods is mixed. Urala and Lähteenmäki (2004) provide suggestive evidence, however, that Finnish consumers are willing to compromise the taste of food to obtain health-enhancing benefits, specifically in the case of juice enriched with

probiotics, cholesterol-lowering spread, blood pressure-lowering milk and meat products with more fibre. However, across all of these products the reliability of the taste construct is relatively low, such that the results should be treated with caution. Conversely, Verbeke (2006) finds that Belgian consumers are not willing to compromise taste for the health benefits of functional foods. Indeed, in this study less than 10 percent of respondents are willing to accept functional foods if they taste worse than conventional foods. At the same time, around 40 percent of consumers are willing to accept functional foods if they taste good. Labrecque et al. (2006), however, find no statistically-significant impact of pleasure and food on the attitudes of French-Canadian, US and French university students towards functional foods. Among French-Canadian respondents, cooking enjoyment was found to be negatively associated with attitudes towards functional foods, but this was insignificant in the case of US and French consumers.

Maynard and Franklin (2003) conduct sensory valuations of dairy products produced with milk from cows fed fish oil to increase the level of conjugated linoleic acid (CLA), which provides benefits against cancer. Where consumers could discern a difference, CLA-enriched dairy products were associated with an undesirable flavour. About one third of respondents expressed a preference for the 'conventional' milk and yoghurt, while 42 percent preferred the 'conventional' butter. Many consumers, however, could discern no difference, especially in the case of the yoghurt (64%).

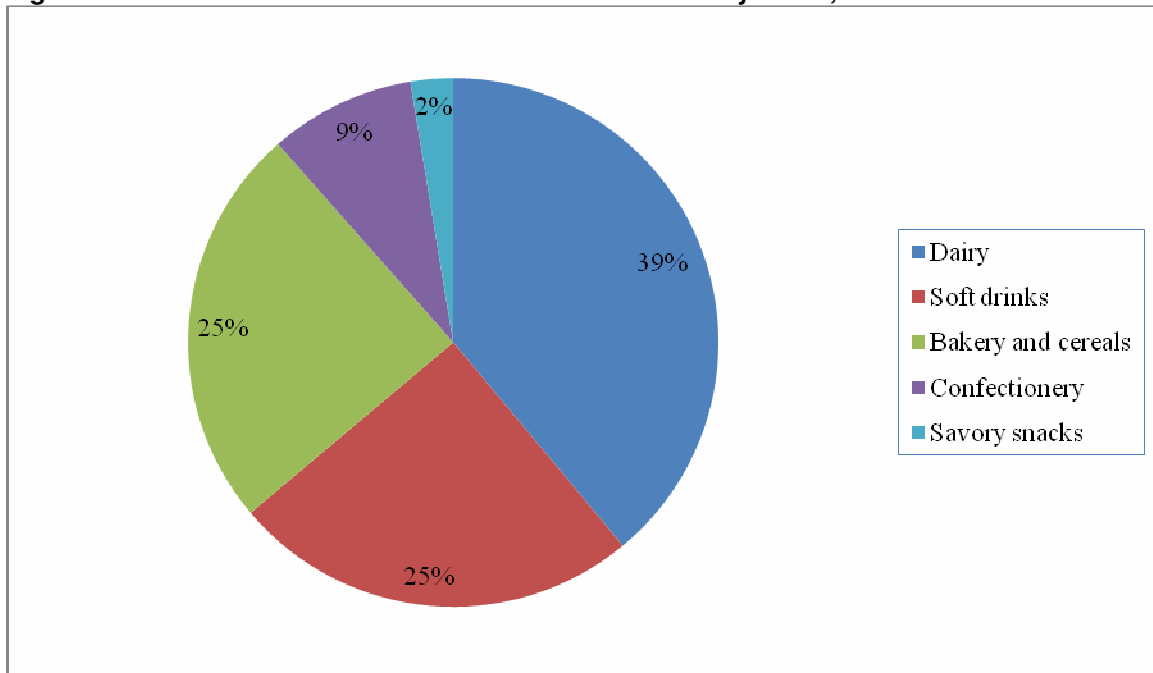
The surveys undertaken by Decima Research (2004; 2006) discussed above, provide information on the relative importance placed on health and taste by Canadian consumers in making food choices. In 2004, 57 percent of respondents reported that they look for nutritional quality, 39 percent for medical benefits and 31 percent for food fortification (Decima Research, 2004). In 2006, the proportion considering nutritional properties in food had increased to 63 percent, while the proportion looking for medicinal properties in foods was 42 percent (Decima Research, 2006). At the same time, however, 75 percent of respondents in 2004 chose food that their family enjoys (Decima Research, 2004), suggesting an unwillingness to compromise taste despite the importance given to health. Accordingly, only 27 percent of respondents in 2006 reported that they are willing to compromise taste for health benefits (Decima Research, 2006). This is further corroborated by INI (2004) that reports that taste is a very important factor in choosing food among 72 percent of Canadians.

The research reported above provide a rather mixed picture on the willingness of consumers to trade-off taste and other sources of pleasure from food and potential health benefits. Clearly, if functional foods have the same organoleptic properties as their non-functional counterparts, this is not an issue. However, where taste, texture and aroma, for example, differ this may be the cause of novel functional foods to be rejected among particular consumer sub-groups. Indeed, among all consumers we might reasonably expect to be a limit to which the pleasures associated with food are relinquished in order to obtain potential (and often uncertain) improvements to health in the future.

### 3.6 Carriers and ingredients of functional foods and natural health products:

According to Datamonitor (2004), the main products in which functional ingredients have been incorporated are dairy products (38.9%), soft drinks (24.9%), bakery products and breakfast cereals (24.6%), confectionary (8.9%) and savoury snacks (2.6%) (Figure 2). Further, over the period 2001-2005 the product categories exhibiting the largest number of new product launches were dairy products, soft drinks, bakery products and breakfast cereals and snack products (Sadler, 2005). In terms of sales, the largest functional food category is soft drinks (including waters) with sales in the United States valued at US\$10.13 billion in 2006, accounting for 25 percent of growth in sales (NBJ, 2007b). In terms of new product launches over the period 2003 to 2005, the most frequently incorporated ingredients are antioxidants, lycopene, omega-3 fatty acids, probiotics and isoflavones (Sadler, 2005).

**Figure 2. Functional Foods and Natural Health Products by Value, 2003:**



Source: Datamonitor (2004)

Consumer preference across functional food products appear to be associated with attractiveness and convenience. Van Kleef et al. (2005) evaluate consumer perceptions of ten functional food carriers in The Netherlands. Products with the highest attractiveness and intention were yoghurt, margarine and brown bread. Overall, the type of carrier was a positive and statistically-significant determinant of intention to try, attractiveness, credibility and uniqueness. Bech-Larsen and Grunert (2005) found that consumers from Denmark, Finland, and the United States negatively associated the enrichment of juice and yoghurt with omega-3 fatty acids and oligosaccharides with product liking. However, the incorporation of omega-3 fatty acids and combinations of spread and oligosaccharides into spreads was positively perceived, indicating that the carrier of functional ingredients is critical to consumer acceptance.

With the exception of products containing enhanced calcium and omega-3 fatty acids, Canadian consumers reported low levels of consumption of functional foods in 2006 (Decima Research, 2006). Overall, 67 percent of Canadians intentionally purchased foods, beverages or pills because they contained calcium. Similarly, 58 percent intentionally purchased foods, beverages or pills because they contained omega-3 fatty acids. Only 12 percent or less purchased foods, beverages or pills because they contained lycopene, isoflavones, probiotics or prebiotics. Such patterns may reflect the number and penetration of functional foods, beverages and pills

containing calcium or omega-3 fatty acids in the Canadian market or consumer preferences across different functional ingredients, perhaps reflecting the demand for their purported health benefits.

There is also evidence that Canadians consumers prefer functional foods that are less processed and/or nearer to the perceived 'natural' state. Thus, according to the survey by Decima Research in 2006, consumers prefer fresh tomatoes (77%) and tomato sauce/juice (66%) as a source of lycopene, compared to only 13 percent in the case of an extract/powder or a pill (Decima Research, 2006). Similarly, fish (66%) is preferred over eggs (36%) and pills (28%) as a source of omega-3 fatty acids.

According to Health Canada (2005) around 71 percent of Canadians have used a natural health product, in particular vitamins and minerals (13%), herbal remedies and teas (12%), additive-free foods (8%). Nevertheless, around 45 percent of consumers are unfamiliar with these products, with only 36 percent considering that they are familiar. The most common used natural health products are vitamins (57%), echinacea (15%), herbal remedies (11%), and glucosamine (8%). The highest rates of usage are observed in British Columbia and Alberta and among women, consumers with higher levels of education or income and are in the 18 to 54 year age group. The main reasons for not using a natural health product are lack of need (20%), lack of information (17%), healthiness (13%), and lack of belief in the product (11%). Although the majority of consumers consider that natural health products can be used to maintain or promote health (77%) or to treat illness (68%), only 43 percent consider these to be better than conventional medicines.

In conclusion, consumer acceptance of functional foods differs across functional foods and natural health products and between alternative carriers within each of these categories. Further, there are clearly interactions between the acceptance of particular functional ingredients and particular carriers. This suggests that consumer acceptance is highly complex and that it is difficult to generalise research results across products and ingredients.

### 3.7 Socio-economic and demographic factors:

Socio-economic and demographic factors are generally considered to be important determinants of consumer choice behaviour, and there is no reason to believe that functional foods and natural health products are an exception. In this context perhaps the most important factor is income, at least in an equity sense, in that this can mitigate the ability to consume such products (Frewer et al., 2003a). Thus, Schroeder (2007) argues that the contribution of functional foods to public health and well-being should be assessed against their affordability and the ability of lower-income groups to afford them.

However, the results of empirical research to date fails to provide consensus on those socio-economic factors, including income, that have the greatest impact on attitudes towards functional foods and natural health products and the propensity to consume these products, nor the direction of the related causal relations.

A number of studies suggest that socio-economic factors, in and of themselves, are not critical factors influencing attitudes towards functional foods and natural health products and of related choice behaviour. For example, Verbeke (2005) reports that age, gender, education and the presence of children at home are not significant factors influencing consumer acceptance of functional foods in Belgium. While Maynard and Franklin (2003) find that households with at least one child under 19 years of age are more willing to pay significantly more for milk and butter enriched with CLA, other socio-demographic factors are not major determining variables. Likewise, Munene (2006) finds no significant effects of gender on willingness to pay for functional foods. Moreover, other demographic variables such as age, children at home, education and income are either not significant or have mixed results.

While Niva and Mäkelä (2007) find that many socio-economic factors have no significant effects on a range of attitudes towards functional foods in Finland, there are some notable exceptions. While consumers aged 45 to 59 years have the most positive attitudes towards functional foods, consumers aged 60 years and above are most concerned about the negative consequences of consuming functional foods. Lower levels of education are associated with less positive experiences with functional foods and with higher levels of concerns about their safety. Gender and children in the household are, however, broadly statistically insignificant determinants of attitudes towards functional foods.

Sorenson and Bogue (2005) analyse consumer preferences towards functional non-alcoholic beverages in Ireland. Five clusters are identified, although one cluster (accounting for 9% of the sample) is functional-food driven. In this cluster significant correlations are observed between age, gender, educational level and purchase intentions. The age group most highly represented in this cluster is 18 to 59 years. Further, the majority of consumers in this segment are males, conflicting with many other studies that suggest women have a greater propensity to consume functional foods (see for example Beardsworth, et al., 2002; Sadler, 2005).

Bogue et al. (2005) report significant and positive effects of gender, age and higher socio-economic status on the acceptance of health-enhancing foods in Ireland. For example, women and consumers in the age 35 to 54 years group are found to be most accepting. However, household size and the number of children at home have no significant effects of acceptance of health-enhancing foods.

While Batte et al. (2007) report that age, income, gender and children at home have no significant impact on the willingness to pay a price premium for genetically-modified-free, pesticide-free and organic foods in the United States, among consumers that are willing to pay a price premium these variables have more explanatory power. In this case, older and female consumers are more willing to pay higher premiums for pesticide-free, genetically-modified-free and organic foods. Similarly, income and having children at home are positively associated with the willingness to pay higher premiums for organic food. Specifically with respect to functional foods, Teratanavat (2005) reports significant heterogeneity in consumer acceptance in the United States based on demographic factors such as gender, age, education and income.

In Canada, several studies analyse the effect of socio-economic and demographic factors on acceptance of functional foods, however similar to studies internationally, the results are rather mixed. Labrecque et al. (2006) find that gender has no significant effect on attitudes towards functional foods among university students from French-Canada, United States and France. West and Larue (2004), analyse the effect of socio-demographic characteristics on the willingness of Canadians to try healthy foods. The results of this study indicate that age is not statistically significant, while some other factors are found to be important. In summary, West and Larue (2004) find that “those most willing to be innovative in the nutritionally enhanced-food market are men, metropolitan consumers, consumers with children present in the household and consumers residing in the province of Quebec” (p. 79).

Peng et al. (2006) analyse consumer attitudes and acceptance of CLA-enriched dairy products in Alberta and British Columbia. Socio-demographic variables such as gender, province of origin and education are found to not be significant determinants of purchase intention. However, age is found to have an influence; the youngest and oldest consumers had no interest in buying CLA-enriched dairy products, but consumers in the 35 to 44 year and 45 to 54 year age groups accept and are willing to buy. Households with children aged 12 years or under are less likely to purchase CLA-enriched dairy products, while having children aged 12 to 17 years increases the probability of buying CLA-enriched one percent milk and flavoured milk, but not two percent milk, yogurt, butter or cheese.

Cranfield et al. (2007) estimate the impact of socio-economic variables on the probability of Canadians making dietary changes through analysis of data from the 2004 survey undertaken by Decima Research discussed above. The results indicate that age, having children at home and gender are not statistically significant. Indeed, only income and education had a significant effect on the probability of having made a dietary change for reasons of health. Households with income lower than CAN\$50,000 per year are less likely to have changed their diet as are consumers with a university degree.

Based on analysis of the 1996 family food expenditure survey, Kirkpatrick and Tarasuk (2003) report that low household income constrains access to nutritious foods (including milk and fruit and vegetables) in Canada. Ricciuto et al (2006) conduct more detailed analysis of the data from this survey. The results indicate that, as household size increases, while the quantity of food consumed also increases, per capita food expenditure declines. The presence of children aged less than 15 years negatively affects the purchasing of grain, fruit and vegetables, meat and alternatives and other food products. However, this same variable positively affects the purchase of milk products. The proportion of seniors (aged 65 years or more) in the household is positively associated with the quantity of all foods purchased (with the one exception of other foods), but especially fruit and vegetables. Higher income positively affects the quantity of all foods purchased, and again especially fruits and vegetables. Having a university degree significantly affects the quantity purchased of fruit and vegetables, but negatively affects the quantity of meat and alternatives and other foods purchased.

Herath et al. (2007b) undertake further analysis of the data from the 2006 Decima Research survey discussed above, with the objective of assessing heterogeneity of consumer attitudes towards functional food and natural health products in Canada. Two clusters of consumers are found on the basis of their attitudes, motivations and knowledge with respect to these products. The first cluster (accounting for around 47% of the sample) is more receptive towards functional foods and natural health products. Consumers in this cluster tend to be older, less educated have lower income level and live in rural areas. The second cluster (accounting for around 53% of the sample) consists of consumers that are less receptive towards functional foods and natural health products, which tend to be younger, well educated, have higher income level and live in urban areas, and feel less concerned about diseases.

It is evident that existing studies suggests that socio-demographic factors, as themselves, do not have a consistent effect on consumer attitudes and propensity to purchase functional foods and natural health products. While such factors are revealed to be important determinants of the receptivity of consumers towards such products in some circumstances, it is not possible to say that, in general terms, one particular group in society is more/less likely to consume them. Socio-demographic factors may be important determinants of broader attitudes, which do influence the response of consumers to functional foods and natural health products, but these are typically picked up directly in the studies reported above.

### 3.8 Willingness to pay (WTP)/Intentions to try functional foods and natural health products:

Functional foods are generally associated with premium prices such that the willingness to pay of consumers is a key issue influencing the propensity to purchase. A number of studies have explored the issue of willingness to pay, both for products that are perceived to be of higher quality and/or that incorporate a particular technology (for example genetic-modification), as well as for functional foods and natural health products specifically.

Batte et al. (2007) estimate the willingness to pay of US consumers for genetically-modified-free and organic foods. The results of this study indicate that consumers, on average, are willing to pay a price premium of US\$0.45 per box of 100 percent organic cereal (against a base price of US\$3.00). More generally, consumers are willing to pay US\$0.43 and US\$0.39 for the attributes of pesticide-free and genetically-modified-free, respectively. Botonaki et al. (2006) determine that

positive health attitude (consciousness) and confidence in organic production are significant factors influencing the willingness to pay for organic foods in Greece.

Maynard and Franklin (2003) estimate US consumer willingness to pay for CLA-enriched dairy products. On average, respondents to the surveys were willing to pay a price premium of US\$0.41 per gallon of CLA-enriched milk, US\$0.38 per pound of CLA-enriched butter and US\$0.15 per eight-ounce cup of CLA-enriched yoghurt. Larue et al. (2004) use a stated choice experiment to analyse the preferences of Canadian consumers with respect to chicken breast, tomato sauce and potato chips with functional properties. The results indicate that adding the property could allow sellers to significantly increase the price of these products. By adding a heart health property to the chicken breast, the price per kilogram could be increased by as much as \$1.88, which is approximately 14 percent of the average base price in the study. Adding the same health property to potato chips, the price of a 150 gram bag could be increased by as much as \$0.64, which is 44 percent of the average base price used in the study. By adding an anti-cancer property to tomato sauce, the price of a 14 oz (398 ml) can could be increased by \$0.64, which is 64 percent of the average base price used in the study. These results suggest significant willingness to pay for functional properties on the part of Canadian consumers.

It is evident, however, that the expressed willingness to pay of consumers for functional foods can sometimes be misleading. For instance, Munene (2006) finds that the majority of consumers express a willingness to pay a price premium for heart healthy spread, cholesterol-lowering spread and bread reducing risks of heart disease and cancer. However, when consumers are asked how much they are willing to pay, the results show that the amount is typically significantly less than the average premium already being charged in food stores. Consumers in these markets have already indicated their willingness to pay these premiums through their actual purchases.

Existing studies suggest that consumers are willing to pay for functional foods and natural health products, which is consistent with the fact that they value the potential health-promoting properties of these products. However, the significant variation in willingness to pay across products, countries and even studies makes it difficult to discern how large this willingness to pay is in practice. We know that such studies are subject to significant effects of study design and that consumers often respond in a manner that is strategic, such that we need to interpret the precise numbers that they produce with some caution.

### 3.9 Preference heterogeneity and market segmentation:

As described above, a number of studies have explored consumer attitudes towards functional foods and (to a lesser extent) natural health products, predominantly with the aim of ascertaining impacts on purchase/consumption behaviour. However, such efforts are complicated by the wide array of products already available in the market and the considerable heterogeneity in consumer attitudes both within and across countries. In turn this implies the need for market segmentation and customised marketing strategies (Mark-Herbert, 2002).

Empirical results on the relative importance of attitudinal and socio-economic factors, as well as product and functional ingredient attributes, on the propensity to purchase/consume functional foods and natural health products are mixed, such that they do not provide a coherent guide to the development of marketing strategies. While socio-economic variables are significant in some cases, they are insignificant in others (Bogue et al., 2005; Sorenson and Bogue, 2005; Verbeke, 2005; Labrecque et al., 2006). A wide array of scales and constructs, including psychometric variables, have been used to assess attitudes towards functional foods and natural health products (Bredahl, 2001; Bäckström et al., 2004; Verbeke, 2005; Labrecque et al., 2006), which makes comparisons and generalizations problematic. What these empirical research findings do make clear, however, is that there is considerable heterogeneity in attitudes (Larue et al., 2004; Sorenson and Bogue, 2005; Labrecque et al., 2006), which must be taken into account in

designing marketing strategies and/or policies aimed at promoting functional foods and natural health products.

Indeed, a good understanding of consumer preferences with respect to functional foods and natural health products is a key factor for successful new product development. However, while there is a growing body of empirical research, our current knowledge of the factors influencing consumer propensity to purchase/consume such products is imperfect, at best. For example, many studies are based on hypothetical rather than actual behaviour, and then employ socio-economic and other variables to explain the derived observations (Louviere et al., 2000). We have very little data on the actual purchase and consumption behaviour of consumers, in part reflecting the fact that the numbers of products that have been launched onto markets to date is limited.

A number of multivariate statistical techniques have been used in analyses of consumer attitudes and preferences towards functional foods and natural health products, as well as towards novel foods and products incorporating differing technologies more generally. Conjoint analysis, which explores preferences between multiple levels of hypothetical product attributes, has been employed in a number of studies (see for example Baker and Burnham, 2001; De Pelsmacker et al., 2005). In many cases cluster analysis is then used to identify sub-groupings of consumers within the general heterogeneity of consumer preferences (see for example Baker and Burnham, 2001; Sorenson and Bogue, 2005). Choice-based conjoint techniques, based on random utility theory, have also been employed in the form of latent class segmentation and random parameter models (see for example Louviere et al., 2000; West et al., 2002). Multiple-item scales, factor analysis and structural equation modelling are other techniques have also been used in an effort to unmask consumer attitudes (see for example Bredahl, 2001; Frewer et al., 2003b). Finally, in a limited number of cases qualitative data collection and analysis techniques have been used (see for example Padel and Foster, 2005).

Due to the wide array of methods employed, it is perhaps not surprising that the collection of studies to date provide differing results that arguably raise more questions than they answer about the factors influencing the propensity to purchase and/or consume functional foods and natural health products (Chandon et al., 2005; Padel and Foster, 2005). Indeed, Frewer et al. (2003a, p. 723) consider that "it is important to develop theoretical models that link perception, attitudes and values to human decision making." Considering this limitation, real choice experiments are increasingly being used in studies of consumer attitudes and preferences (see for example Alfnes et al., 2006). Further, multidisciplinary studies that consider economic, psychological, physiological sociological and even spiritual factors are recommended in order to understand better consumer preferences with respect to novel product concepts, as with functional foods and natural health products (Blaylock, 1999; Maynard and Franklin, 2003; Bäckström et al., 2004). Indeed, Maynard and Franklin (2003) promote the importance of multidisciplinary research on the viability of functional foods and the opportunities this creates for farmers. The challenge, however, is to develop and employ research methodologies that encompass all these factors, while being amenable to data analysis and the effective communication of results to stakeholders.

#### **IV. Regulation of functional food and natural health product markets:**

It is recognised that effective development of functional food and natural health product markets requires a framework of appropriate regulations (Verschuren, 2002; Bagchi, 2006). On the one hand, consumers need to be protected against product safety concerns and the scope for false product differentiation on the basis of inefficacious products. In turn, such conditions can engender confidence and trust among consumers in functional foods and natural health products. On the other hand, having clear 'rules of the game' acts to bring about stability in the market environment, equality of operating conditions across firms and, in turn, facilitates effective incentives for the development and commercialisation of new products (Shimizu, 2003). However, with the notable exception of Japan, the regulatory environment for functional foods

and natural health products is typically underdeveloped (Heasman, 2005) and lags behind scientific and technological developments.

A particular concern in markets for functional foods and natural health products is the ability to make claims regarding the health effects of these products. Claims are considered an effective vehicle through which the benefits of functional foods and natural health products can be brought to the attention of consumers, alongside other product attributes. Indeed, it is widely contended that regulated health claims can bring about benefits to both the industry and consumers (Aruoma, 2006). Thus, regulated health claims are seen as promoting consumption of such products as a means to promote health, alongside broader dietary changes, while establishing product credibility and reputation and engendering trust and acceptability among consumers (Heasman, 2005). Indeed, it is purported that the impact of more developed regulatory regimes for health claims can be seen through the evolution of markets for functional foods and natural health products in countries such as the United States (Wrick, 2005) and Japan (Bailey, 2005).

Where functional foods fall into the category of novel foods and/or ingredients they are typically subject to a more rigorous process of pre-market approval. Such products are generally taken to have no recorded history of safe use because they have not been previously consumed at a significant level in the target country. In a number of countries specific mechanisms have been established for the regulation of novel foods (Ottaway, 2005; Wrick, 2005; Health Canada, 2006a). While recognised as essential to protect the safety of consumers, such mechanisms can act as a barriers to the development and commercialisation of new products, increasing the costs of bringing product to market, delayed product launch and increasing the risks of innovation (Burdock et al., 2006; Coppens et al., 2006).

We now explore the regulatory regime for functional foods and natural health products in a number of key markets in turn below.

#### 4.1 Japan:

Japan is considered to have the most developed system for the regulation of functional foods and natural health products. In response to the increasing public health burden of an aging population, in the mid-1980s the Japanese government supported research on food products with potential health benefits (Arai, 2002; Bailey, 2005). As a result of these efforts the concept of 'functional foods' emerged. Manufacturers of food products started to promote 'health foods' claiming drug-like effects, which were sometimes contrary to current legal restrictions (Ohama et al. 2006). In order to regulate health claims for food products, the Japanese government established the category of 'Food for Specified Health Uses' (FOSHU) in 1991 (Arai, 2002; Ohama et al., 2006).

In order to obtain FOSHU approval, manufacturers have to make an application to the Ministry of Health, Labour and Welfare (MHLW). Shimizu (2003, p. 242) summarizes the three essential requirements of FOSHU approval:

“The first is the effectiveness based on scientific evidence, including clinical studies. The second is the safety of the product with additional safety studies in human subjects. The last is an analytical determination of the effective components.”

The information provided by manufacturers is evaluated by expert committees, which include nutrition, pharmacology, and medical science specialists. What makes FOSHU products different from drugs is that they are targeted at healthy individuals, but that are potentially at health risk. The minimum time needed for approval of FOSHU products is six months, although the process more typically takes one year (Shimizu, 2003). In 2005, the FOSHU category was sub-divided into three sub-groups, namely standardised FOSHU, qualified FOSHU and disease risk reduction claims for FOSHU.

By 2003, the number of approved FOSHU products was approximately 330, including health claims that can be broadly grouped into eight categories, namely: gastrointestinal conditions, blood pressure, serum cholesterol, blood glucose, absorption of minerals, blood lipids, dental health and bone health. By the end of 2005, there were 569 products approved as FOSHU (Ohama et al., 2006).

In 2001, the FOSHU category of products was expanded to include capsules and tablets, defined as 'Foods with Nutrient Functional Claims' (FNFC). This new regulation allows for existing FOSHU products and FNFCs under the broader category of 'Food with Health Claims' (FHC). Currently, 12 vitamins and two minerals are approved as FNFCs (Shimizu, 2003; Ohama et al., 2006).

#### 4.2 United States:

After Japan, perhaps the United States has the most advanced regulatory system for functional foods, and in particular the ability to make health claims on food. However, there are on-going controversies and criticisms of this system (Burdock, et al., 2006; Noonan and Noonan, 2006), especially related to the balance between consumer protection and the latitude given to the food sector to make health claims.

Health claims are regulated by the US Food and Drug Administration (FDA). According to FDA (2003):

"Health claims describe a relationship between a food, food component, or dietary supplement ingredient, and reducing risk of a disease or health-related condition."

The Nutrition Labelling and Education Act (NLEA) of 1990 first allowed the use of health claims describing the relationship between a food substance and the risk reduction of a disease or health-related condition, based on "significant scientific agreement." In 1994, the Dietary Supplement Health and Education Act (DSHEA) permitted structure/function claims which describe the role of a nutrient or a dietary ingredient in the normal structure or function of the human body. An example of this type of claim is "calcium builds strong bones."

Over time, the evidential base required in order to make health claims has changed. While the NLEA required "significant scientific agreement" on the basis of a claim, in 1997, the Food and Drug Administration Modernization Act (FDAMA) permitted health claims based on "authoritative statements" from a scientific body of the US Government or the National Academy of Sciences. This change, while relaxing the requirements of the NLEA, was seen as expediting the approval of claims by the FDA where "authoritative statements" are available (Hasler, 2002; Burdock, et al., 2006; Rowlands and Hoadley, 2006). Subsequently, in 2003 the "Consumer Health Information for Better Nutrition Initiative" permitted the use of health claims based on emerging evidence of the relationship between a food substance and reducing risk of a disease or health-related condition. Such claims are termed 'Qualified Health Claims'.

At the current time, health claims under the NLEA and FDAMA are considered 'better positioned' within the industry (Hasler, 2002; Burdock et al., 2006). The provisions of the DSHEA and the Consumer Health Information for Better Nutrition Initiative of 2003 remain controversial because of the level of scientific support (Hasler, 2002; Burdock et al., 2006; Noonan and Noonan, 2006). As a result, regulation changes are expected in the future.

Novel foods ingredients in the United States are regulated under the Federal Food Drug and Cosmetic Act (FFDCA). Moreover, all food ingredients used must be 'Generally Recognized as Safe' (GRAS), according to FDA regulations. A potential 'loophole' relevant to functional foods and natural health products, however, is that the provisions of the DSHEA do not explicitly require

approval of food additives under the FFDCA or that GRAS is demonstrated (Heller, 2001). Instead, the FDA requires pre-market safety notification for dietary ingredients in the form of supplements. Dietary ingredients are classified as “old” and “new” based on their use before or after 15 October 1994, respectively. A New Dietary Ingredient (NDI) requires pre-market notification of 75 days prior to its introduction to the market, providing evidence that the ingredient is safe. An Old Dietary Ingredient (ODI) is considered safe and only requires pre-market notification to FDA of 30 days prior to its introduction to the market. At any time, however, FDA can prevent/remove products from the market if they are considered unsafe (Burdock et al., 2006; Noonan and Noonan, 2006).

#### 4.3 Canada:

Until quite recently, the regulatory environment for functional foods and natural health products in Canada was considered one of the most restrictive internationally (Smith et al., 1997). However, recognising the potential importance of these products for public health as well as for the agri-food industry, the Canadian government has brought about substantial changes (Fitzpatrick, 2005; Nestmann et al., 2006). The recognition that some foods may have ‘drug-like’ properties, and that these properties may help reduce disease risks, and enhance overall health, is nothing new. However, under the Food and Drugs Act and attendant Regulations there was no middle ground between ‘food’, on the one hand, and ‘drugs’ on the other (Health Canada, 1998).

Major changes in the regulation of functional foods and natural health products relate to controls on health claims and approval of natural health products. In the case of health claims, five ‘science-based’ claims were approved in 2003 for use on food labels and in advertising of food products (Health Canada, 2006b):

- Sodium and hypertension.
- Calcium and osteoporosis.
- Saturated and trans-fat and cholesterol and coronary heart disease.
- Fruits and vegetables and cancer.
- Sugar alcohol and dental caries.

These health claims are already approved in the United States under the NLEA. Four further claims are under review at the current time:

- Folate and neural tube defects.
- Fibre-containing grain products, fruits and vegetables and cancer.
- Dietary lipids and cancer.
- Soluble fibre and coronary heart disease.

A system of approval for product-specific claims has been put in place, although no such claims have been approved to date.

In January 2004, a regulatory regime for natural health products was implemented under the Natural Health Product Regulations (Health Canada, 2007). Here, natural health products are taken to include herbal remedies, homeopathic medicines, vitamins, minerals, traditional medicines, probiotics, amino acids and essential fatty acids. The regulations include provisions on product licensing, site licensing, good manufacturing practices, adverse reactions, clinical trials and labelling. Companies manufacturing and marketing natural health products are given a

two-year transition period in order to comply with license requirements. Products with a valid Drug Identification Number (DIN) have a six-year transition period to obtain a product license under new regulations (Health Canada, 2007). It is expected that these regulations will significantly contribute to the development of the functional food and natural health product sector in Canada through the establishment of a coherent and 'balanced' regulatory regime.

Health Canada (2006a) has defined a framework for the regulation of novel food or novel food ingredient through its "Guidelines for Safety Assessment of Novel Foods". Functional foods and natural health products using novel foods or novel food ingredients are subject to these regulations. In this context, new food imports, new species introduced as a food source, food produced through new processing techniques and food produced through genetic engineering of micro-organisms, plants, and animals are considered 'novel'.

#### 4.4 European Union:

In spite of the fact that European Union is the second largest market for functional foods and natural health products, the process of harmonisation of the regulatory regimes of the 27 Member States has not been completed (Ottaway, 2005; Coppens, et al., 2006; Richardson et al., 2007). Since the mid-1990s, however, joint initiatives have been launched with the purpose of gaining consensus about an appropriate regulatory regime, including "Functional Food Science in Europe" (FUFOSE) and "Process for the Assessment of Scientific Support for Claims on Foods" (PASSCLAIM).

The aim of FUFOSE was "to develop and establish a science-based approach for the emerging concepts in functional food development" (Diplock, et al., 1999). As the outcome of this initiative the "Scientific Concepts of Functional Foods in Europe Consensus Document" was developed with the participation of scientists of EU Member States. This document includes guidelines for the development of functional foods based on basic scientific knowledge. Two type of health claims are identified, namely Enhanced Function Claims and Reduction of Disease Claims.

Building on FUFOSE, the PASSCLAIM initiative was launched with the following objectives: 1) to evaluate existing schemes which assess scientific substantiation; 2) to produce a generic tool for assessing the scientific support for health claims for foods; and 3) to establish criteria for marketers which can be used to explore the links between diet and health (Aggett, et al., 2005). It is generally recognized that the FUFOSE and PASSCLAIM have significantly contributed towards the harmonisation of functional food and natural health product regulations in the EU (Richardson, 2003). The process of harmonisation is expected to be completed by 2012 (Ottaway, 2005; Gulati and Ottaway, 2006).

The EU approved regulations on nutrition and health claims for foods in December 2006 that come into effect in July 2007 (European Parliament and Council, 2007). Under these regulations nutrition and health claims must be scientifically justified. By 31 January 2008, EU Member States are required to provide a list of proposed claims, while a list of permitted claims must be published by 31 January 2010. The application of the new EU regulation and its impacts on dietary choices and diseases will be evaluated by the end of January 2013. Guidelines for the evidence review system for the justification of claims are provided in Richardson et al. (2007).

Regulations of novel food ingredients in the EU have been harmonised since 1997 under Regulation (EC) 258/97 Concerning Novel Foods and Novel Food Ingredients. This sets out a standard system for the approval of novel foods, including the evidential basis (Coppens, et al., 2006). At least one functional food, spread containing plant phytosterols, has been approved under this legislation.

#### 4.5 Regulatory environment in other countries:

Of the emerging economies with significant markets for functional foods and natural health products, China perhaps has the most developed system of regulation. Indeed, China is in the

process of constructing a unique regulation system for functional foods and natural health products (Arai, 2002). Consistent with traditional medicine practices in China, by the end of 2002 there were more than 4,000 approved health food products although less than half had been released to the marketplace. It is recognised that this wide array of health food products demands the wholesale revision of existing regulations (Huang and Lapsey, 2005).

With the one exception of Brazil, regulatory systems for functional foods and natural health products have not evolved in Latin America (Lajolo, 2002; 2005).

#### **V. Implications for the functional food and natural health product market:**

The development of the functional food and natural health product sector can have a number of implications for the public health and agri-food sectors:

- Reduction in public health costs.
- Product efficacy, safety and interaction with other drugs.
- Opportunities to add value to primary agricultural and natural products.

In turn, the development of the sector can be challenged by prevailing regulatory regimes and the need for commensurate developments in policy related to health and agri-food sectors. We consider each of these issues in turn below.

##### **5.1 Reduction in public health costs:**

Several studies illustrate the potential reductions in public health costs associated with dietary changes. For instance, Cash et al. (2006) report that the direct and indirect health costs in Canada associated with heart disease, cancer, stroke and diabetes were CAN\$29.4 billion in 1993 (in 2004 dollars). The authors report that there is substantial evidence that the consumption of fruit and vegetables, whole grains, fish and soy protein can provide protection against coronary heart diseases and cancer, which in turn would contribute to substantial reductions in direct and indirect health costs.

Lutter and Tucker (2002) estimate that lowering the cost of production of farmed salmon, and the associated increase in salmon consumption, would prevent between 600 to 2,600 deaths per year from coronary heart disease in the United States. Such reductions are associated with salmon omega-3 fatty acids, which have been shown to be preventive against coronary heart disease. Alongside, lower the production costs of salmon, it is claimed that better farming methods can also enhance the levels of omega-3 fatty acids in salmon, with further health benefits.

According to Gray et al. (1998), between 1955 and 1993 Canadians reduced their consumption of animal fats while increasing their consumption of less saturated vegetable oils, resulting in an estimated reduction of 10.1 percent in the incidence of coronary heart disease. The reduction in direct and indirect costs in 1993 associated with this reduction in incidence is estimated at CAN\$832 million. Gray and Malla (1998) point out that, although dietary change is the result of the private decision of consumers, the disease cost associated with diet is paid socially through the publicly-funded health care system. Thus, health care cost externalities associated with food consumption can be large, which make it necessary to incorporate them into agricultural policy analysis.

A more recent study, conducted by Malla et al. (2007) illustrates that reductions in the risk of diseases associated with food consumption has the potential to bring large public benefits. The results of this study show that, under certain scenarios, reduction in consumption of trans-fatty acids would reduce the annual health care costs associated with coronary heart disease by between CAN\$1,094 and CAN\$1,818 million. On the basis of these results, Malla et al. (2007)

explore the possibility of using taxes and/or subsidies to reduce the consumption and/or production of unhealthy food products.

## 5.2 Product efficacy, safety and interaction with other drugs:

In spite of the potential benefits of functional foods and natural health products, there are concerns about the efficacy of these products. Hasler (2002) considers that functional foods are not a “magic bullet” or “panacea” to reduce the risk of diseases, and instead emphasise that a healthy diet is just one aspect of a lifestyle aimed at good health. Further, there are concerns about the risks of consuming some functional ingredients, especially where there is only weak scientific evidence regarding their long-term safety. There are similar concerns about herbal products and their potential interactions with drugs.

While some products, such as probiotics, may provide health benefits, the quality and safety of carrier products can be uncertain. Hamilton-Miller et al. (1998) conducts a microbiological evaluation of 52 products containing probiotics. The results indicate that the information provided in labels does not match the content of a number of these products. Moreover, few of these products are considered completely satisfactory or acceptable. For many of the products evaluated, there was no bacterial growth, low bacterial counts, and/or additional and non-labelled species of bacteria.

Halsted (2003) suggests that, in spite of the widespread use of dietary supplements and functional foods in the United States and Canada, there is little communication between consumers and medical physicians regarding dietary and functional food habits, such that there is scope for interactions of these products with drugs. Moreover, herbal medicine practitioners are not always aware of the purity, toxicity and/or side-effects of the products they prescribe.

Natural health products are generally considered safe because they are “natural” and have an established history of human use. However, these products have complex active ingredients, which may cause adverse drug events. Further, there is the risk of contamination, adulteration and/or substitution (Foster et al., 2005). Although there are some anecdotal reports of adverse drug events, many of these reports are considered incomplete and contradictory. At the same time there have been very limited clinical trials with these products. Given the complex active ingredients of many of these products, and their potential synergism and interaction with other drugs, the risk is increased in patients with confounding health problems (Foster et al., 2005). Overall, this translates into a major challenge for Health Canada’s Natural Health Product Directorate in guarantee the quality and safety of natural health products, which some specialists consider that should instead be subject to the Food and Drug Act (Kondro, 2003).

Schroeder (2007) raises several questions regarding public health, ethics and functional foods, focused on their safety, efficacy, the awareness/knowledge of consumers and affordability.

Landström et al. (2007) conduct a qualitative study to analyse the perceptions of dieticians, nurses and physicians towards functional foods in Sweden. While dieticians have a positive perception towards functional foods, nurses and physicians are generally sceptical about these products, in particular the enhanced physiological benefits of functional foods compared to conventional products. Similarly, nurses and physicians perceive health claims more as a marketing strategy than as credible information, and consequently are reluctant to recommend these products to patients.

Canadian physicians and nurses have more positive views of functional foods and natural health products, with a greater proportion and a great proportion believing in their health benefits (AAFC, 2005). However, communication between health professionals and their patients regarding these products tends to be limited. Moreover, only a small proportion of physicians recommend these products to their patients; functional foods and natural health products are only recommended by 37 percent and 18 percent of physicians, respectively. A possible explanation of this behaviour is the low satisfaction of physicians with the available information on these products. Only 37 percent of physicians are satisfied with the available information on functional foods, with a lower proportion (20%) satisfied with the available information on natural health products (AAFC, 2005).

Kwan et al. (2006) conclude that pharmacists in the United States and Canada need more training about dietary supplements (what are termed natural health products in Canada) in order to understand the use, efficacy and safety of these products, and to be able to interact confidently with patients. Similarly, Boon and Kachan (2007) suggest that health care practitioners should be prepared to discuss information about these products with patients, especially regarding the potential risks, such as interactions between natural health products and conventional drugs.

### 5.3 Opportunities for adding value to primary agricultural and natural products:

The production and marketing of functional foods and natural health products is seen as an opportunity for adding value and differentiating agricultural and food products (AAFC, 2002). Further, the incorporation of functional properties into products is seen as a means to promote acceptance of genetically-modified foods. Thus, it is argued that the major beneficiaries of the “first generation” of genetic-modification have been farmers and agribusinesses (Bredahl, 2001; Hobbs, 2002; Veeman, 2002). There are, however, great expectations that the “second generation” will lead to products with health-enhancing properties that are valued by consumers.

Maynard and Franklin (2003) consider the enrichment of milk with CLA through farm production practices as a means to add value to dairy products, such as milk, yoghurt and butter, in the United States. While CLA is naturally present in cow’s milk, through special feeding programs the level of CLA can be considerably increased. Likewise, Peng et al. (2006), explore this strategy for enhancing the value of milk in Canada, providing health-enhancing products for consumers and at the same time providing a competitive advantage to the dairy sector through product differentiation. Other examples of value-addition through enrichment of foods with health-enhancing properties include the marketing of soybean products with functional properties (Chema et al., 2006).

It is estimated that nearly 400 firms are involved in the production of functional foods and natural health products in Canada, with a total revenue of CAN\$2.9 billion and 12,872 employees in related activities in 2004 (Palinic, 2007). The raw ingredients used by these firms are largely sourced domestically, especially in the case of functional foods. This illustrates the potential opportunities for domestic agriculture, including the supply of milk, oil seeds, meat and poultry, seafood and marine species, grains and cereals, pulses/legumes, fruits, vegetables and herbs/spices. In the case of natural health products, however, imported raw ingredients are more important. Here there may be scope, however, for the domestic propagation of non-indigenous species.

### 5.4 Challenges to the development of the industry and trade due to regulations:

The lack of harmonised regulations for functional foods and natural health products internationally is considered a significant barrier for the development of this sector (Rudge, 2005; Yeung et al., 2007). Aruoma (2006, p. 119) points out that:

“Food regulation in the main is aimed at protecting the consumer’s health, increasing economic viability, harmonizing well being and engendering fair trade on foods within and between nations.”

Towards this aim, a number of generally-recognised food safety practices have been put in place, such as Hazard Analysis and Critical Control Points (HACCP) and Good Manufacturing Practices (GMP), to govern basic food hygiene. International standards have been codified, for example through Codex Alimentarius, and there are significant processes of harmonisation and mutual recognition between major trading partners. While these principles apply to the production of functional foods and natural health products, arguably more important elements of the regulation of these products, including permissibility of health claims and approval of novel products, differ markedly between countries (Aruoma, 2006).

The regulatory framework for natural health products in Canada was put in place in an effort to guarantee quality and safety of these products as well as to provide the industry an appropriate regulatory environment for its operation. Laeeque et al. (2006a) conduct a qualitative study of industry motivations to comply with the natural health product regulations. The results indicate that large firms are mainly motivated to comply to avoid negative media coverage, to provide accurate information to consumers, to maintain a competitive advantage and/or to simply comply with legal requirements. Conversely, SMEs are mainly motivated to comply due to “deterrent fears” and the “duty to comply.” Such firms see regulations more as a requirement rather than as an opportunity to gain consumer credibility and competitive advantage.

Laeque et al. (2006b) study 20 firms in the natural health products sector producing chondroitin and/or glucosamine in order to assess their perceptions and factors driving compliance. Generally, SMEs perceive that they have more difficulties than larger firms in complying with the Natural Health Product Regulations. These firms were assessed in terms of their compliance with these regulations following the 30 June 2004 deadline for submitting a product license application. Of the seven SMEs, three were non-compliant and four were in the process of compliance. Of the nine large firms, four were compliant and five were semi-compliant. The perception of large firms is that these regulations are necessary and there is broad satisfaction with the framework they define. In the case of the SME, however, the regulations were considered too strict and there is considerable disquiet about their justification.

The results of the 2005 survey of the functional foods and nutraceuticals sector by Statistics Canada for AAFC provides useful information on the structure of the sector and impact of the current regulatory regime. Overall, 43 percent of firms engaged in functional food perceive positive impacts from the use of health claims on domestic sales, while 45 percent see benefits in terms of developing new products. The proportion of firms perceiving negative impacts is minor, although a large proportion of firms perceive no impact or is not able to assess the likely effects. Among firms engaged in natural health products, 41 percent perceive positive impact from the Natural Health Product Regulations on domestic sales, while 39 percent see positive impacts in terms of developing new products. The majority of firms engaged in functional foods and/or natural health products do not perceive positive impacts in terms of export sales or global competitiveness. More generally, these results suggest synergism between the ability to make health claims on functional foods and health claims based on the Natural Health Product Regulations (Palinic, 2007).

The perception of firms about the effects of health claims on the functional food and natural health product sector in Canada is evaluated by Herath et al. (2007a) who undertake further analysis of data from the 2005 survey of the functional foods and nutraceuticals sector discussed above. The results indicate that firms perceive that the ability to make health claims can have positive impacts on domestic sales, export sales, the willingness to conduct research in support of claims and global competitiveness. The types of claim considered to have the most beneficial effects are ‘disease reduction claims’, which are regarded as most effective in communicating credence information to consumers.

#### 5.5 Need for public and business policy developments:

The functional food and natural health product sector involves several stakeholders, including raw material producers, consumers, government, manufacturers and retailers. Thus, policy-makers face considerable challenges in addressing diverse needs and priorities. More generally, Childs and Poryzees (1997) highlight the challenges in connecting science, food and health. Despite the potential and often recognised benefits of a healthy diet, time constraints and established preferences may confound efforts by consumers to make dietary changes. Thus, there is a key role for public and business policies in facilitating the development of ‘healthy’ products, communicating effectively the benefits of these products and ensuring that consumers are not misled. Private food companies are critical here through their innovation and commercialisation of new products that minimise the compromise expected of consumers between taste and

healthiness. This applies not only to product manufacturers, but also the food service sector (Schröder and McEachern, 2005; Cash et al., 2006).

Alston et al. (2006), analyse the links between US agricultural policy, human nutrition and obesity. Although there is no a clear causal relationship, agricultural policies influence production costs and commodity prices, which in turn can affect food prices. At the same time, adjusting agricultural policies in order to address issues of consumer health is controversial. Cash et al. (2006) undertake comparable analysis of Canadian agricultural policy, highlighting the extensive use of subsidies, price support and regulation of agricultural marketing which can have significant impacts on the dietary behaviour of consumers. At the same time, the lack of coherent empirical evidence linking agricultural policy decisions to consumer food choices and health confounds calls for reform.

It is increasingly recognised that new supply relationships are required in order to exploit successfully the opportunities provided by, for example, functional foods and natural health products (Hobbs, 2002, p. 559). Indeed, existing trends in food supply chains may confound attempts to compete successfully in such emerging markets including upstream concentration in input supply and downstream concentration in the manufacturing sector, uncertainty over intellectual property rights, asset specificity and uncertainty, and information asymmetry and uncertainty in regulations. For example, concentration in the input supply and manufacturing sectors may limit the ability of primary producers to reap the benefits of value-added activities such as the production of crops with functional ingredients. Under such a scenario the incentives to grow these crops may be limited. Instead, the entire supply chain needs to be coordinated, with the benefits from functional foods and natural products in end-product markets being distributed along the chain. This may require, for example, the establishment of longer-term supply chain relations.

## **VI. Conclusions:**

The review presented above has attempted to summarise the main consumer and regulatory issues that affect the development of the functional food and natural health product sector, both internationally and in Canada. Emphasis has been put on the factors that affect consumer acceptance of these products, on the basis that consumer preferences and choice behaviour will be the main drivers of the development and marketing of functional food and natural health products. The regulatory regime, in turn, is critical here, especially in governing the level and manner in which firms are able to communicate the purported health benefits of their products.

### **6.1 Functional food and natural health product market:**

Although there are no generally-recognised definitions of functional foods and natural health products internationally, it is evident that markets for these products have grown significantly in recent years, while this trend is expected to continue into the future. The markets with the greatest potential in the short to medium term include the United States, Europe, Japan and Canada. At the same time there are emerging markets, for example China, India, Russia, Eastern Europe and Latin America, that will become more important in the longer term.

The Canadian functional food and natural health product sector has grown considerably and consistently in recent years in terms of sales, number of firms and new product launches. Recent regulations allowing the limited use of health claims are having positive impacts, mainly on domestic sales and the development of new products, although the regulation of claims remains highly restrictive in comparison with the United States and Japan, in particular. Harmonisation of attendant regulations with leading and emerging markets could potentially benefit the export of Canadian products, especially to the United States.

### **6.2 Attitudes towards technology:**

Consumer attitudes towards functional foods and natural health products are influenced by the perceived risks and benefits of the technologies employed. Certain of these technologies,

whether employed now or in the future, for example genetic-modification may be perceived as risky by consumers and can act to curtail purchase and/or consumption of such products. At the same time, the benefits associated with functional ingredients may serve to offset such concerns, such that consumers are willing to bear the perceived risks associated with the technology. Thus, consumer perceptions of the benefits of functional foods and natural health products are critical to the propensity to purchase and/or consume such products. However, attention also needs to be given to communication with consumers about their concerns, while the ways in which functional ingredients are developed and/or commercialised may need to be adjusted.

There is evidence of significant within and cross-country differences in consumer attitudes towards technologies employed in the production and manufacture of foods. This suggests that a product which is widely accepted by consumers in Canada, for example, could be rejected wholesale in Europe. This emphasises the need to understand the consumer within the context in which they are situated and to address marketing strategies and innovation and commercialisation approaches accordingly.

### 6.3 Nutrition knowledge:

The relationship between nutrition knowledge and the propensity to make dietary changes is far from straightforward. There is evidence that many consumers are aware of the role that diet plays in having good health and preventing chronic diseases, however, they may not change their dietary behaviour accordingly. This may be partially explained by the fact that, while many consumers believe that they are well-informed about diet and nutrition, in practice their knowledge is limited. At the same time, nutrition knowledge and awareness of the relationship between diet and health are associated with gender, age and level of education. With respect to functional foods and natural health products, high levels of nutrition knowledge are not always associated with the acceptance and propensity to purchase and/or consume. Indeed, in some cases there appears to be an inverse relationship between knowledge of diet and health and the willingness to accept such products.

Canadian consumers self-rate their nutrition knowledge and awareness of chronic diseases very highly. However, empirical evidence suggests that actual knowledge of nutrition, and also of functional foods and natural health products, is quite low. At the same time, however, high levels of concern about diet-related chronic diseases mean that Canadian consumers are likely to be receptive to new information about diet and health and to functional foods and natural health products that purport to provide health benefits.

#### 6.4 Health risks and concerns:

Own and family perceptions and experiences of the risks to health can be a critical influence on the acceptance of functional foods and natural health products. When consumers perceive a threat, and are aware of the existence of health-enhancing products to cope with this threat and have confidence in their efficacy, they are generally more willing to accept these products. Understanding perceptions of risk and responses to it, however, is far from simple. For example, consumers may be subject to over-optimism in terms of their own risks to health, which can confound motivations to make dietary changes.

There is evidence that Canadian consumers are very concerned about the risks of chronic diseases such as cancer, and cardiovascular diseases and related conditions such as obesity and high blood cholesterol. Similarly, the majority of Canadian consumers are aware of the relationship between diet and health, and claim to have made dietary changes in recent years for the purpose of improving health. Here, the perceived threat to health and belief that diet can bring about dietary improvements (response efficacy) are key factors influencing the propensity to make dietary changes.

#### 6.5 Trust in information:

Consumer access, use and understanding of information regarding functional foods and natural health products are critical factors influencing acceptance. While information about such products is provided on labels, the use of such information tends to be mitigated by lack of trust and/or competition for the attention of consumers from other information, including the brand name. Critical to trust in information is the nature of source and the mode through which the information is provided. At the same time, communication efforts must face the reality that consumers tend to ignore much of the information to which they are exposed, especially where this is not easy to understand.

The majority of Canadian consumers claim that they always/usually read product labels. However, a large proportion is sceptical of the information provided, especially with respect to nutrition and where the source of information is the manufacturer, and even the government. Canadian consumers tend to give more credibility to information coming from physicians, dieticians/nutritionists and pharmacists. At the same time, the ability to provide information on product labels about the health benefits of functional foods products is believed to be a key factor limiting the development of such markets. Evidence on how consumers perceive such information, however, suggests that the ability to make health claims, per se, may be of limited benefit unless efforts are made to enhance perceived credibility.

#### 6.6 Taste, enjoyment and convenience:

In product markets, functional foods may almost directly compete with their non-functional counterparts. While the purported health benefits of such products may offset certain losses of quality or a higher price compared with conventional products, broadly functional foods need to compete in terms of taste, convenience and other attributes of salience to consumers. Indeed, there is little empirical evidence that consumers are willing to compromise taste and convenience in order to switch to functional food products. Moreover, the presence of functional ingredients may itself influence perceptions of the expected taste of functional food products, although such perceptions may not be borne out by the results of blind taste tests.

There is evidence that taste and enjoyment of foods are strong determinants of food choices by Canadian consumers. While attention is given to the nutritional properties of food, there is little evidence that consumers will shift away from food choices that their family enjoys. Functional foods may have an important role to play here, providing opportunities to consumers to enhance the healthiness of their diet while not requiring large-scale changes that compromise the pleasure from food.

#### 6.7 Carriers and ingredients:

The carriers of functional ingredients, as well as the nature of the ingredients themselves, and their purported health benefits, have been shown to be major determinants of consumer acceptance. Further, while a particular functional ingredient may be regarded as compatible with one product (for example yogurt), this does not mean that it will be accepted in another product (for example ice cream). Acceptance of particular products also appears to differ within and across countries, requiring market segmentation and the need to customise products across markets.

Currently, the most common types of functional food products are dairy products, soft drinks, bakery products and breakfast cereals. In terms of functional ingredients, antioxidants, lycopene, omega-3 fatty acids, probiotics and isoflavones are found in functional foods most frequently. The functional food products consumed most frequently in Canada contain calcium and omega-3 fatty acids. Across all functional ingredients there is a preference for products that are less processed and perceived to be more 'natural'. The majority of Canadian consumers have used natural health products of some sort, most often vitamins and minerals and herbal remedies. The most frequently consumed natural health products are vitamins, echinacea, herbal remedies and glucosamine.

#### 6.8 Socio-economic factors:

A number of socio-economic factors influence consumer acceptance of functional foods and natural health products. Empirical evidence on the role of particular factors, for example gender or age, however, fails to provide a consistent picture of the significance and direction of causal relations. Further, the role played by socio-economic variables differs across countries. That having been said, the general tendency appears to be towards greater acceptance of functional foods and natural health products among women, those with children at home and individuals that are middle-aged.

With respect to age, relations with acceptance of functional foods and natural health products are particularly complex. Low acceptance in younger age groups presumably reflects a low level of perceived threat to health problems and chronic disease. Among older age groups there may be perceptions that it is 'too late'; functional foods and natural health products may bring little benefit unless the purported health effects are experienced in the short to medium term. Thus, we see that it is consumers in their middle ages that have the greatest tendency to purchase and consume such products; they perceive the greatest threat of chronic disease, but still have sufficient time horizon to see the benefits in older age.

#### 6.9 Willingness to pay:

Several studies assess willingness to pay for functional foods and natural health products that generally carry a price premium over conventional alternatives. There is some evidence that consumers, including in Canada, are willing to pay a price premium for health-enhancing foods, especially when they are not the products of genetic-modification. The caveat, however, is that most of these studies of these studies are based on hypothetical rather than actual product choices. There is some evidence that the results of these studies do not provide a reliable measure of the actual premium that consumers are willing to pay in practice.

#### 6.10 Preference heterogeneity:

A common finding in many of the studies reviewed above is a high degree of heterogeneity in consumer attitudes and purchase propensity, both within and across countries. This requires that marketing strategies be based on country-specific market research and segmentation based on consumer preferences, which themselves may bear little relationship to more easily observable factors such as socio-demographics.

To date, a range of research methodologies, including multivariate analysis techniques and qualitative studies, have been used to research consumer attitudes towards functional foods and natural health products. This makes it difficult to compare and contrast results and make sense

of differences within and across countries; to what extent are the observed differences a product of the study design and to what extent real differences between consumers?

#### 6.11 Regulation of functional foods and natural health products:

Regulation of the functional food and natural health product sector is critical to the successful development and commercialisation of new products and to the successful exploitation of market opportunities. In many countries, however, the regulatory system remains 'work in progress', while efforts towards international harmonisation or mutual recognition of national standards has not commenced, with the one exception of the EU. Critical here is not only the scope to make health claims, but also the efficacy of mechanisms for the approval of novel products that can impede innovation processes.

Among the main markets for functional foods and natural health products, Japan probably has the most developed regulation system, with the implementation of FOSHU system since 1991. While the United States also has a well-developed regulatory system, there is not a consensus that the US government has 'got it right' in terms of the balance between consumer/public health and industry interests. Thus, there is concern about structure/function claims for dietary supplements and qualified health claims based on emerging evidence, such that regulatory change is anticipated in the near future.

In the EU, efforts have been made towards harmonisation of regulatory regimes for functional foods and natural health products across the 27 Member States. The most significant advances to date have been the FUFOSE and PASSCLAIM initiatives, setting out guidelines for Enhanced Function Claims and Risk Reduction Claims and developing criteria for the validation and scientific substantiations of health claims. European regulations on nutrition and health claims in foods came into effect in July 2007, although it is expected to be some time before a fully-harmonised system for the approval of health claims is implemented in the EU.

The regulatory environment for functional foods and natural health products in Canada was considered highly restrictive until reforms were implemented in recent years. In 2003, a series of generic health was permitted, while a system for the approval of product-specific claims was developed, although none have been approved to date. In 2004 the Natural Health Product Regulations brought in a coherent system for the regulation of natural health products. While still considerably more restrictive than, for example, the United States, there is evidence that these changes have been beneficial to the functional food and natural health product sector in Canada. Further reform could presumably bring about further benefits for the sector.

#### 6.12 Implications for the functional food and natural health product sector:

The functional food and natural health product sector offers the opportunity to reduce the direct and indirect health costs associated with treating certain chronic diseases, for example coronary heart disease and cancer. At the same time there are concerns about the safety, quality and efficacy of such products and the scope for interactions with drugs. With the exception of a quite small number of functional ingredients, the scientific evidence on health effects is often quite limited, while the lack of scientific studies on longer-term use makes it difficult to infer safety. In the case of natural health products, the complexity of the functional and other constituents mean that can be considerable scope for interactions with drugs. These concerns are compounded by the fact that there is evidence of often very limited communication between physicians and patients about the consequences of consumption of natural health products.

The agri-food and health product sectors consider that functional foods and natural health products offer significant opportunities to add value to primary commodities and to exploit sizeable latent demand on the part of consumers, while bringing about significant public health benefits. Examples include the enrichment of milk with CLA that can reduce the risks of certain cancers and enable dairy farmers to enhance the value of the milk they produce. The Canadian functional food and natural health product sector has grown significantly in recent years and,

given that it sources many of its raw materials domestically, presumably there have been commensurate benefits for the agricultural sector. There may also be scope for producers to engage in the production of crops with enhanced functional properties or to substitute the importation of non-indigenous products that are currently sourced internationally.

The functional food and natural health product sector is subject to a multi-layered system of regulation. While functional foods are subject to the same controls on food safety as conventional food products, there are additional 'hoops' to be jumped through if products are judged to be novel. Further, given that the chief basis on which these products are developed and commercialised is their purported health benefits, restrictions on health claims remain a significant impediment to the exploitation of opportunities, especially in domestic markets. While the Natural Health Products Regulations are a welcomed initiative, they still present challenges for SMEs such that there must be concerns about the ability of smaller firms in their sector to compete.

The complex issues faced by the functional food and natural health product sector in Canada call for public and business policies to provide an appropriate environment in which firms can innovate and commercialise. The diversity of interests, however, makes this problematic. For example, there is an on-going debate in many countries as to the appropriate balance between protecting consumers/public health, preventing consumers from being misled due to the allowance of ineffective products and facilitating the commercial activities of firms engaged in the functional food and natural health product sector. Overly strict controls will act to stifle innovation, while impeding the international competitiveness of Canadian firms and curtailing the potential flow of public health benefits. An overarching issue is the need to understand and respond to consumer attitudes towards functional foods and natural health products, communicating the potential health benefits and engaging in dialogue over concerns in order to promote acceptance and use.

#### 6.13 Potential areas for future research:

It is evident from the review that considerable gaps exist in existing research on consumer attitudes towards functional foods and natural health products, especially in Canada. There is a need to develop more rigorous methods, including theoretical frameworks, in order to enhance the quality of research in this area and to permit comparison across studies and within and across countries. There is also an imperative to move from analysis of hypothetical choices to actual purchase and consumption behaviour, that becomes more practical as market become better established for functional foods and natural health products in countries such as Canada.

Within the overarching need for rigour and a focus on actual product choices, some specific research themes or issues emerge:

- Analysis of the key decision variables influencing actual choice of functional foods and natural health products.
- Impact of regulatory controls on novel products and on health claims on consumer trust and acceptance of functional foods and natural health products.
- Separation of the novelty of the functional food concept and related aspects of neophobia, from attitudes towards the specific characteristics of functional foods and natural health products.
- Analysis of changes in consumer attitudes towards functional foods and natural health products over time as markets evolve for these products in Canada.

- Further analysis of the role of the product carrier on consumer acceptance of functional foods and natural health products and interactions between the functional ingredient and the carrier.
- Comparison of consumer attitudes towards functional foods and natural health products across Canada and how such differences change over time and relate to actual product choice.
- Analysis of how firms engaged in the functional foods and natural health products sector manage consumer acceptance and regulatory issues, with a drive towards identifying and/or defining 'good practice'.

To drive this agenda forward there is a need for more enhanced collaboration between research teams in Canada and internationally that facilitates the sharing of research approaches and results.

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## APPENDIX I

### Research Networks and Researchers Engaged in Work on Consumer Aspects of Functional Food and Natural Health Products

#### **Advanced Foods and Materials Network (AFMNet):**

Information about the network and the list of researchers can be found at the network web site:

<http://www.afmnet.ca/>

AFMNet is Canada's front line of research and development in the area of advanced foods and bio-materials – from new, lower cost antibiotics, to improved frozen food quality to faster healing wound dressings. AFMNet is hosted by the University of Guelph. AFMNet works in functional foods and nutraceuticals (foods and bio-materials for specific health benefits and medical uses). The main projects related to functional foods and natural health products are:

- Understanding Consumer Acceptance of Functional Foods and Nutraceuticals. Project Leader: Dr. Spencer Henson, University of Guelph.
- Natural Health Product Regulations: Perceptions and Impacts. Project Leader: Dr. Heather Boon, University of Toronto.

The Scientific Director of AFMNet is Dr Ricky Yada of the Department of Food Science, University of Guelph ([ryada@uoguelph.ca](mailto:ryada@uoguelph.ca)).

#### **Consumer and Market Demand (CMD) Network:**

Information about the network and the list of researchers can be found at the network web site:

<http://www.consumerdemand.re.ualberta.ca/>

The purpose of the Consumer and Market Demand Network, funded by AAFC, is to address issues around changing consumer preferences for food attributes such as food safety, biotechnology, environmental friendliness and health. Research will also address the impact of how changing consumer demand affects producers, processors and retailers. The Consumer and Market Demand Network is funded by Agriculture and Agri-Food Canada (AAFC) and hosted by the Department of Rural Economy at the University of Alberta.

The Network Leader is Dr. Ellen Goddard of the Department of Rural Economy, University of Alberta ([ellen.goddard@ualberta.ca](mailto:ellen.goddard@ualberta.ca)).

**Western Canadian Functional Food and Natural Health Product Network (WCFN):**

Information about the network and the list partners can be found at the network website:

<http://www.bcf2.com/>

Food & Natural Health Product Network develops and advances the functional food, nutraceutical and natural health product industry in Western Canada (British Columbia, Alberta, Saskatchewan, and Manitoba).

The WCFN Board of Directors has approved several key initiatives that were deemed the most important to achieve the WCFN's vision. These initiatives are:

- Business Development Opportunities - WCFN's mandate is to promote the products, services and capabilities of Western Canadian industry. It is our goal to facilitate networking and partnering opportunities to help our member companies grow. This will be accomplished through several activities: missions, tradeshow, business referrals and targeted seminars to address industry needs. Our continued efforts to grow our network through increased membership enables us to learn more about our member companies so that we can best represent and address their needs.
- Educational Opportunities – Through conferences, seminars, workshops and a large database of experts regionally, nationally and internationally involved in the functional food and natural health product industry, the WCFN prides itself in having established a critical mass of expertise around scientific, regulatory and marketing issues in the FFNHP sector.
- Increase Regional Scope Across the 4 Western Provinces – After 8 years of services to the functional food and natural health product sector, the BCFN changed its name to the Western Canadian Functional Food and Natural Health Product Network (WCFN), to reflect its expanded scope into Manitoba, Saskatchewan and Alberta. The association launched the Canada West Program, a two year program comprised of a series of valued added workshops across Western Canada from 2006 to 2008. The WCFN is collaborating with Ag West Bio in Saskatchewan, Manitoba Food Processors in Manitoba and a WCFN Chapter in Alberta to help execute the program.

**The Richardson Centre for Functional Foods and Nutraceuticals:**

Information about the research centre and researchers can be found at the research centre website:

<http://umanitoba.ca/research/rcffn/>

The Richardson Centre for Functional Foods and Nutraceuticals is in the midst of exciting and ongoing research. Located in Smartpark Research and Technology Park, University of Manitoba, the Centre is dedicated to the discussion, discovery, and development of functional foods and nutraceuticals, with a focus on the crops of the Canadian Prairies.

Examples of current research projects are:

- Effects of a diet rich in diacylglycerol (DAG) oil on body weight, body composition, and blood lipid levels in women.
- Effect of Heart & Stroke Portfolio diet on lipid metabolism and weight loss in men.

- Effect of pulses and pulse fractions on indices of lipid, carbohydrate and energy metabolism, as well as oxidative status in overweight, hyperlipidemic individuals.
- Use of conjugated linoleic acid (CLA) as a nutraceutical for weight loss in humans.
- Evaluation of very long chain fatty acids/alcohol and plant sterols as functional food ingredients for cholesterol-lowering in hypercholesterolemic humans.
- Effects of dietary cholesterol with and without simvastatin on cholesterol absorption and synthesis and sterol profile in Smith Lemli Optiz syndrome (SLOS) patients.
- Effects of unique algal based polysaccharides on plasma lipid levels and energy metabolism in hamsters.
- Evaluation of plant sterol and cholesterol absorption in overweight, hypercholesterolemic men with and without coronary heart disease.
- Extraction and characterization of flax lignans using supercritical fluid extraction.
- Structure-function properties of novel bioactive peptides.

**International Food Economy Research Group (InFERG):**

Information about the research group and the list of researchers can be found at the research group web site:

<http://www.inferg.ca>

InFERG is a centre of excellence for research, education and communication based in the Department of Food, Agricultural and Resource Economics (FARE) of the University of Guelph with active research, educational and communication activities related to the local and global food economy.

The activities of InFERG in the area of diet and health focus on analysis of the following key issues:

- Understanding the factors associated with dietary change in support of enhanced health and wellness.
- Consumer perception and acceptance of novel foods and agriculturally related products which carry positive health benefits.
- Understanding the economic and socio-demographic factors associated with obesity.

InFERG's diet and health research takes as its starting point the theoretical and empirical tools of economics, but is informed and employs approaches from other social science disciplines, most notably social psychology, as well as the field of marketing. The predominant geographical focus of this work is Canada, the United States and Europe.

**Leslie Dan Faculty of Pharmacy, University of Toronto:**

For further information see the website:

<http://www.pharmacy.utoronto.ca/>

The main member of faculty working on natural health products at the Leslie Dan Faculty of Pharmacy is Dr. Heather Boon (heather.boon@utoronto.ca). Her current projects include:

- Natural Health Product Regulations: Perceptions and Impact.
- Production, Characterization and Functionality of Plant-extracted Oligosaccharides: Towards Enhancing the Health-promoting Properties of Encapsulated Probiotics.
- Understanding Consumer Acceptance of Functional Foods and Nutraceuticals.

**Centre de Recherche en Économie Agroalimentaire, Département d'économie, de l'agriculture et de la consommation, Université Laval:**

Information about the research group and the list of researchers can be found at the research group website:

<http://www.crea.ulaval.ca/>

Members of the department undertake research on consumer aspects of functional foods and natural health products.

**Department of Bioresource Policy, Business and Economics, University of Saskatchewan:**

More information can be obtained at the department website:

<http://www.ag.usask.ca/departments/agec/>

Members of the department, in Particular Dr Jill Hobbs, undertake research on consumer aspects of functional foods and natural health products.

**Department of Marketing, HEC Montreal:**

More information can be obtained from the website:

<http://www.hec.ca/marketing/index.html>

The main member of faculty working on consumer aspects of functional foods and natural health products is Dr. JoAnne Labrecque