

Consumer Knowledge of Functional Foods

Maria Sääksjärvi

Delft University of Technology and Hanken School of Economics

Maria Holmlund

Hanken School of Economics

Nina Tanskanen

Hanken School of Economics

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Maria Sääksjärvi, Delft University of Technology and Hanken School of Economics,

Maria Holmlund*, Hanken School of Economics, and

Nina Tanskanen, Hanken School of Economics

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* Send correspondence to Professor Maria Holmlund, Hanken School of Economics, PO Box 479, FIN-00101 Helsinki, Finland. Phone: +358-40-3521 396, fax: +358-9-431 33 387, email: maria.holmlund-rytkonen@hanken.fi. Assistant Professor Maria Sääksjärvi, Delft University of Technology, Department of Product Innovation Management, Landbergstraat 15, 2628 CE Delft, the Netherlands, Hanken School of Economics, Finland. MSc Nina Tanskanen, Department of Marketing, Hanken School of Economics, PO Box 479, FIN-00101 Helsinki, Finland.

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Dr. Maria Sääksjärvi is an assistant professor of consumer behaviour at the Department of Product Innovation Management, Delft University of Technology, the Netherlands and an assistant professor at Hanken School of Economics in Helsinki, Finland. Prior to her current position, she worked at Accenture as a technology consultant. Her research interests lie in the areas of innovations, high technology, and statistical methods. She has published articles in *Journal of Interactive Marketing*, *Journal of Relationship Marketing*, *European Journal of Innovation Management*, *International Review of Retail, Distribution and Consumer Research*, and *International Journal of Internet Marketing and Advertising*.

*Dr. Maria Holmlund (corresponding author) is a professor of marketing at Hanken School of Economics in Helsinki, Finland. Her research interests include methodological and conceptual issues related to service and customer-oriented management in business-to-business and business-to-consumer markets. Her publications have appeared in for example *Journal of Marketing Management*, *International Journal of Service Industry Management*, *Journal of Business & Industrial Marketing*, *Industrial Marketing Management*, *International Review of Retail, Distribution and Consumer Research*, and *International Small Business Journal*.

M.Sc. Nina Tanskanen is a graduate from Hanken School of Economics in Helsinki, Finland. She majored in marketing and is now working in consumer marketing.

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Abstract

This study constructs a multi-dimensional index to measure consumer knowledge of functional foods. A nationwide survey in Finland shows that objective and specific knowledge are the most important components in the consumer knowledge index and that they distinguish experts from novices. Gender, education, income, and age serve as antecedents to consumers' knowledge of functional foods, which in turn affects attitudes towards health and, consequently, buying behaviour. The study extends the application of consumer knowledge literature to non-durables and edible products and provides further insights into the growing functional foods market as seen from the consumer perspective.

Key words: functional foods, consumers, knowledge, Finland

CONSUMER KNOWLEDGE OF FUNCTIONAL FOODS

Introduction

Functional foods can be defined as foods or dietary components that may provide a health benefit beyond basic nutrition (International Food Information Council IFIC 2007). Milk, yoghurt, juice, chewing gum, ice cream, spreads, drinks, dairy and cereal products are some product categories in which consumers all over the world have a wide array of functional foods to choose from. These foods have gained notable success due to their alleged ability to prevent or reduce indigestion, high blood pressure, cholesterol, or the risk of cancer and heart disease, for instance. Many factors fuel interest in functional foods, such as rapid advances in science and technology, increasing healthcare costs, changes in food laws affecting label and product claims, an aging population, and rising interest in attaining wellness through diet.

The US is regarded as the most important and dynamic functional food market, valued at USD 21.3bn in 2006, while the European market reached USD 8bn (Functional Food & Drink Consumption Trends 2007). Japan is considered the market where the first health-enhancing products were marketed. Germany, France, the UK and the Netherlands are the major countries for functional foods in Europe. The share of the total food and drinks market accounted for by functional foods is estimated to be about one per cent in Europe, compared to five per cent in the US. Northern and Central Europeans buy more functional foods than Mediterranean Europeans. Functional foods are not equally common over all product categories. Gut health products, i.e. dairy products, tend to

account for around two thirds of all sales in Europe and are showing impressive growth (Menrad 2003).

Even though it is estimated that growth rates will keep rising and more new products will be launched, the functional food market is experiencing several difficulties. One challenge is the regulatory situation, since from a legal point of view functional foods are in a grey zone between food and pharmaceuticals; this creates uncertainty and different country-specific market rules. An additional and common challenge for many countries is the high rate of product failure. Despite the lack of exact data, it is estimated that the product failure rate exceeds that of the total food market (Menrad 2003; Verbeke 2005). Consumers have many grounds for criticism. From the consumer perspective, there is undoubtedly more information available than ever before, but it is quite fragmented and specific (not to mention contradictory), and seems to be getting even more so. Specialised terminology that is not easy for consumers to comprehend – such as peptide and plantstanol – adds to the confusion and complexity. In addition, consumers will not buy products that they think are of a poor quality or unsafe, and this applies in particular to product categories such as functional foods that are consumed by eating and directly affect health and life. Consumers can only be expected to choose functional over conventional foods if they are aware of and know enough about both functional and conventional products and believe that the differences justify the higher prices and that the health claims will benefit them without risk.

The relatively low degree of familiarity with and acceptance of functional foods among consumers poses a distinct market challenge. In a global survey polling over 21,100 respondents – regular Internet users – in 38 markets across Europe, Asia Pacific,

North America, Latin America, and in South Africa, ACNielsen (2005) found that consumers' awareness of different healthy foods – including functional foods – was remarkably low. Other studies have reported equivalent findings (e.g. Menrad 2003; Verbeke 2005). For example, a US survey conducted by the American Dietetic Association (Killackey-Jones, Lyle, Evers and Tappe 2004) found that only 21 per cent of Americans had ever heard of functional foods, and even fewer could relate them to health issues. As for buying patterns, ACNielsen (2005) for example found that yoghurts with *Acidophilus* cultures/probiotics are bought regularly by 20 per cent of Europeans and 22 per cent of North Americans, compared to 44 per cent of South Africans. On average, about a third of consumers in all countries in the ACNielsen survey did not believe that functional foods really offer additional health benefits. It seems that extensive comparative studies have not been made lately, but earlier findings (Lappalainen, Kearney and Gibney 1998) showed significant differences in consumer attitudes to food, nutrition and health between fifteen pan-European countries. For example, thirteen per cent of Finns consider knowing enough about healthy food as a criterion to healthy eating compared to twenty-four, twenty-two and twenty per cent of Danes, Swedes, and Brits, respectively. Finnish consumers have been found to be comparatively positive towards functional foods, more so than Americans and other Europeans (Bech-Larsen and Grunert 2003; Urala and Lähteenmäki 2003).

Another challenge for functional food marketers is related to the price premium of 30-50 per cent that functional foods tend to imply. A major reason for not buying functional foods that came to light in ACNielsen's (2005) study is that their benefits are poorly understood and therefore do not justify a price premium.

Research Gap

As functional food alternatives are being launched at a faster rate and commonly displayed with more conventional food products, it becomes increasingly difficult for consumers to choose an appropriate product. Although functional foods have received attention in the marketing literature, research has not focused specifically on one important component of functional foods: consumer knowledge. Many studies have addressed attitudes and acceptance of functional foods (Childs and Poryzees 1998; Gilbert 2000; Bech-Larsen and Grunert 2003; Urala and Lähteenmäki 2003; Verbeke 2005) and demographic factors that contribute to attitudes and acceptance behaviour (e.g. Bogue, Coleman and Sorenson 2005). Such studies are certainly important in light of the growing interest of marketers in functional foods, but neglect the fact that consumers may need to have more specialised knowledge to purchase functional foods than conventional food products. This directly points to a need to distinguish consumer knowledge as a factor related to buying functional foods.

Knowledge of health claims is considered one driver for consumers to engage in health-related behaviour (Moorman and Matulich 1993). With specific reference to functional food consumption, Wansink, Westgren, and Cheney's (2005) study focusing on 606 American and Canadian consumers showed that the level of nutritional knowledge about soy did not necessarily influence how much people liked soy, but was related to how much people consumed soy. This would indicate that buying propensity might also be affected by knowledge. They further found that consumers with attribute-related and consequence-related knowledge were much more likely to consume soy than

those who only had one type of knowledge. This may, again, indicate that buying can be promoted by broadening the knowledge of consumers.

Due to the cost of functional foods and the potential lack of knowledge about them, the threshold to buy them can be considered to be higher than for other food products. It can be expected that the antecedents to buying functional foods – including knowledge about them – are numerous and interact in a complex manner. This in turn may indicate that there is great variation in the nature of consumers and how much they know about functional foods, making this an interesting topic to disentangle and explore further.

Purpose

Functional foods and specifically what consumers know about them represent a timely and significant area for research. This article develops a scale (in the form of an index) for measuring consumer knowledge of functional foods. The scale will help marketers identify what consumers know about functional foods, who to target with promotional endeavours, and how to distinguish between customers who differ in their propensity to purchase functional foods. The scale for measuring consumers' knowledge of functional foods is built on existing knowledge scales, but augments them with health-specific issues pertinent to the area of functional foods. Existing scales of consumer knowledge are well developed, but lack the scope to measure knowledge of functional foods. Most scales of consumer knowledge are directed towards more traditional product categories, in which products can be separated by brand and number of attributes, and in which the targeted product category is not pre-defined as being significantly more

expensive than other products in a category. In contrast to other types of food products, functional foods require specialised knowledge of nutrition, differential effects of functional ingredients, and the ability to distinguish conventional foods from functional food alternatives. As Wansink, Westgren, and Cheney (2005) point out: To consume a functional food, people need to know “what” and “why” (p. 267). Without specialised knowledge, a consumer is likely to only buy functional foods occasionally, reflecting random fluctuations in his or her buying behaviour rather than a consistent preference towards functional foods.

Justification

The knowledge component is especially essential for an area such as functional foods, in which the cost of engaging in health-related behaviours significantly exceeds the cost of conventional behaviour. Thus knowledge is crucial in this kind of product setting that is characterised by features that are more numerous and complex than those of food in general, and in which the benefits yielded by functional foods cannot be easily assessed. Across all product categories, functional foods tend to be significantly more expensive than the corresponding conventional products. Product information displayed on food labels and packages may provide little information about product benefits and list ingredients that are unfamiliar to most consumers. Previous models of knowledge have been developed for other product types such as consumer durables and technical devices. A new scale adapted to the specific features of functional foods is therefore needed for this rapidly growing product category. What makes functional food special as a food

product category is that it is enhanced to target specific groups of consumers who are concerned about their health.

It is valuable for companies selling and marketing functional foods to gain insights specifically into consumers' knowledge in order to segment their target markets as well as plan and direct marketing efforts. Considering that marketing costs for functional foods have been claimed to be high (Menrad 2003) and that the awareness and buying propensity of consumers varies, new customer understanding could be useful. The functional foods market is estimated to grow in the future, up to as much as five per cent of the food market; rather than a mass market, it would become a multi-niche market with very few high-volume product categories (Menrad 2003). Understanding the knowledge element could be used to hone companies' competitive advantage in this business environment. For example, patterns in the knowledge of buyers and non-buyers can be used in advertising, packages and product messages. Country- and product-specific understanding is essential, and it can be complemented with the findings of our study to help build better marketing strategies for functional foods.

Studies and reports reveal that what consumers know about functional products varies a great deal (e.g. Menrad 2003; Wansink, Westgren and Cheney 2005; de Jong, Hoendervangers, Bleeker and Ocké 2004; Bogue, Coleman and Sorenson 2005). Those who are knowledgeable about food and nutrition are concerned about their own health. They perceive that diet influences health and that dietary guideline recommendations are important. They are thus more likely to consume healthy foods. In order to promote health and welfare, individuals and society consequently need to learn more about consumers' knowledge about functional foods. Considering that a lack of consumer

knowledge could erode marketing and communication efforts and, ultimately, lead to the loss of sales and customers, companies similarly face a strong need for research about consumers' knowledge of functional foods.

Outline

The rest of the paper is organised as follows. It begins with the conceptualisation of consumer knowledge of functional foods, and defines the components of consumer knowledge that are pertinent to functional foods. It continues with a discussion of the conceptual framework (i.e. the nomological network) of functional foods. Then, the index for measuring consumer knowledge of functional foods is developed. Finally, the index is tested and validated, and implications and an evaluation of the study are presented.

Conceptualising the Consumer Knowledge of Functional Foods Index

The conceptualisation of consumer knowledge of functional foods draws on well-established literature on consumer knowledge with numerous distinctions of knowledge. Most researchers agree that consumer knowledge should be conceptualised as a multidimensional construct consisting of several different sub-components (Brucks 1985; Alba and Hutchinson 1987; Mitchell and Dacin 1996; Spence and Brucks 1997). The different components proposed by researchers vary, ranging from the content and organisation of knowledge to the context in which knowledge is acquired and further on to how it is used. Although these scales are to a certain degree directly applicable to the domain of functional foods, most of them have been developed for measuring knowledge of consumer durables (Mitchell and Dacin 1996; Park, Mothersbaugh and Feick 1994).

Functional foods are distinct from durable products in that they are consumed almost immediately and require little deliberation (as they are low-involvement products, see Holmes and Crocker 1987). That said, specialised knowledge is required to stimulate buying. The specialised demands of functional foods limit the extent to which the literature on consumer knowledge alone can be relied on when developing an index. Although any type of scale can be adapted to suit a particular context, knowledge scales often need to be developed for particular product categories, especially if the product category demands specialised knowledge (cf. Mitchell and Dacin 1996).

The most common distinction of knowledge proposed in the literature that is also applicable to functional foods is the difference between objective and subjective knowledge (Brucks 1985; Park and Lessig 1981). Objective knowledge is a measure of how much factual knowledge a consumer has about a particular topic, and entails knowledge about products, their attributes, and linkages between differing product attributes and their relationship to performance (Moreau, Lehmann and Markman 2001). Objective knowledge is “objective” in the sense that it does not measure consumer perceptions, but factual issues related to a product class (Brucks 1985; Park, Mothersbaugh and Feick 1994). In contrast, subjective knowledge measures consumers’ perceptions about how much they think they know about a product (Bettman and Park 1980; Park, Gardner and Thukral, 1988). Thus, subjective knowledge reflects consumer perceptions of the amount of information they know (Flynn and Goldsmith 1999) and varies depending on the consumers’ personal experiences.

In addition to the objective-subjective dimensions of consumer knowledge, we propose a general-specific continuum of consumer knowledge of functional foods.

According to the categorisation literature, consumers possess knowledge on different levels (Rosch 1978). General (basic) level knowledge comprises knowledge about the shared features of a product class, including information about the product group, and the potential benefits/risks of the products belonging to it. In contrast, specific (subcategory) knowledge comprises information about different products and brands in the product class, their differentiating features, and how their price and packaging information is distinguished. In the case of functional foods, specific knowledge would refer to the names of different products in a product class and information about where they are sold, their differentiating ingredients, and how to recognise them in stores.

Distinctiveness of the Dimensions of Consumer Knowledge

Based on the conceptualisation, the current study proposes that consumer knowledge of functional foods consists of four components: objective, subjective, general, and specific knowledge. The components are expected to correlate and jointly determine the expertise a consumer has in a particular product class. All of these dimensions are important, as they pertain to a consumer's category structure (cf. Alba and Hutchinson 1987). Consumers have both general and specific knowledge about categories (Sujan 1985), which consist of both objective and subjective knowledge (Alba and Hutchinson 1987; Brucks 1985; Cordell 1997, Mitchell and Dacin 1996). Thus, by using these four dimensions, we aim to capture consumer knowledge as represented in product categories and the corresponding category structures.

Although the four components are expected to correlate, the literature has not found their interrelations to be consistent. Although most research reports high

correlations between objective and subjective knowledge (e.g. Mitchell and Dacin 1996), some studies report no similarity across the two measures (e.g. Brucks 1985). Alba and Hutchinson (1987) propose that the differences between expertise and experience can explain the result. As objective knowledge corresponds more to the content of consumers' knowledge structures, whereas subjective knowledge is more related to consumers' personal experiences with the product class (Alba and Hutchinson 1987), the degree to which the two are correlated depends on how the information a person has about a product class correlates with actual usage of it. A consumer can be experienced with a product category without being an expert in it (Jacoby, Troutman, Kuss and Mazursky 1986).

The literature has also found that general and specific knowledge are correlated, but the reasoning for their intercorrelation differs from that of objective and subjective knowledge. Specific knowledge is a more detailed type of knowledge than general knowledge, and the relationship between the two can be described by preclusion (Alba and Hutchinson 1987; Sujan 1985). A person having specific knowledge is also likely to have general knowledge, but a person having general knowledge might not have specific knowledge. Thus, specific knowledge can be considered a subset of general knowledge, and depending on the number of people having specific knowledge the correlation between the two knowledge components may be higher or lower.

Objective and subjective knowledge are also expected to be correlated with general and specific knowledge (Alba and Hutchinson 1987). The more information consumers have about a product class, and the more they use it, the greater the likelihood that they will know a great deal about the benefits of the product class, the number of

products offered in different categories, and the availability of such products in local shops and establishments.

A product class expert has generally been shown to be high in objective knowledge and to possess specific knowledge of a product class (Sujan 1985). Subjective knowledge is not factual, and may therefore be deceptive. Even a novice in a product class may hold a certain degree of general knowledge (Sujan 1985). As their knowledge increases, consumers become more aware of the different subcategories in a product class, and gain more specific knowledge of the product class (Alba and Hutchinson 1987). Further, consumers with specific knowledge would be well aware of different subcategories that exist in the market (Mitchell and Dacin 1996), and could elaborate more on the product class, including listing more product attributes and their relation to product performance (Sujan 1985). Thus, although all four components determine consumer knowledge of a product class, experts are expected to score high in all four dimensions, whereas novices are likely to score high only in two of them. Thus, experts can be expected to differ from novices in terms of their objective and specific knowledge.

Knowledge has been proposed to be indirectly linked to buying behaviour. For example, Brucks (1985) and Brucks and Schurr (1990) propose that knowledge facilitates searching for information and increases the variability of the search. Sujan (1985) found that greater consideration of product attributes (which is facilitated by information search) leads to greater product evaluation, thus corroborating a link between knowledge and product evaluation. Mitchell and Dacin (1986) found that knowledge has a significant impact on the choices consumers make, which, in turn, is expected to lead to buying behaviour. Cordell (1997) found that consumer knowledge increases willingness to pay

for a product, furthering consumer buying. Recognising this link, we propose that consumer knowledge has an indirect effect on buying behaviour, mediated by the consumer's attitude towards functional foods.

Conceptual Framework

Given that no empirical research has been conducted on how the overall, multi-dimensional consumer knowledge construct of functional foods is linked to other important constructs in marketing, this study aims to fill this gap in the literature by specifying the antecedents and consequences of consumer knowledge of functional foods. The study hypothesises that gender, socioeconomic status, age and income serve as meaningful antecedents for consumer knowledge of functional foods. Buying behaviour in terms of purchasing functional foods is portrayed as a consequence, while concern for one's well-being serves as a mediator between knowledge and buying. Each of these issues is elaborated in the hypotheses that follow. Hypotheses at the index level are specified as the expected relationships between the antecedents, and consequences are expected to be similar for all knowledge dimensions.

Gender

Studies addressing consumer attitudes and acceptance of functional foods have often found gender differences. In general, women tend to be more open and interested in functional foods than men are (Childs and Poryzees 1998), and also seem to be more health conscious (Harnack, Block, Subar, Lane and Brand 1997; Turrell 1998; Bogue and Ryan 2000). Such results may stem from the fact that females rather than men tend to buy groceries and food products for their families. Thereby, they are more exposed to

functional foods in stores and may also talk more frequently to other women about food products and cooking than men do. In support of this line of reasoning, Bogue and Ryan (2000) find that females use functional food products more frequently than men. Bogue, Coleman and Sorenson (2005) also find that women, especially in families with children, tend to know more about nutrition than men do. In light of these findings, women are expected to be more knowledgeable than men about functional foods:

H1: Women are more knowledgeable than men about functional foods and score higher on the consumer knowledge index.

Age

Age has also been found to be related to consumer acceptance of functional foods. Results are not as consistent as for gender: some studies find that older adults tend to be more willing to accept functional foods, whereas others (Childs and Poryzees 1998; Armstrong, Farley, Gray and Durkin 2005) find that younger respondents display a greater openness towards functional foods. In a study addressing consumers' nutrition knowledge, Bogue, Coleman and Sorenson (2005) find that the 35-45 age group scored higher than the 14-34 and 55+ age groups, which suggests a curvilinear effect between age and consumer knowledge of functional foods. In general, de Jong, Ocké, Branderhorst, and Friele (2003) suggest that it is difficult to generalise the demographic findings from different types of studies, as they have tended to focus on one particular functional food. For example, de Jong, Hoendervangers, Bleeker, and Ocké (2004) show that gender, age and education affect the use of functional food products, but that the effects differ across food products. Nevertheless, as studies have shown that older adults

tend to be more concerned about disease and health-related problems such as cholesterol and cardiovascular diseases (e.g. Bhaskaran and Hardley 2002), a positive relationship between age and consumer knowledge of functional foods can be predicted:

H2: Age has a positive impact on consumer knowledge of functional foods, and older individuals score higher on the consumer knowledge index than younger respondents.

Income

Income has generally not been addressed in studies addressing functional foods. Yet, given that functional foods are much more expensive than regular food products, it would seem plausible that people with higher incomes would be more likely to be more knowledgeable about functional food products because they can purchase them with fewer financial concerns than low-income households. Support for this hypothesis comes from research into how consumers search for information in a nutritional context. For example, Wang, Fletcher, and Carley (1995) find that higher-income consumers searched for more nutritional information than lower-income consumers. Turrell (1998) reports that the high-income group liked a greater number of healthy foods than the welfare sample, which was significantly less likely to buy healthy food and disliked many of the healthier alternatives. Thus, the following hypothesis is proposed:

H3: Income has a positive impact on consumer knowledge of functional foods, and high-income individuals score higher on the consumer knowledge index than low-income respondents.

Education

Bogue, Coleman, and Sorenson (2005) find that higher socio-economic groups scored higher on nutrition knowledge than lower socio-economic groups. De Jong, Hoendervangers, Bleeker, and Ocké (2004) also report that education affected the use of functional food products, as they found that people with higher education were more prone to use functional food products. Harnack, Block, Subar, Lane, and Brand (1997) discover that the less well educated lacked the knowledge about nutrition required to act in accordance with the recommended dietary guidelines, and that this explained differences in healthy food choices. Thus:

H4: Education has a positive impact on consumer knowledge of functional foods, and highly educated individuals score higher on the consumer knowledge index than low educated respondents.

Attitude towards ones' health

Consumers' knowledge of functional foods is likely to affect their attitude towards their health. Menrad (2003), for example, shows that consumers' knowledge of health effects is linked to the acceptance of a specific functional ingredient. The specific findings of his study point out that ingredients that consumers have known about for a long period of time (e.g. vitamins, minerals) achieve considerably higher acceptance than those which are relatively new (e.g. flavonoid, Omega-3). On a more general level, Feick, Herrmann, and Warland (1986) find that consumers who cared about their nutrition searched for more information about health-related claims. Related to this issue,

Moorman and Matulich (1993) show that consumers with higher health motivation are more likely to engage in health-related behaviour. Thus, we propose that consumers' attitudes towards their health serve as a mediator between consumers' knowledge of functional foods and purchase behaviour.

H5: Attitude towards one's health serves as a mediator between consumers' knowledge of functional foods and their purchase behaviour.

The model featuring antecedents and consequences is displayed in Figure 1 and will be tested with partial least squares modelling.

Figure 1 here.

Measurement and Collection of Empirical Data

A nation-wide study in Finland is used to assess consumers' knowledge of functional foods. Finland was considered an appropriate market to research, as the country is one of the forerunners in the development of functional foods, and consumers can be expected to have varying degrees of knowledge of functional foods across the population. As a result of early functional food launches, Finns are familiar with the notion of functional foods (see Appendix 2). The market is constantly growing, and both new products and brand extensions are launched.

A questionnaire was sent out electronically or in a postal envelope to one hundred friends and family all over Finland. A snowballing data collection technique was used: the persons received the questionnaire together with a letter asking them to forward

it to their friends and family with different demographic profiles. The aim was to reach different types of respondents matching the population of Finland in terms of age, gender, education, occupation, income, household type, and geographical spread. The respondents did not receive a reward for participating in the survey. Subsequent statistical analysis confirmed that the sample was representative of the Finnish population. We estimate that about 1,000 persons were asked to fill in the questionnaire. The period of data collection was August-October 2006. The result was 429 responses, out of which 409 were deemed usable. Twenty questionnaires were discarded due to unreliable answers and too many blanks. Due to the snowballing technique, an exact response rate is difficult to estimate, but based on the information provided by the persons assisting in the data collection and the number of queries received, we estimate the response rate at approximately 43 per cent. Initially, questionnaires were sent all over Finland (South, North, West, and East based on the established region zones covering the whole country that are used by Statistics Finland, for example. The final response rate approximates the number of inhabitants in each district representing the whole country, using a comparison standard obtained by Statistics Finland. Thus, the data collection technique was successful in reaching consumers all over the country.

Measurement

The scale for *objective knowledge* was adapted from Park, Mothersbaugh and Feick (1994). It featured 15 questions examining consumers' objective knowledge of CD players, and consisted of questions ranging from how a CD player should be used to questions concerning models and brands in the market. Consumers could respond "True"

“False”, or “Don’t Know” to the questions. We adapted this scale to be suitable for functional foods.

Subjective Knowledge was measured by asking how long consumers had known about functional foods, and the extent to which they perceived themselves to be more knowledgeable about functional foods than other people (Park, Mothersbaugh and Feick 1994). The scale of subjective knowledge ranged from 0 to 10.

General knowledge was measured by asking consumers what functional foods are, what the most common ingredients added to functional foods are, how functional foods are recognised, and to list the number of brands of functional foods that they knew. Consumers were also asked to combine the right type of health problem (such as high blood pressure) with the right active ingredient (peptide), and were given five different combinations. The resulting scale ranged from 0 to 15.

Specific knowledge was measured by asking consumers to list what functional food products are available in Finland, what companies in Finland produce functional foods, and to combine the right product (such as Benecol) with the right type of benefit it provides (lowers cholesterol). As in the scale for general knowledge, they were given five different combinations. The resulting scale ranged from 0 to 21. All of the scales of the knowledge components are fully presented in Appendix 1.

Buying behaviour was measured by asking consumers how often they buy functional foods (ranging from “every day” to “never”), the number of different types of functional foods they buy, and the number of brands of functional food they purchase.

Results

Demographics

Geographically, the respondents were distributed proportionally to the number of inhabitants in each district: 187 (40.9%) were from South Finland, 130 (35.6%) from West Finland, 55 (12.7%) from East Finland, and 37 (9.1%) from North Finland. The respondents were mainly women (76%). Most of the respondents had a secondary education (32%) or a college or university education (34%). Almost half of the respondents were married (48%), whereas 24 per cent were unmarried, and 20 per cent were living together. A third of all respondents (34%) were couple households, whereas 25 per cent represented single households. 23 per cent of the respondents had 1-2 children in the household, and 8.8 per cent had more than 2 children.

Correlations

First the intercorrelation is estimated between the four knowledge components: objective, subjective, general, and specific knowledge. The correlations are presented in Table 1. As can be seen, all correlations are significant, ranging from .21 to .53. The largest correlation is between general and specific knowledge (.53), whereas the smallest is between subjective and general knowledge (.21). Despite the fact that all correlations are significant, there is no indication of multicollinearity, as the correlations do not exceed .60 (Hair, Anderson and Tatham 1998).

Table 1 here.

Cluster analysis

A K-means cluster analysis with two clusters produced an understanding of different customers' buying propensity. The purpose of the cluster analysis was to find out how different segments of customers in the data are distinguished based on the

knowledge dimensions. The cluster solution divided the data into experts and novices. Cluster 1, which represents experts, has cluster means of 5 (objective), 5 (subjective), 3 (general), and 4 (specific). Cluster 2 representing novices has corresponding means of 4 (objective), 5 (subjective), 3 (general), and 3 (specific). The results of the cluster analysis are depicted graphically in Figure 2. As can be seen, the only differences between the clusters are in the components of objective and specific knowledge. A t-test run between the cluster means shows that the groups differ significantly in their buying behaviour ($m = 11$ for cluster 1, and $m = 6$ for cluster 2, $p < .001$) and thereby represent different market segments. To optimise buying behaviour, experts should be targeted. As the results show, objective and specific knowledge can be used to reach these consumers.

Figure 2 here.

Knowledge index

In forming the index, each knowledge scale was converted into an eight-point scale, ranging from 0 to 7. All of the resulting scales loaded on one factor, and were collapsed for subsequent analysis. Specific knowledge made the largest contribution to the index (factor loading .80), whereas subjective knowledge had the lowest impact on the index (factor loading .66). All of the knowledge dimensions exhibit high reliability, with factor loadings exceeding .60, composite reliability exceeding .70, and average variance extracted exceeding .50 (Fornell and Larcker 1981).

Hypothesis testing

The hypotheses were tested with partial least squares modelling (PLS) using PLS Graph 3.0. PLS is a structural equation modelling technique. It is well-suited for marketing data that often do not satisfy the requirements of multinormality, interval

scaling, or the sample size required by maximum likelihood estimation (Fornell and Bookstein 1982). It permits the use of categorical variables in the model and places less stringent requirements on sample size than covariance-based techniques such as LISREL (Chin 1998). By being flexible in its requirements, PLS also avoids factor indeterminacy and inadmissible solutions (Fornell and Bookstein 1982; Gopal, Bostrom and Chin 1992). Path coefficients can be interpreted as regression weights (i.e., standardised beta weights) and indicator loadings as principal component loadings within the context of the model (Falk and Miller 1992; Gopal, Bostrom and Chin 1992).

The results are shown in Table 2, and will be discussed next.

Table 2 here.

H1 predicted that women are more knowledgeable than men about functional foods and score higher on the consumer knowledge index. The results show that females were more likely to be knowledgeable than males about functional foods ($\beta = .129$, $t = 2.69$, $p < .01$) with the means for the overall index differing significantly from each other ($m = 16.36$ for females vs. $m = 15.24$ for males, $t = 2.86$, $p < .01$). H1 is thus supported.

H2 predicted that age has a positive impact on consumer knowledge of functional foods, and that older individuals score higher on the consumer knowledge index than younger respondents. The results failed to yield support for this hypothesis ($\beta = .062$, $t = 1.26$, $p > .10$). A post-hoc test revealed that younger adults (18-25 years) differed significantly from old adults (66+) and that the 55-65 and 66+ age groups differed significantly from the others. The age group scoring highest on overall knowledge of functional foods was 55-65-year-olds ($m = 17.45$), with the youngest adults and old adults scoring the lowest ($m = 15.37$ [young adults] and $m = 14.30$ [old adults]). No

systematic relationship between age and knowledge of functional foods appears to exist. Rather, certain age groups stand out by having more or less knowledge than others.

H3 proposed that income has a positive impact on consumer knowledge of functional foods, and that high-income individuals score higher on the consumer knowledge index than younger respondents. H3 is supported ($\beta = .115$, $t = 1.86$, $p < .01$). A post-hoc test showed that the relationship between income and knowledge is linear, with people earning less than EUR 10,000 annually having the lowest knowledge of functional foods ($m = 15.52$) and consumers earning more than EUR 60,000 having the highest knowledge of functional foods ($m = 17.15$).

H4 predicted that education has a positive impact on consumer knowledge of functional foods and that highly educated individuals would score higher on the consumer knowledge index than low educated respondents. H4 is also supported ($\beta = .097$, $t = 2.25$, $p < .01$). Consumers with a high-school education scored lower on the knowledge index ($m = 14.21$) than university-educated respondents ($m = 16.23$).

H5 proposed that attitudes toward one's health would mediate the effect between consumers' knowledge of functional foods and buying behaviour. The paths between knowledge and attitude towards one's health ($\beta = .187$, $t = 3.25$, $p < .01$) and attitude toward one's health and buying behaviour are significant ($\beta = .164$, $t = 3.50$, $p < .01$). A Sobel test for mediation showed that attitude serves as a meaningful mediator between consumers' knowledge of functional foods and purchase behaviour ($t = 2.38$, $p = .017$ (two-tailed)). H5 is thus supported.

Summary

The purpose of this article was to construct an index to measure consumers' knowledge of functional foods. Most consumer knowledge scales have been created for consumer durables, and it was therefore considered fruitful to develop a scale directly applicable to the domain of functional foods. Based on previous studies (e.g. Brucks 1985; Alba and Hitchinson 1987; Mitchell and Dacin 1996), the scale was conceptualised to consist of four components: objective knowledge, subjective knowledge, general knowledge, and specific knowledge. These components were hypothesised to correlate, with objective knowledge being the most important component in the index.

The results show that the knowledge components correlated moderately with each other, with partial correlations ranging from .21 to .53, with objective and specific knowledge being the most important components in the index, as they distinguish experts from novices. The prediction was that gender, age, education, and income would serve as antecedents to consumers' knowledge of functional foods, whereas attitude towards one's health would mediate the effect between knowledge and purchase behaviour. With the exception of age, all of these hypotheses are supported. Thus, the consumer knowledge index can be considered a reliable measurement instrument for assessing consumers' knowledge of functional foods.

Conclusions and Implications

Contribution

This study makes several contributions to the current body of research. First, the study contributes to current knowledge about consumer knowledge by developing, testing and presenting a new scale for measuring consumer knowledge. Existing scales of

consumer knowledge from other consumer product categories are adapted to accommodate the objectives of the study, and a two-dimensional scale of general knowledge is created in accordance with the distinction between generalised and specific knowledge presented in cognitive psychology. The scale introduces a new general-knowledge dimension that extends the literature on consumer knowledge so that it is more applicable to non-durables and edible products. Previous scales are adjusted to fit functional foods, which is important because it provides insights into consumer behaviour regarding such products. In contrast to previous scales of consumer knowledge, the current scale focuses on a consumer good category that is relatively new and evolving fast, and which directly affects consumers' health while requiring special buying incentives to offset their potential reservations and a comparatively high price level. Previous knowledge scales, such as procedural knowledge and knowledge organisation, are more appropriate for consumer durables for which consumers do not only need knowledge about the product itself, but also about its use. Specifically for functional foods, the findings suggest that while all four knowledge components correlate (without multicollinearity), specific knowledge is the most important knowledge component. Compared to Wansink, Westgren, and Cheney's study (2005), in which they used attribute-related knowledge of the food and consequence-related knowledge of how it will benefit them, the new scale encompasses and distinguishes more knowledge dimensions. Further, in contrast to the current study, which covers dairy and juice products, their study was narrower, focusing on knowledge about one selected product, soy. Their findings are in line with the current study, also underscoring the importance of

differentiating between different types of knowledge when trying to understand this knowledge-behaviour link.

Second, the study contributes to current knowledge about consumer knowledge by empirically demonstrating differences in knowledge about functional foods between so-called novices and experts. This distinction has not been revealed in previous studies. Not only can two groups be distinguished, but they also significantly differ in terms of their buying propensity. These findings could be explored in greater depth in other product categories as well in order to understand and explain consumer buying behaviour. These findings help both researchers and marketers to distinguish and approach fundamentally different functional food consumers.

Third, the study adds to the body of empirical research on functional food within the marketing discipline. It confirms findings from other studies (de Jong et al 2004) that also have found that consumer knowledge about functional foods varies greatly and that consumers are rather confused about usage practices, target groups, safety, efficacy, and health claims. In general, the findings are in accordance with those of other studies on consumer attitudes towards food and nutrition (Wang et al 1995; Childs and Poryzees 1998; Childs and Poryzees 1998, Harnack et al 1997; De Jong et al 2004; Turrell 1998; Bogue et al 2005). They confirm that, in the specific context of Finland, the consumers who are likely to use functional foods are higher-income and higher-educated women. These groups of consumers seem to be more knowledgeable about functional foods and their purchase behaviour is affected by their attitude towards their own health. On the other hand, the influence of age on knowledge was not as straightforward as could be expected and as previously found (Bhaskaran and Hardley 2002; Armstrong et al 2005;

Bogue et al 2005). The findings also support Moorman and Matulich's (1993) as they indicate that a person's attitude towards his or her own health serves as a mediator between knowledge and buying of functional foods.

Limitations

These findings and conclusions should, as always, be seen within the context of certain limitations. First, the study is indicative but exploratory in the sense that this study should be replicated to determine the extent to which the findings can be generalised to other countries and product categories. Second, the cross-sectional design of the survey implies that it represents a snapshot picture of a situation that is dynamic and changes over time. The study could have benefited from choosing a time perspective that reveals changes in consumers' knowledge, alternately adding more or selecting other functional food products. Using other knowledge components would also have yielded other findings as would considering mediating variables, for instance the respondents' medical condition and use of prescription medication. Emotions such as fear and trust were not included in the study but could have been, as they would have provided supplementary insights.

Managerial Implications

Manufacturers of functional foods are faced with several challenges. Given that health claims have increased significantly in the past years (de Jong et al 2004), consumers find it increasingly difficult to distinguish between the health claims provided by general nutrition, medicines, and functional foods. From a managerial point of view,

gaining an insight into consumers' knowledge of functional foods allows companies to achieve better market segmentation. Given that consumers have differing types of knowledge in the market, targeting highly knowledgeable consumers ensures sufficient response to promotional offers, for example. A primary goal of functional food manufacturers should be to teach and educate consumers about their products. By informing consumers about the ingredients used in their products, and the corresponding health benefits, manufacturers can increase sales while also helping consumers take better care of themselves. Working with health practitioners could also ensure that consumers with specific health issues – for example, in relation to digestion – can alleviate their symptoms with the use of functional foods.

Further Research

Future research is needed to validate the scale of consumer knowledge of functional foods. As we only presented the index in this paper, future research needs to corroborate the findings of this study.

The link between consumers' knowledge of functional foods and physical health is an interesting area for future research to explore. Moorman and Matulich (1993) found that knowledge of health claims is considered a key driver for consumers to engage in health-related behaviour. Thus, it is in the interest of health practitioners to motivate consumers to learn about healthy lifestyle alternatives, and to educate consumers about non-medical choices that foster their health. It would therefore be useful to examine the extent to which consumers who buy functional foods are also concerned about their physical condition.

Functional foods offer a great deal of potential for future research. One idea is to distinguish similarities and differences in consumer knowledge about functional foods versus conventional foods. Another research idea would be to examine early adopters of functional food products, as the literature on adoption behaviour indicates that experts in core areas (in this case, in conventional foods, such as cooks) might be more sceptical towards new areas that take a different point of departure (i.e. medicine, nutrition) than regular developments in the category (e.g. organic food). Instead, health professionals and medical doctors that are experts in a supplemental area (nutrition and medicine) might be the first to adopt functional foods.

Another interesting research topic would be the motivations of food manufacturers to develop functional foods, the incentives they give to consumers to try functional foods, and the marketing tactics they use to stimulate demand for functional foods, and educate consumers about their benefits. It would also be interesting to examine collaboration between functional food manufacturers and health professionals, as their interrelationships might influence the development and sales of functional foods.

REFERENCES

- ACNielsen 2005. A Global ACNielsen Online Survey - Consumer Attitudes Towards Functional Foods & Organics.
http://www.acnielsen.fi/news/documents/Functional_Organics_Nov05.pdf.
- Alba, J.W., and W.J. Hutchinson. 1987. Dimensions of consumer expertise. *Journal of Consumer Research* 13, no. 4: 411-454.

- Armstrong, G., H. Farley, J. Gray, and M. Durkin. 2005. Marketing health-enhancing foods: implications from the dairy sector. *Marketing Intelligence & Planning* 23, no. 7: 705-719.
- Bech-Larsen, T., and K.G. Grunert. 2003. The perceived healthiness of functional foods: A conjoint study of Danish, Finnish and American consumers' perception of functional foods. *Appetite* 40, no. 1 February: 9-14.
- Bettman, J.R., and C.W. Park. 1980. Effects of prior knowledge and experience and phase of the choice process on consumer decision processes: A protocol analysis. *Journal of Consumer Research* 7, no. 3 December: 234-248.
- Bhaskaran, S., and F. Hardley. 2002. Buyer beliefs, attitudes and behaviour: Foods with therapeutic claims. *Journal of Consumer Marketing* 19, no. 7: 591-606.
- Bogue, J., T. Coleman, and D. Sorenson. 2005. Determinants of consumers' dietary behaviour for health-enhancing foods. *British Food Journal* 107, no. 1: 4-16.
- Bogue, J., and M. Ryan. 2000. Market-oriented new product development: functional foods and the Irish consumer. Agribusiness Discussion Paper No. 27. Department of food economics. National University of Ireland, Cork.
- Brucks, M. 1985. The effects of product class knowledge on information search behavior. *Journal of Consumer Research* 12, no. 1 January: 1-16.
- Brucks, M. 1986. A typology of consumer knowledge content. In *Advances in Consumer Research* Vol. 13, ed. R.J. Lutz, 58-63. Provo, UT: Association for Consumer Research.

- Brucks M. and P. H. Schurr. 1990. The effects of bargainable attributes and attribute range knowledge on consumer choice processes. *Journal of Consumer Research* 16, no. 4: 409-419.
- Childs, N.M., and G.H. Poryzees. 1998. Foods that help prevent disease: consumer attitudes and public policy implications. *British Food Journal* 100, no. 9: 419-426.
- Cordell, V. V. 1997. Consumer knowledge measures as predictors in product evaluation. *Psychology and Marketing* 14, no. 3: 241 – 260.
- de Jong, N., M.C. Ocké, H.A.C. Branderhorst, and R. Friele. 2003. Demographic and lifestyle characteristics of functional food consumers and dietary supplement users. *British Journal of Nutrition* 89, no. 2: 273-281.
- de Jong, N., C.T. Hoendervangers, J. K. Bleeker, and M. C. Ocké 2004. The opinion of Dutch dietitians about functional foods. *Journal of Human Nutrition and Dietetics* 17, no. 1 February: 55-62.
- European Food Information Council (EUFIC). Scientific Substantiation: A Key Ingredient for Functional Foods and Health Claims. <http://www.eufic.org/article/en/page/FTARCHIVE/artid/scientific-substantiation-functional-foods-health-claims/>.
- Falk, R. F. and N. B. Miller .1992. *A primer for soft modeling*. Akron, Ohio: The University of Akron Press.
- Feick, L.F., R.O. Herrmann, and R.H. Warland 1986. Search for nutrition information: A probit analysis of the use of different information sources. *The Journal of Consumer Affairs* 20, no. 2 Winter: 173-192.

- Flynn, L. R., and R.E. Goldsmith. 1999. A short, reliable measure of subjective knowledge. *Journal of Business Research* 46, no. 1 September: 57-66.
- Fornell, C, and F. L. Bookstein. 1982. Two structural equation models: LISREL and PLS applied to consumer exit-voice theory. *Journal of Marketing Research* 19, no. 4: 440-452.
- Fornell, C. and D. F. Larcker (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research* 18 no. 1: 39-50.
- Functional Food & Drink Consumption Trends, Food/Beverage Market Research Reports Portal by Global Information Inc. <http://www.foodandbeveragereports.com/products/dc49371.html>.
- Gilbert, L. 2000. Marketing functional foods: how to reach your target audience. *AgBioForum* 3, no. 1: 20–38.
- Gopal, A., R. P. Bostrom, and W. W. Chin. 1992. Applying adaptive structuring theory to investigate the process of group support systems use. *Journal of Management Information Systems* 9, no. 3: 45-69.
- Hair Jr, J. F., R. E. Anderson, W. C. Black, and R. L. Tatham. 1998. *Multivariate Data Analysis*. 5 ed. New Jersey: Prentice Hall.
- Harnack, L., G. Block, A. Subar, S. Lane, and R. Brand. 1997. Association of cancer prevention-related nutrition knowledge, beliefs, and attitudes to cancer prevention dietary behaviour. *Journal of the American Dietetic Association* 97, no. 9 September: 957-965.

- Holmes, J.H., and K.E. Crocker. 1987. Predispositions and the comparative effectiveness of rational, emotional and discrepant appeals for both high involvement and low involvement products. *Journal of the Academy of Marketing Science* 15, no. 1: 27-35.
- International Food Information Council (IFIC), Consumer Attitudes toward Functional Foods/Foods for Health. <http://www.ific.org/research/funcfoodsres07.cfm>.
- Jacoby, J., T. Troutman, A. Kuss, and D. Mazursky. 1986. Experience and expertise in complex decision making. In *Advances in Consumer Research* Vol. 13, ed. R.J. Lutz, 469-472. Provo, UT: Association for Consumer Research.
- Johnson, E. J., and E.J. Russo. 1981. Product familiarity and learning new information. In *Advances in Consumer Research* Vol. 8, ed. K.B. Monroe, 151–155. Ann Arbor, MI: Association for Consumer Research.
- Killackey-Jones, B., R. Lyle, W. Evers, and M. Tappe. 2004. An effective 1-hour consumer-education program on knowledge, attitude, and behavior toward functional foods. *Journal of Extension* 42, no. 1. <http://www.joe.org/joe/2004february/iw2.shtml>
- Lappalainen, R., J. Kearney, and M. Gibney 1998. A pan EU survey of consumer attitudes to food, nutrition and health: an overview. *Food Quality and Preference* 9, no. 6: 467-478.
- Menrad, K. 2003. Market and marketing of functional food in Europe. *Journal of Food Engineering* 56, no. 2: 181-188.
- Mitchell, A.A., and P.A. Dacin. 1996. The assessment of alternative measures of consumer expertise. *Journal of Consumer Research* 23, no. 3: 219-239.

- Moorman, C., and E. Matulich. 1993. A model of consumers' preventive health behaviors: The role of health motivation and health ability. *Journal of Consumer Research* 20, no. 2 September: 208-228.
- Moreau, P.C., D.R. Lehmann, and A. Markman. 2001. Entrenched knowledge structures and consumer response to new products. *Journal of Marketing Research* 38, no. 1 February: 14-29.
- Park, C. W., and P.V. Lessig. 1981. Familiarity and its impact on consumer decision biases and heuristics. *Journal of Consumer Research* 8, no. 2 September: 223-231.
- Park, C. W., M. L. Gardner, and Thukral V. K. 1988. Self-perceived knowledge: Some effects on information processing for a choice task. *American Journal of Psychology* 101, Fall: 401-424.
- Park, C. W., D.L. Mothersbaugh, and L. Feick 1994. Consumer knowledge assessment. *Journal of Consumer Research* 21, no. 1 June: 71-82.
- Raisio. www.raisiogroup.com
- Ronteltap, A., J.C.M. van Trip, R.J. Renes, and L.J. Frewer. 2007. Consumer acceptance of technology-based food innovations: Lessons for the future of nutrigenomics. *Appetite* 49, no. 1 July: 1-17.
- Rosch, E.H. 1978. Principles of categorization. In *Cognition and categorization*, eds. E.H. Rosch and B.B. Lloyd, 27-48. Hillsdale, N.J.: Erlbaum Associates.
- Spence, M.T., and M. Brucks. 1997. The moderating effects of problem characteristics on expert judgment. *Journal of Marketing Research* 34, no. 2 May: 233-247.

- Sujan, M. 1985. Consumer knowledge: Effects on evaluation strategies mediating consumer judgments. *Journal of Consumer Research* 12, no. 1 June: 31-46.
- Turrell, G. 1998. Socio-economic differences in preference and their influence on healthy food purchasing choices. *Journal of Human Nutrition and Dietetics* 11, no. 2 April: 135-149.
- Urala, N., and L. Lähteenmäki. 2003. Reasons behind consumers' functional food choices. *Nutrition & Food Science* 33, no. 4: 148-158.
- Valio. <http://www.valio.fi>
- Verbeke, W. 2005. Consumer acceptance of functional foods: socio-demographic, cognitive and attitudinal developments. *Food Quality and Preference* 16, no. 1 January: 45-57.
- Wang, G., S.M. Fletcher, and D.H. Carley. 1995. Consumer utilization of food labeling as a source of nutrition information. *The Journal of Consumer Affairs* 29, no. 2: 368-380.
- Wansink, B., R.E. Westgren, and M.M. Cheney. 2005. Hierarchy of nutritional knowledge that relates to the consumption of a functional food. *Nutrition* 21, no. 2: 264-268.
- Xylitol. <http://xylitol.org/>

Figure 1 Consumers' Knowledge of Functional Foods: Antecedents and Consequences

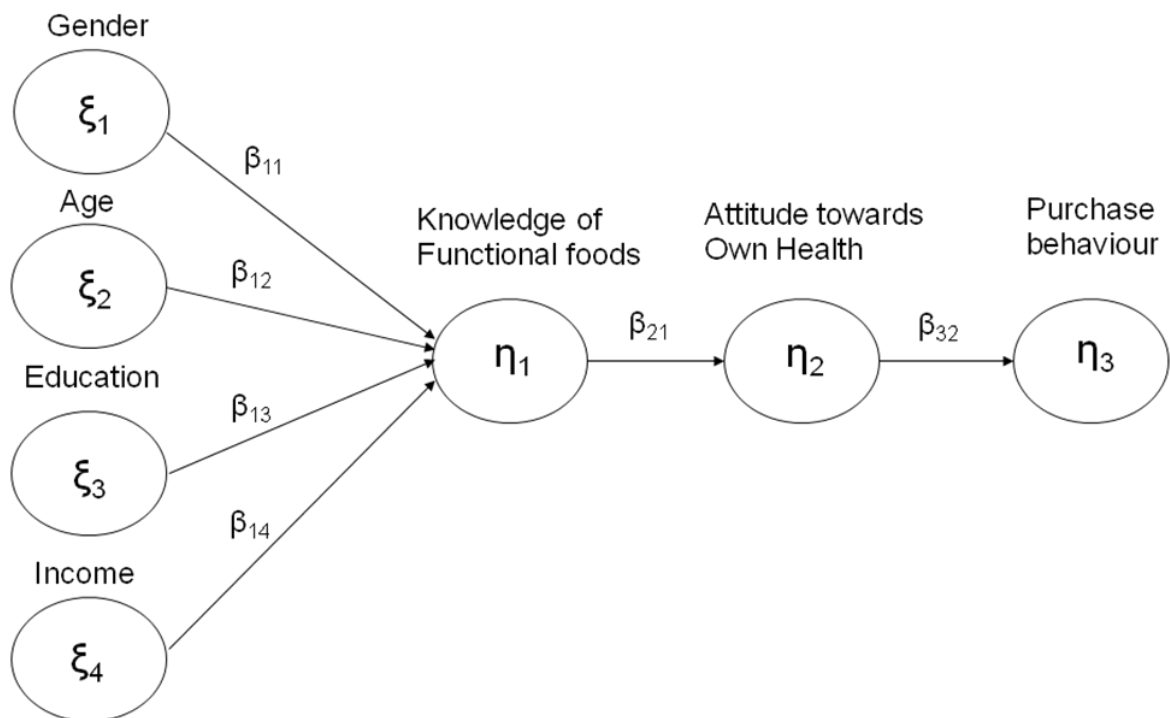


Table 1 Correlations among Knowledge Components

	Objective knowledge	Subjective knowledge	General knowledge	Specific knowledge
Objective knowledge	1			
Subjective knowledge	.38**	1		
General knowledge	.36**	.21**	1	
Specific knowledge	.36**	.38**	.53**	1

** all significant at the .01 level

Figure 2 Knowledge Dimensions

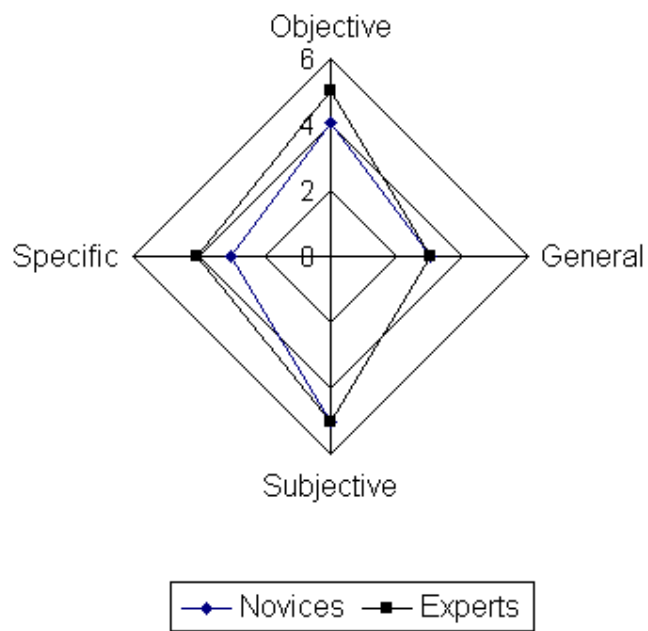


Table 2
Path Coefficients and Significance Values

Dependent variable	Independent variable	Path coefficient	t-value	significance	Supported
Knowledge	Gender	-.129	2.69	p<.01	Yes
	Age	.062	1.26	p<.10	No
	Education	.097	2.25	p<.01	Yes
	Income	.115	1.86	p<.01	Yes
Attitude toward one's health	Knowledge	.187	3.25	p<.01	Yes
Buying	Attitude toward one's health	.164	3.50	p<.01	Yes

Appendix 1 General Knowledge

Item	Options
1. What are functional foods?	1. Gene manipulated foods 2. Food with added beneficial ingredients 3. Food in capsules or pills 4. Ecological food 5. I don't know
2. What are the most common ingredients added to functional foods?	1. Fibre 2. Berries 3. Milk bacteria 4. Vitamins 5. Flavonoids 6. Artificial sweetener 7. Iron 8. Calcium 9. Olive Oil 10. Herbs 11. Plantstanol 12. Peptides 13. I don't know
3. Combine the right type of health problem with the right active ingredient	1. Calcium – Weak bones 2. Peptide – High blood pressure 3. Flavonoid – Urinary tract infection 4. Milk bacteria – Digestion problems 5. Plantstanol – High cholesterol

Specific Knowledge

Item	Options
1. What functional food products are available in Finland?	1. Yoghurt 2. Milk 3. Sour milk 4. Enriched drinks 5. Ice cream 6. Juice 7. Thick juice (Juice soup) 8. Cheese 9. Margarine
2. What companies in Finland produce functional foods?	1. Valio Oy 2. Danone Finland Oy 3. Ingman Foods Oy Ab 4. Raisio Oyj 5. Unilever Finland Oy 6. Juustoportti Oy 7. All dairies in Finland 8. I don't know
3. Combine the right type of product with the benefit it provides	1. Rela – Digestion 2. ProFeel – Weight control, calcium supplement 3. Benecol – Lowers cholesterol 4. Evolus – Lowers high blood pressure 5. Actimel – Helps strengthen overall health

Objective Knowledge

Item	Options
1. Functional foods contain medical ingredients	
2. You can get an overdose from functional foods	
3. Only people with health problems should use functional foods	
4. Functional dairy and juice products cost on average 400-500 per cent more than conventional dairy and juice products	
5. Functional foods are expensive, since their research and development is costly	
6. Functional foods only exist in the dairy product and juice categories	
7. Functional foods are only sold in specialty stores and pharmacies	
8. Functional foods have existed in Finland for more than 10 years	
9. Functional dairy and juice products are only sold in Finland	
10. Most functional dairy and juice products are especially good for children	
11. Fat-free or sugar-free dairy and juice products can be classified as functional	
12. After using functional foods a few times you notice the difference in your health and then you can stop taking them	
13. Functional foods should be used periodically	
14. Japan and Finland are the forerunners in the research and development of functional foods	
15. By consuming functional foods, you can reduce medication for cholesterol (with your doctor's permission)	

Subjective Knowledge

Item	Options
1. List the number of brands of functional foods that you know	
2. How long have you known about functional foods?	1. I had not heard about them before this survey 2. Less than a year 3. 1-5 years 4. 5-10 years 5. More than 10 years
3. How much do you know about functional foods?	1. Nothing really 2. I am somewhat knowledgeable about functional foods 3. I know more than the average person 4. I know a great deal about functional foods

Appendix 2 Functional foods on the Finnish market

Three functional food products in Finland were introduced early and are still the best known. The first and oldest is Xylitol-Jenkki, the first xylitol chewing gum in the world, launched by the Finnish company Leaf in 1975. Xylitol is a sweetener that also dramatically reduces new tooth decay, along with halting or even reversing existing dental caries. Today Xylitol is sold globally and has been added to toothpaste, mints and other products (Xylitol 2007).

The second household functional food product is Benecol margarine, launched by Raisio in 1995. It contains plant stanol ester and is intended for people who wish to reduce their serum cholesterol levels through diet. The Benecol brand has now been extended to other product categories such as oils, spreads, yoghurts, pasta, oatmeal and dairy products, and launched outside Finland in Europe and the US (Raisio 2007).

The third familiar functional food ingredient is GEFILUS, launched in 1990 by Valio, Finland's largest dairy company. It contains the *Acidophilus* cultures/probiotic *Lactobacillus GG* lactic acid bacterium. Its health-promoting effect occurs mainly in the digestive tract and the intestines. Today, the product range includes yoghurts, fermented milks, milks, daily dose drinks, juices, berry soups, cheese and capsules. GEFILUS products are also exported to Russia, Sweden, and the Baltic States (Valio 2007).