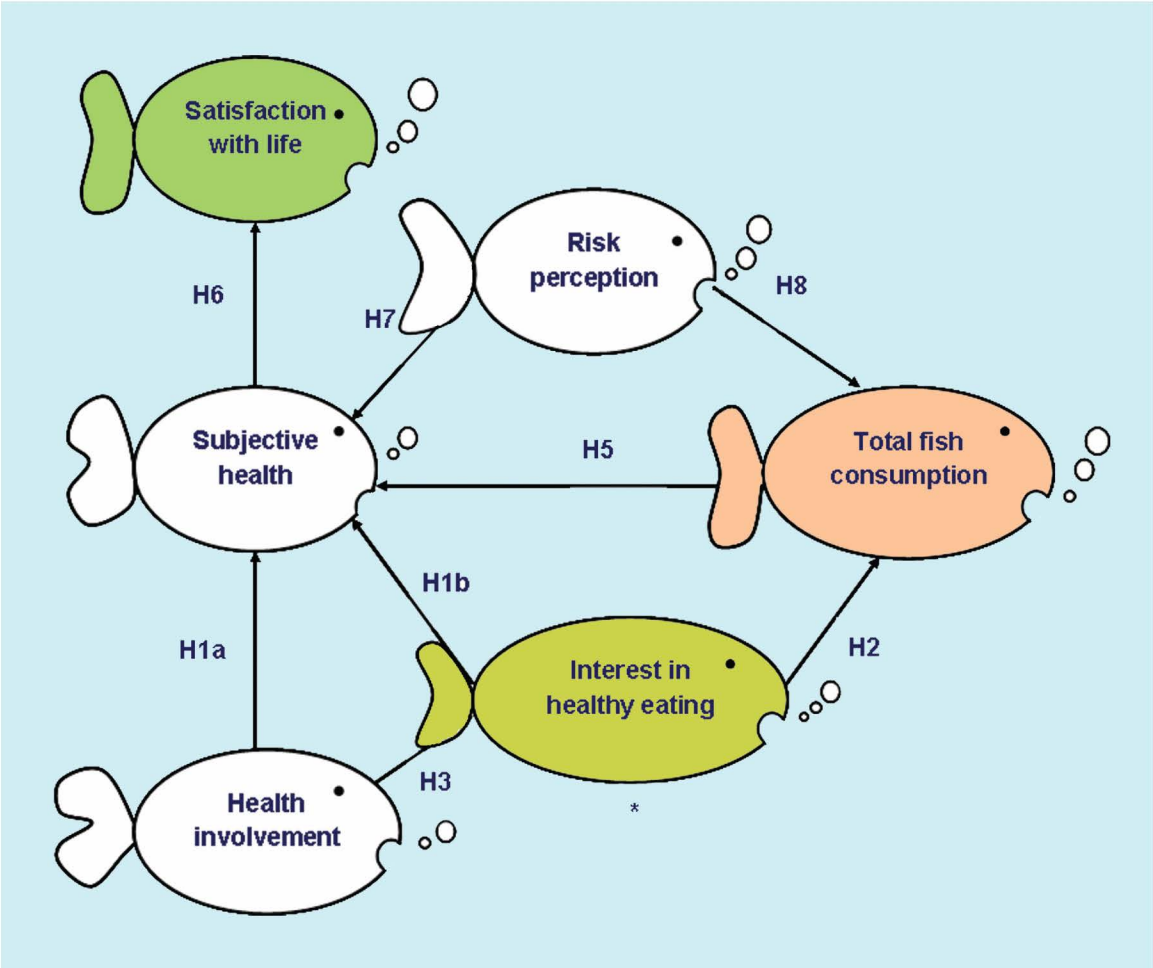

Information and health-related beliefs as determinants of fish consumption

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Chapter I

Scope, objectives and outline of the thesis

Preface

This doctoral research has been performed within the framework of the European Integrated Project SEAFOODplus, which has been funded during 2004-2008 by the European Union as part of the Sixth Framework Programme (FP6) for Research, Technological Development and Demonstration. The overall strategic objective of the SEAFOODplus project is to reduce health problems and to increase the well-being among European consumers by applying the benefits obtained through consumption of health promoting and safe seafood products of high eating quality.

This doctoral research has been part of the research activities performed within the Consumer Pillar of SEAFOODplus. This pillar concentrated on consumer issues related to seafood consumption, more specifically on improving the understanding of consumer preferences, attitudes and choices related to seafood in general, and fish in particular. Consumer interest in information (about health, safety and ethical issues), labelling and traceability related to seafood has been covered specifically in the SEAFOODplus project 2.3 SEA-INFOCOM, which is the primary project under which this doctoral research resorts. Data collection and analysis have been performed in close collaboration with the SEAFOODplus project 2.1 CONSUMERSURVEY, where the main focus has been on understanding and explaining the cross-cultural differences in seafood consumption levels in Europe by means of consumers' motives and barriers, attitudes, preferences and eating habits across different consumer segments.

Thus far, very few studies concerning consumer information needs, the role of different information sources and labelling cues, have concentrated specifically on fish, which is exactly the gap in contemporary knowledge this study aims to bridge, at least partly.

Gaining insight into consumer interest in different information sources and cues, and the role of information and health-related beliefs as determinants of seafood consumption, is an important challenge since consumer decision-making and utility maximisation are disturbed by imperfect information and uncertainty, or because consumers lack knowledge about how to use information cues. Ultimately, decision-making under uncertainty leads to choices that are not well aligned with actual preferences, and this means obviously a restriction to consumer's well-being. Since this idea contradicts the overall aim of SEAFOODplus, namely increasing the well-being of European consumers through providing them with safe and healthy seafood, we felt it worth devoting our attention to information and health-related beliefs as determinants of fish consumption.

1 General introduction

Nowadays, a lot of research in various scientific disciplines, e.g. nutrition science, medicine, sociology, psychology but also consumer and marketing science is carried out with the overall objective to reduce food- and lifestyle-related health problems and to increase the overall well-being of consumers. Several studies have demonstrated a clear and positive link between personal health and expressions of well-being, particularly also between subjective, thus self-evaluated health, and satisfaction with life (Arrindell et al., 1991; Brief et al., 1993; Michalos et al., 2007) as well as subjective well-being (George & Landerman, 1984; Wilson, 1967).

Through changing lifestyles and dietary patterns, chronic, non-communicable diseases – including cardiovascular disease, diabetes, obesity, hypertension, stroke, and some types of cancer – have globally become important causes of disability and premature death (World Health Organization, 2003). Diet and nutrition are major determinants of chronic diseases, with extensive scientific evidence (e.g. Feldeisen & Tucker, 2007; Kaline et al., 2007; Stampfer et al., 2000) supporting the opinion that alterations in diets have strong effects, either positive or negative, on health throughout the entire human life (World Health Organization, 2002). Most importantly, dietary adjustments may not only influence people's present health status, but may also determine whether or not an

individual will develop diseases such as cancer, cardiovascular disease and diabetes much later in life. As a result, healthy eating has been heavily promoted during the last few decades in most European countries that showed as outcome distinct trends toward more healthy food consumption (Elmadfa & Weichselbaum, 2005; Gilbert, 2000; Leek et al., 2000; Ragaert et al., 2004). Nevertheless, some studies (Ashfield-Watt et al., 2004; Ashfield-Watt et al., 2007) indicated that despite the public health efforts, still a large proportion of the population was not complying with the recommendations, particularly those related to fruits and vegetables.

It is generally agreed that seafood is a valuable resource for human nutrition. Although the beneficial effects of seafood have been well known since the 1950´s, there has been an overwhelming focus on the essential long-chain polyunsaturated fatty acids (PUFA) i.e. eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), as carriers of almost all the documented health effects. However, consumption of seafood ensures several important nutrients and micronutrients beyond the well-documented the essential long-chain polyunsaturated fatty acids (PUFA) (Hooper et al., 2006). Scientific evidence is available that fish and seafood are an important source of a number of nutrients, particularly protein, retinol, vitamin D, vitamin E, iodine and selenium (Slimani et al., 2002). Epidemiological studies indicate that seafood contributes to a healthy diet, and populations that eat seafood regularly have been reported to face a lower risk of coronary heart diseases (Mozaffarian et al., 2005; Nestel, 2000; Schmidt et al., 2000), inflammatory diseases (Calder, 2006; Lands, 2005) and cancer (Caygill et al., 1996; Fernandez et al., 1999). Furthermore, high maternal fish consumption during pregnancy and infant's fish intake during the first year is associated with higher cognitive, fine motor, communication and social developmental skills (Daniels et al., 2004; Hibbeln et al., 2007). Hence, there is abundant evidence that seafood may play an important role in a healthy diet – and consequently also in securing consumer well-being in general.

Nevertheless, at the same time fish is also a potential source of human exposure to contaminants like methyl mercury, polychlorinated biphenyls (PCBs), dioxins, organochlorin pesticides and other environmental contaminants (Kris-Etherton et al.,

2003; Kris-Etherton et al., 2002; Sioen, 2007), as these bio-accumulate in the marine food chain. Recent research has for instance indicated that fish is the major source of exposure to dioxin-like substances via food in the Belgian population (Bilau et al., 2007; Vrijens et al., 2002). The health risks related to the consumption of contaminated fish can be due to carcinogenic contaminants (like PCBs and dioxins), and to the very toxicological characteristics of some heavy metals (like arsenic, mercury, and cadmium). Apart from the intrinsic toxicological effects, the hypothesis rises that methyl mercury can diminish the beneficial health effect of the omega-3 PUFAs in fish (Kris-Etherton et al., 2003; Kris-Etherton et al., 2002; Sidhu, 2003).

Hence, despite the overriding health benefits from seafood consumption, potential safety risks are into play as well. Within this nutritional-toxicological conflict situation, potentially confusion may arise over the role of fish consumption in a healthy diet, both among individual consumers as well as at the level of public health policy and the formulation of dietary recommendations (Mozaffarian & Rimm, 2006; Sioen, 2007). The reason is that increased seafood consumption to achieve an adequate n-3 PUFA intake might simultaneously increase the contaminant intake to levels of toxicological concern. On the other hand, consumers reducing their seafood consumption in order to avoid contaminant exposure might be incurring an inadequate intake of n-3 PUFA (Cohen et al., 2005). As a result, recently several studies concentrated on the question whether it is possible to eat fish frequently (e.g. twice a week) without exceeding tolerable intakes of chemical contaminants (Budtz-Jorgensen et al., 2007; Mozaffarian & Rimm, 2006; Sioen, 2007; Smith & Sahyoun, 2005). Their results showed that health benefits of eating fish outweigh the potential risks to a substantial extent. Nevertheless, despite convincing scientific evidence some consumers may remain confused and uncertain.

Dietary recommendations are consistent in promoting fish consumption. The World Health Organization recommends eating two portions of fish a week, of which one should be fatty fish (World Health Organization, 2003). The current recommendation of the Belgian Health Council is to consume one or two portions of fish per week, corresponding to 150 to 300g of fish per week (Belgian Health Council, 2004). The

American Heart Association recommends for adults eating fish (particularly fatty fish) at least twice a week (Kris-Etherton et al., 2003). More specific recommendations are given for pregnant women, women who are planning to become pregnant, nursing women and young children. These people should not eat fish with the highest levels of mercury, such as shark, swordfish, tilefish and king mackerel and limit their consumption of all fish with moderate mercury levels, like fresh or frozen tuna, red snapper and orange roughy. Despite the evidence of health benefits from fish consumption, a large share of the population fails to meet these recommendations in many countries, including Belgium.

Higher awareness of conflicting information among consumers can be a reason, among others such as disliking, inconvenience or economic reasons (Brunsø et al., 2007), to eat less fish; to refrain from increasing fish consumption, and hence to remain below the recommended fish consumption levels (Verbeke et al., 2005).

In the present research the focus will be on five countries with different fish consumption tradition: Poland with an overall low fish consumption frequency; Belgium, the Netherlands and Denmark with a moderate fish consumption level and Spain with a high fish consumption level. Below, the fish consumption levels of each of the countries will be briefly discussed, with the special focus on fish consumption in Belgium.

Figure I-1 presents the fish and seafood[1] consumption levels based on the Food Balance Sheets (FAO, 2006). It should be noticed that the FAO data refer to ‘‘average food available for consumption’’, which, for a number of reasons (for example, gross amounts are taken into account, waste at retail and household level is not accounted for), is not equal to average food intake or average food consumption. Therefore, the term ‘‘food consumption’’ should be interpreted as ‘‘food available for consumption’’[2].

[1] According to the FAO Food Balance Sheet data, seafood consists of cephalopods, crustaceans and molluscs (excl. cephalopods); whereas fish consists of demersal, freshwater, large pelagic and marine fish

[2] The annual Food Balance Sheets provide national data on food availability and give a complete picture of supply (including production, imports, stock changes and exports) and utilization (including final demand in the form of food use and industrial non-food use, intermediate demand such as animal feed and seed use, and waste) by commodity (FAO, 2006).

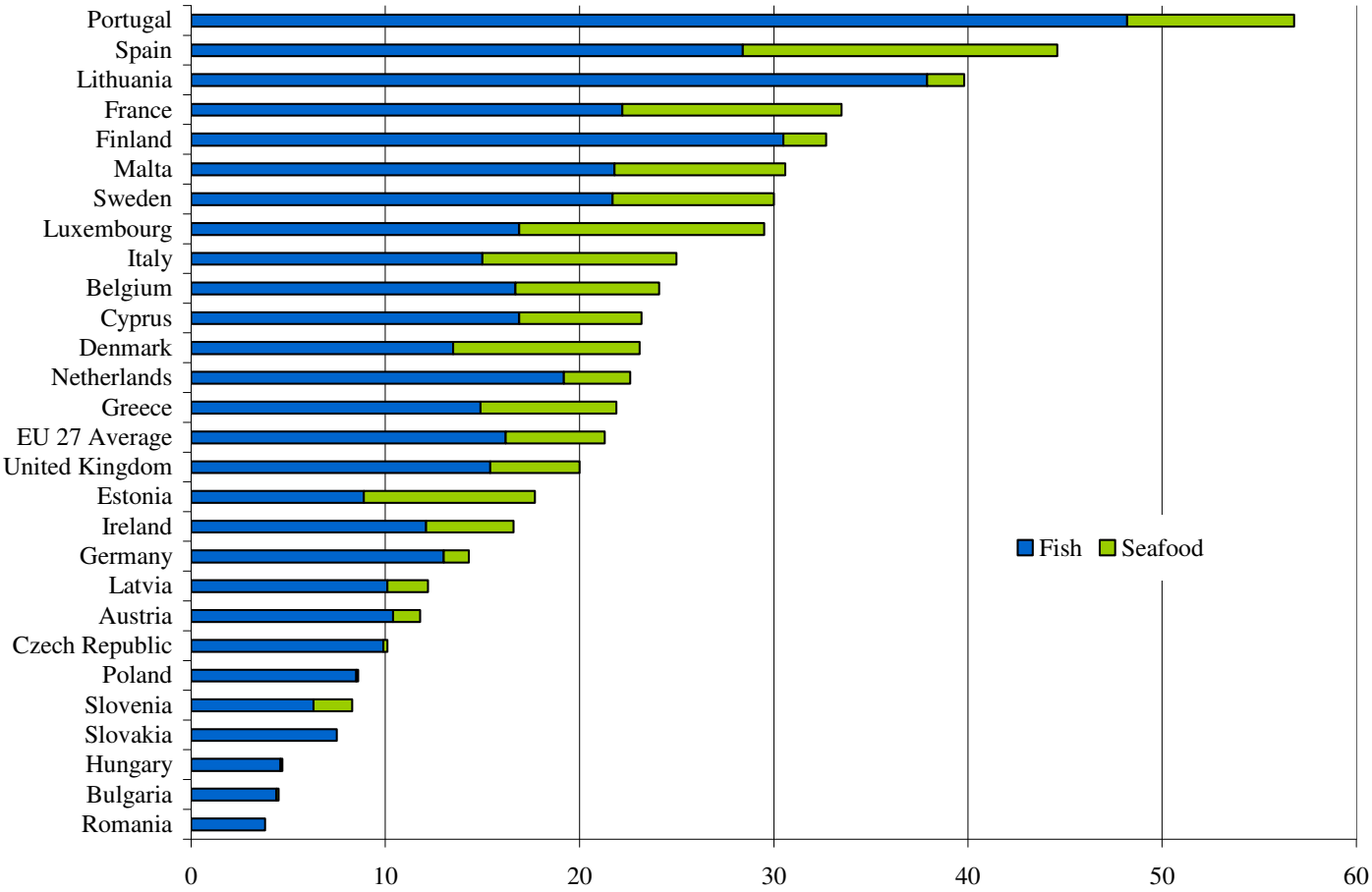

Figure I-1. Total fish and seafood consumption (kg/capita/year) in 27 EU countries based on the Food Balance Sheets (FAO, 2006)

The results show that among the 27 European countries, the highest total fish and seafood consumption is observed in Portugal (56.8 kg/capita/year), followed by Spain (44.6 kg/capita/year). Spain ranks fourth highest in terms of fish consumption level in the European Union (28.4 kg/capita/year) and shows the highest consumption of seafood in the EU (16.2 kg/capita/year). Three of the countries considered in this dissertation, namely Belgium (24.0 kg/capita/year), Denmark (23.0 kg/capita/year) and the Netherlands (22.6 kg/capita/year) reported a moderate level of total fish and seafood consumption, just above the EU average based on the 27 countries (21.4 kg/capita/year). In Denmark and in Belgium a relatively high level of seafood consumption is reported (9.6 and 7.4 kg/capita/year, respectively). Finally, Poland reported a very low total fish

and seafood consumption level (8.6 kg/capita/year). Remarkably, the total fish and seafood consumption in Poland consists almost only of fish. Polish seafood consumption is almost negligible (0.1 kg/capita/person).

Based on the Food Balance Sheets data, from the five investigated countries only in Poland, a decrease (-11%) in the total fish and seafood consumption since 2000 was reported in 2005. In Denmark (+4%), the Netherlands (+2.5%), Spain (+3%) and in Belgium (+4%) an increase in total fish and seafood consumption since 2000 has been observed in 2005. The per capita fish consumption in Belgium amounted to 24.0 kg in 2005, which is above the average per capita European fish and seafood consumption of 21.4 kg (FAO, 2006). Nevertheless, only about one-fourth of this volume (5.8 kg per capita in 2006), is reflected in the household purchase data reported as fish at home (GfK, 2003).The GfK data (2007) indicate that fish consumption at home dropped by 20% as compared with 2004 (7.2 kg per capita) and by 15% as compared with 2005 (6.8 kg per capita). Results from a Belgian study clearly showed that the majority of respondents did not fulfill dietary recommendations for fish (43% of the respondents did not eat fish even once a week) (Verbeke et al., 2005).

It is a fact that huge differences in consumption levels exist across European countries calling for a systematic approach to analyse this variability, in terms of differing motives and barriers for seafood consumption. Many studies focused on the factors influencing food consumption and particularly in the last decade also on fish consumption. Several studies have demonstrated that physical and sensory properties (such as bones, smell, and taste), together with price, availability, preparation and cooking skills, ability to evaluate fish quality, convenience, influence of other people (family members, children), as well as personal involvement, and interest in health and nutrition are important factors that influence seafood consumption behaviour in general, and fish consumption in particular (Juhl & Poulsen, 2000; Leek et al., 2000; Myrland et al., 2000; Nielsen et al., 1997; Olsen, 2003; Olsen et al., 2007; Scholderer & Grunert, 2001; Trondsen et al., 2004b; Trondsen et al., 2003; Verbeke & Vackier, 2005). Furthermore, whereas food risk perception in the strict sense is well-documented, little is known about the balance of

safety risks and health benefits in consumers' food and particularly fish choice (Alhakami & Slovic, 1994; Siegrist, 2000).

Food-borne illnesses caused by contaminants and residues were recently subjected to intensive mass media coverage (Miles and Frewer, 2001; 2003; Miles *et al*., 2004). Fish, due to its potential harmful effect on human health on the one hand, and evident health benefits on the other hand, have been often the subject of communication to the consumers. The public is faced with seeming conflicting news/messages over the risks and benefits from eating fish, resulting in controversy and confusion over the role of fish consumption in a healthy diet (Verbeke et al., 2005). It is known that negative publicity can have a harmful effect on consumer perceptions (Ahluwalia et al., 2000; Dean, 2004). Empirical results indicated that negative information affects consumers' decisions more heavily than favourable news (Mizerski, 1982; Verbeke & Ward, 2001). Furthermore, it seems that with regard to food safety information, mass media prefer publishing negative aspects of news items (Swinnen et al., 2005). In such circumstances, knowledge of consumers' trust in information sources is crucial for health authorities and the food industry, which have a joint interest in stimulating fish consumption. Wildavsky and Dake (1990) claimed that trust in institutions and information is more important than consumers' knowledge about potential risk or information provided itself. Thus, effective communication about food risks and safety is influenced by the extent to which people perceive the source to be reliable (Frewer et al., 1996a). As trust plays a crucial role in the utilisation of provided information (Thiede, 2005) information addressed to consumers must be reliable and trustworthy (Salaün & Flores, 2001).

Use of information sources associates with consumer's behaviour and/or food choice (Alba & Marmorstein, 1987). Empirical evidence shows that different information sources are used by consumers depending on the product, communicated information and potential safety risk (Gutteling & Wiegman, 1996; Jungermann et al., 1996; Richardson et al., 1994). To author's knowledge, only a few studies concerning information sources and labelling concentrated specifically on fish (Kaabia et al., 2001; Scholderer & Grunert, 2001, 2003). Additionally, little scientific evidence is available on the type of information

consumers seek on product labels (Bernues et al., 2003; Verbeke & Ward, 2006; Wandel, 1997) and how consumers use food labels (Abbott, 1997; Capps, 1992). None of these studies focused specifically on consumer's use of fish label information.

2 Conceptual framework

A classical model of consumer-decision making process (Engel et al., 1968) constitutes as the core of this conceptual framework. Consumer behaviour is a process, of which choice, such as fish consumption is considered as one point in a particular course of actions undertaken by a consumer (Bettman et al., 1991). In order to understand that ultimate point, an examination of the preceding stages, such as problem or need recognition, the search for and processing of information, and the evaluation of product alternatives, is needed (Figure I-2). In this PhD dissertation a special focus on three stages will be made: information search, evaluation of alternatives and behaviour itself.

The aforementioned multi-stage model of consumer decision-making is referred to as extended problem-solving behaviour, which requires a certain degree of active reasoning. One key determinant of the consumers' engagement in active reasoning and (an extensive) decision process, is the level of motivation the consumer has in the specific topic, issue or product (Petty & Cacioppo, 1986; Zaltman & Duncan, 1977). This motivation element has often been studied as "involvement" (Chaiken et al., 1989). The concept of involvement has received a great deal of attention in consumer research. Involvement refers to personal relevance and importance attached to issues, based on inherent needs, values and interests (Zaichkowsky, 1985). In a food context, for example, involvement can result from particular hedonic or symbolic values of food or from heightened perceived safety risks (Verbeke, 2007). In consumer behaviour literature, different types of involvement are said to exist when referring to different objects that are the focus of consumer's involvement (Mittal, 1989). In general, under normal conditions, and in comparison with durable goods, food is believed to be a rather low involvement product (Beharrel & Denison, 1995). However, in the last decade fish seems to become a higher involvement product – relative to other foods and its potential substitutes –

because of its higher price (e.g. Trondsen et al., 2003; Verbeke & Vackier, 2005), its health benefits, combined with the potential nutritional - toxicological conflict (Sioen, 2007), and a higher risk perception due to some less favourable news about the potential adverse health impact of contaminants in fish (Kris-Etherton et al., 2003; Verbeke et al., 2005).

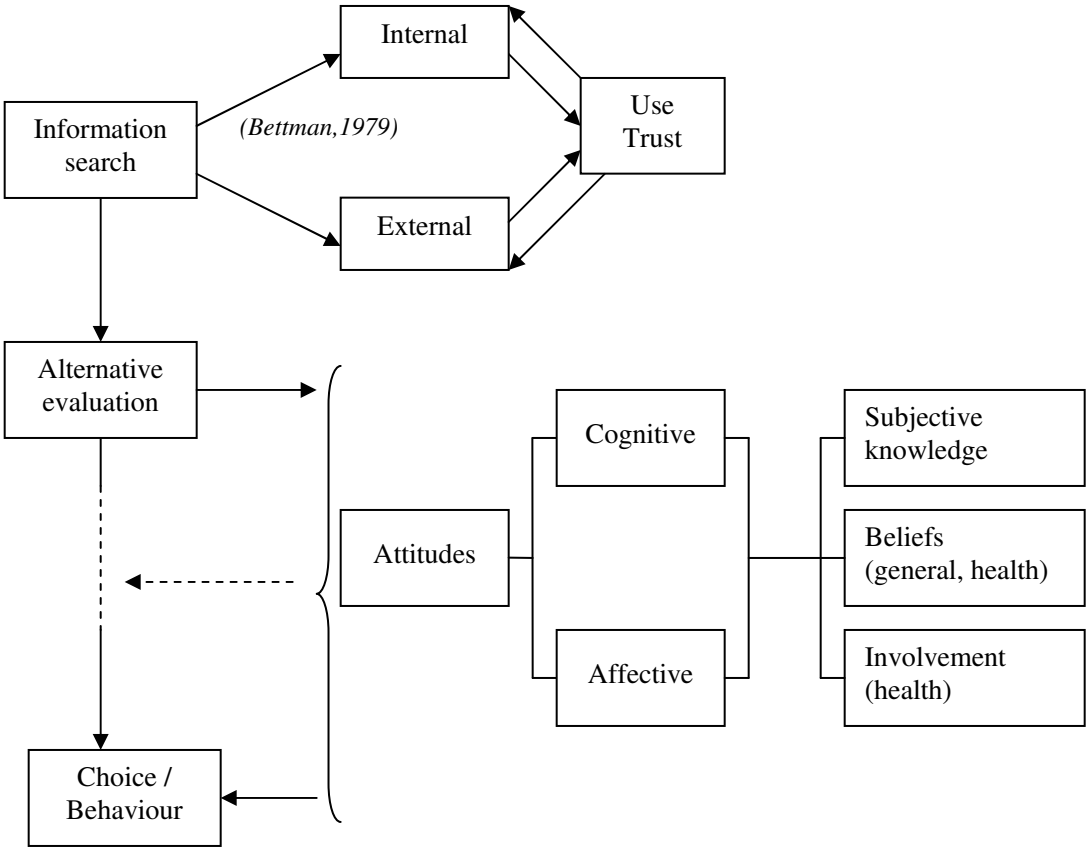

Figure I-2. Conceptual framework for analysing different factors of the consumer decision-making process toward fish consumption

Additionally, Engel et al. (1995) stated that the degree of active reasoning is determined by the degree of differentiation between alternatives, and eventual time pressure. An optimal degree of differentiation between product alternatives, e.g. fatty fish versus lean fish, or choice between different species stimulates active reasoning, whereas situations

with too much or too little differentiation may limit the degree of active reasoning. With regard to fish, time pressure seems not to be a direct determinant of active reasoning.

Therefore, it may be assumed that recently fish consumption became a higher involvement decision process, which leads to more extended problem solving. Most consumer behaviour theories suggest that under high involvement conditions, individuals engage in more extensive information search and information processing (Engel et al., 1995; Hawkins et al., 1986; Howard & Sheth, 1969). As a result, consumers are actively monitoring the environment for relevant information, accepting that information which is felt to be pertinent and relevant and rejecting that information which is not. Individuals who actively seek out information about a decision topic are seen as better prepared to engage in more informed decision making and more successful decision strategies (Radecki & Jaccard, 1995).

Two types of consumer information search processes exist – internal search and external search (Bettman, 1979). Internal search occurs when individuals use information already stored in the memory, based on past experiences (Bettman & Park, 1980), whereas external search involves seeking information from the environment. Bettman (1979) suggested that an internal search is usually performed initially, and is followed by an external search if there is insufficient information in a person's memory to make a decision. Since the scope of this thesis is partly on health, it is worth mentioning that health-oriented individuals are likely to engage in active information search and therefore, gather their information from active-oriented channels (Dutta-Bergman, 2004).

In the information search stage in our framework, special reference is made to the use of and trust in information sources. Thiede (2005) states that trust plays a crucial role in the utilisation of provided information; it is an important determinant of the effectiveness of information. Trust allows a person to take decisions and to act in the absence of complete knowledge of the consequences. Any missing information is replaced by trust in order to tolerate the perceived uncertainty of the situation a person is facing (Earle & Cvetkovich,

1995; Frewer et al., 2003; Luhmann, 1988). Therefore, information addressed to consumers must be reliable and trustworthy (Salaün & Flores, 2001).

Active information search affects the consumer's cognitive structure and feeds into to the next stage in the decision-making process, alternative evaluation (Engel et al., 1995). During alternative evaluation consumers form beliefs and attitudes regarding the decision alternatives (Mowen, 1993). In this research framework, special focus is paid on consumers' attitudes. The classical approach defines attitude as a mental and neural state of readiness to respond, which is organised through experience and exerts a directive and/or dynamic influence on behaviour (Alloport, 1935). Fishbein (1963; 1967) describes attitudes as emotions reflecting affect or feelings for or against a stimulus, an object or a particular behaviour and, therefore, refer to the degree to which a person has a favourable or unfavourable evaluation or appraisal. Most recently, attitudes were defined as evaluations (like/dislike) of items (e.g., foods) that summarize information regarding those items (e.g., healthiness, taste) (Aikman & Crites, 2007). Importantly, Trafimow and Sheeran (1998) pointed out, following Fishbein (1980), that people do not make decisions about things, but about their behaviour pertaining to them.

Three underlying attitude dimensions have been recognised by Engel et al. (1968), namely: affective, cognitive and conative. Afterwards many other researchers have drawn a distinction mainly between affective (i.e. feeling) and cognitive (i.e. knowing) components of attitudes (Breckler & Wiggins, 1989; Crites et al., 1994; Eagly et al., 1994; Millar & Tesser, 1986; Trafimow & Finlay, 1996). Affect has typically been used to refer to the positive and/or negative feelings and emotions that an individual associates with an attitude object whereas the term cognition has generally been used to describe beliefs about positive and/or negative attributes of an attitude object (e.g. Breckler, 1984; Crites et al., 1994). Empirical research has confirmed that people differentiate between affective versus cognitive beliefs and attitudes (e.g. Breckler, 1984; Trafimow et al., 2004)}, and it has been also shown that affective and cognitive bases of food attitudes can be identified (Letarte et al., 1997).

The theory of reasoned action (Fishbein & Ajzen, 1975) assumes that given the assumptions people make, their intentions are the result of a reasoned process. Thus, cognition would seem to be implicated as the primary determinant of most behavioural intentions. Eagly *et al*. (1994) also proposed that cognition is more important than affect as a factor influencing/predicting behaviour or/and behavioural intention. On the other hand, Johnston (1999) suggested that affect might be more important than cognition as a determinant of most behaviour. Also Trafimow et al. (2004) found that affect is more important than cognition for most behaviour. However, Eagly et al. (1994) pointed out that it is unlikely to distinguish between pure affect and pure cognition, completely uncontaminated by each other. They have used a term "synergistic relation" to describe the fact that affect and cognition influence each other. Nevertheless, some beliefs seem to be ''more affective'' and others ''more cognitive''(Trafimow & Sheeran, 1998).

Within the attitudinal strength perspective, researchers have identified several attributes of attitudes that are associated with attitude strength (see Petty & Krosnick, 1995). Among these attitude strength-related attributes are certainty, knowledge, extremity, elaboration, intensity and importance (Cantril, 1946; Krosnick & Abelson, 1992; Petty & Cacioppo, 1986; Wood, 1982). However, a lack of clear distinction between these concepts, especially with regard to their contents, antecedents and consequences is seen (Olsen, 1999; Visser et al., 2003). Not all of these dimensions are equally easy to define measure and operationalise. Attitude-relevant knowledge has typically been defined as the number of attitude-relevant beliefs and experiences that come to mind when encountering an attitude object (Davidson, 1995; Wood et al., 1993). Attitude-relevant knowledge is associated with various subjective (metacognitive) attitude strength-related beliefs, such as certainty and perceived knowledge (e.g. Krosnick et al., 1993). Attitude importance or involvement is defined as an individual's subjective sense of the concern, care, and significance the person attaches to an attitude (Boninger et al., 1995b). Kronick et al. (1993) inclined to recommend against the use of attitude strength as a generic concept and to view attitude strength as a formal latent construct. Hence, in this research, the focus will be on selected separate constructs, which are potential attitude strength attributes. Specifically, the focus will be on the importance attached to health (health

involvement) and to healthy eating (interest in healthy eating), subjective knowledge and beliefs (general and health) that might be classified as a part of the cognitive and a part of the affective component of attitude.

3 Research objectives and hypothesis

The overall objective of the research is to improve the understanding of information and health-related beliefs as determinants of European consumers' fish consumption. This study focuses on finfish consumption only, i.e. including fresh, deep-frozen, canned and smoked finfish, though excluding shellfish and other seafood like algae. Important levels of analysis are cross-cultural variations in Europe, consumer's needs for fish information, attitudes and preferences in relation to fish, and the link of these aspects to perceived health, well-being and involvement with health from a consumer point of view.

More specifically, this research will try to meet this purpose by focusing on four overall research objectives: (1) on assessing European consumers' interest in and need for information related to fish, their knowledge about fish, but also beliefs, attitudes and behaviour toward fish consumption; (2) on testing cross-cultural differences and validity of constructs related to information, knowledge, health beliefs, health involvement and risk perception; (3) on assessing the impact of affective and cognitive determinants of fish consumption through the conceptualisation and validation of two unique models; and finally (4) on identification of market segments based on consumer's use of and trust in information sources about fish. Additionally, specific research objectives are included in the subsequent thesis chapters.

Furthermore, ten research hypotheses are advanced in this research. Verification of these research hypotheses will yield valuable insights for improved understanding of information and health-related beliefs as determinants of European consumers' fish consumption.

H1. Cross-cultural differences exist for consumer's (a) attitudes; (b) health-related beliefs; (c) information use; and (d) behaviour towards fish consumption (*Chapters III, IV, V*).

H2. Constructs, related to information and knowledge, used in this study are cross-cultural valid (*Chapter III*).

H3. Consumers' use of and trust in information sources and cues about fish is markedly affected by socio-demographic factors (*Chapter III*).

H4. Subjective knowledge is better correlated with behaviour (fish consumption) than objective knowledge (*Chapter III*).

H5. Consumers' fish consumption levels are strongly influenced by socio-demographic factors. Fish consumption frequency will be (a) higher among women, and will increase with (b) increasing age, (c) increasing education and income level (*Chapter IV*).

H6. Constructs related to health beliefs, health involvement and risk perception used in this study are cross-cultural valid (*Chapter V*).

H7. Consumers' interest in healthy eating and health involvement positively influence whereas risk perception negatively influences fish consumption (*Chapter V*).

H8. Consumers' affective (e.g. belief that eating fish is healthy, interest in healthy eating) and cognitive (e.g. subjective and objective knowledge about fish) determinants have an impact on fish consumption behaviour (*Chapter VI*).

H9. Consumer segments can be identified based on consumers' use of and trust in information sources about fish (*Chapter VII*).

H10. Differences in compliance with dietary recommendations and motives for fish consumption exist among people from households with versus without a medical history of cardiovascular diseases (*Chapter VIII*).

4 Research design and data sources

Information required to meet the research objectives and to test the hypotheses is gathered through both exploratory and conclusive research procedures with exploration of both secondary and primary data sources. Data for this study were collected within the consumer pillar of the European Commission Sixth Framework Programme Integrated Project SEAFOODplus.

4.1 Qualitative exploratory study

First, in order to gain preliminary insights in consumers' attitudes toward fish in general, factors influencing fish consumption and aspects related to use of information about fish, exploratory data were collected through qualitative focus group discussions in May 2004 in Spain and Belgium. More details about this exploratory study will be provided in *Chapter II*, section 3. Simultaneously, in-depth literature review was carried out for better understanding of the problem background related to fish consumption, role of information, attitudes, involvement and other factors in the context of consumer decision-making process.

4.2 Quantitative conclusive study

Second, a quantitative cross-sectional consumer survey was carried out in November-December 2004 in five European countries: Belgium, Denmark, the Netherlands, Poland and Spain. A quota sampling procedure with age and region as quota control variables was used, since age and region have been proven to be the main socio-demographic determinants of fish consumption (Myrland et al., 2000; Trondsen et al., 2004b; Verbeke & Vackier, 2005). Respondent selection and recruitment procedures differed between countries, depending on cost efficiency, time effectiveness and best practice of the market research agencies that performed the fieldwork. In Denmark and Belgium, mail surveys were conducted, with a response rate of 79% (Denmark) and 53% (Belgium), respectively. In Poland and in Spain, the participants were recruited through face-to-face contact at their homes, whereas in the Netherlands, data were collected electronically by

means of a web-based survey. This gender distribution reflects the criterion that all respondents were the main responsible people for food purchasing within their household. Table I-1 provides details related to the sampling procedures within each country.

Table I-1. Sampling details for the SEAFOODplus consumer survey, November 2004

Country	Number of questionnaires		Response rate	Data collection	Sample selection
	Valid	Distributed			
Belgium	852	1600	53.3	Postal	panel
Denmark	1110	1400	79.3	Postal	phone numbers
The Netherlands	809	*	*	Electronically	panel
Poland	1015	**	**	face-to-face	random walk
Spain	1000	**	**	face-to-face	random walk

* Electronic data collection precludes providing the exact number of distributed questionnaires and calculating the response rate

** When initial respondents were unavailable, the sampling scheme required interviewers to follow a random-generated route and personally establish contact with the next potential respondent. Unlike mail surveys, such random walk samples do not have a defined response rate. The rate of persons refusing to participate in the research although they were available was negligible.

This gender distribution reflects the criterion that all respondents were the main responsible people for food purchasing within their household. All respondents were personally contacted at home. Upon their agreement to participate, they were asked to self-administer and return the questionnaire. A total sample of 4,786 consumers (n=800-1,100 respondents per country) was obtained. Samples were representative within each country for age and region. All respondents were responsible for food purchasing within their household. The gender, age, income, education and country distribution of the sample is presented in Table I-2.

Table I-2. Total sample characteristics (%, n=4,786)

Gender	Male	23.7	*Education*	Unskilled	44.4
	Female	76.3		Skilled	41.6
				Higher education	14.0
Age	18-25 years	10.2			
	26 to 35 years	23.3	*Country*	Belgium (n= 852)	17.8
	36 to 45 years	24.0		Denmark (n=1,110)	23.2
	46 to 55 years	23.6		Netherlands (n=809)	16.9
	> 55 years	18.9		Poland (n=1,015)	21.2
	Mean (S.D.)	42.7 (12.6)		Spain (n=1,000)	20.9
Income class	Lower 25%	5.9			
	Middle 50%	25.6			
	Upper 75%	36.4			

4.3 Questionnaire

A questionnaire was developed in English and further translated into Dutch and French (Belgium), Danish (Denmark), Dutch (the Netherlands), Polish (Poland) and Spanish (Spain) by professional translation service within each country. Multiple techniques of translation have been used as recommended by Brislin et al. (1973) for cross cultural research.

First, the procedure of back-translation was used to verify translation of the questionnaire. Next, the questionnaires have been pre-tested in the national languages by the research agencies and the responsible researchers through pilot studies. In pre-test procedures, a pilot study is recommended to be carried out after translation is completed in order to ensure that future users of the target language version can comprehend all questions and procedures (Brislin, 1970). The questionnaire measured a wide variety of constructs including behaviour, attitude, beliefs, perceptions, involvement, knowledge with respect to fish, and use and interest in information sources and cues. Details about specific constructs, items and measurement scales will be provided in the relevant empirical chapters later in this dissertation.

4.4 Data analysis procedures

English transcripts of the focus group discussions were analysed systematically by coding responses and examining for common themes according to content analysis procedures (Morgan & Krueger, 1997; Miles & Huberman, 1994). The consumer survey data were analysed using the statistical software SPSS version 12.0 (SPSS Inc., Chicago, IL, USA). In cases where multiple items were used to measure a particular construct, the internal reliability coefficient (Cronbach's alpha coefficient), which is an estimate of the degree to which items on the scale form a homogenous measure, was computed (Cronbach, 1951; Peterson, 1994). The internal consistency reliability is a correlation among items in the scale (Bearden et al., 1993) or an assessment of the consistency of the entire scale (Hair et al., 2006) (in this study of objective and subjective knowledge, need for cognition, satisfaction with life, subjective health, interest in healthy eating and health involvement). The generally agreed threshold value for a satisfactory scale is 0.7 (Robinson et al., 1991), which denotes that the different items measure one single construct and therefore may be aggregated for further analyses.

Comparison of mean scores through independent sample t-tests and analysis of variance F-tests with Tukey's honestly significant difference (HSD) post hoc comparisons, were used to detect differences in consumer beliefs, attitudes, involvement and information use between different socio-demographic consumer groups or consumer segments. Two-step clustering (Wedel & Kamakura, 2000) based on likelihood measures was applied to obtain consumer segments.

The present data were collected in five different EU member states, which implies some concerns related to the cross-cultural validity of the collected information. Therefore, analysis of the measurement invariance and cross-cultural validity of constructs related to health and information have been performed through confirmatory factor analyses, using the robust maximum likelihood procedure (Satorra & Bentler, 1988) in LISREL 8.72.

Finally, structural equation modelling (LISREL) has been used in order to develop and estimate two models. Several measures were used to estimate model fit. Since the traditional χ^2 fit test is a test of exact fit, it has been recognized as inappropriate for our large sample size (n=4786). It is therefore appropriate to use statistical tests of close fit. Root mean square error of approximation (RMSEA) is such a test, and should have a value less than 0.05 to indicate close fit or less than 0.08 to indicate reasonable fit (Browne & Cudeck, 1992). Goodness-of-Fit Index (GFI) and Comparative Fit Index (CFI) are other fit indices that will be used and reported. GFI measures how much better the model fits as compared to no model at all (Jöreskog & Sörbom, 1989), and is found to be sensitive to sample size, while CFI is essentially independent of sample size (Anderson & Gerbing, 1988). Acceptable model fits are indicated by GFI and CFI values above 0.90.

5 Thesis outline

The thesis consists of a compilation of papers that have been published, accepted or submitted as contributions to international peer-reviewed journals, books or proceedings, covering the scientific disciplines of agricultural and food marketing, food and nutrition science and consumer behaviour. The thesis includes nine chapters in total. Figure I-3 presents the positioning of the different chapters relative to the conceptual framework. Table I-3 presents the positioning of main constructs used in the thesis relative to the chapters. Each chapter covers relevant literature and focuses on analysing specific parts of the framework, following the rationale presented below.

Chapter II provides exploratory insights and builds further into the information search stage of the consumer making decision process. Secondary data from literature are combined with primary data obtained from qualitative focus group discussions in order to explore consumers' use of internal (prior experience and knowledge) and external information sources (personal, media, impersonal and independent sources and product label), consumers trust in those sources as well as use of information cues with regard to fish.

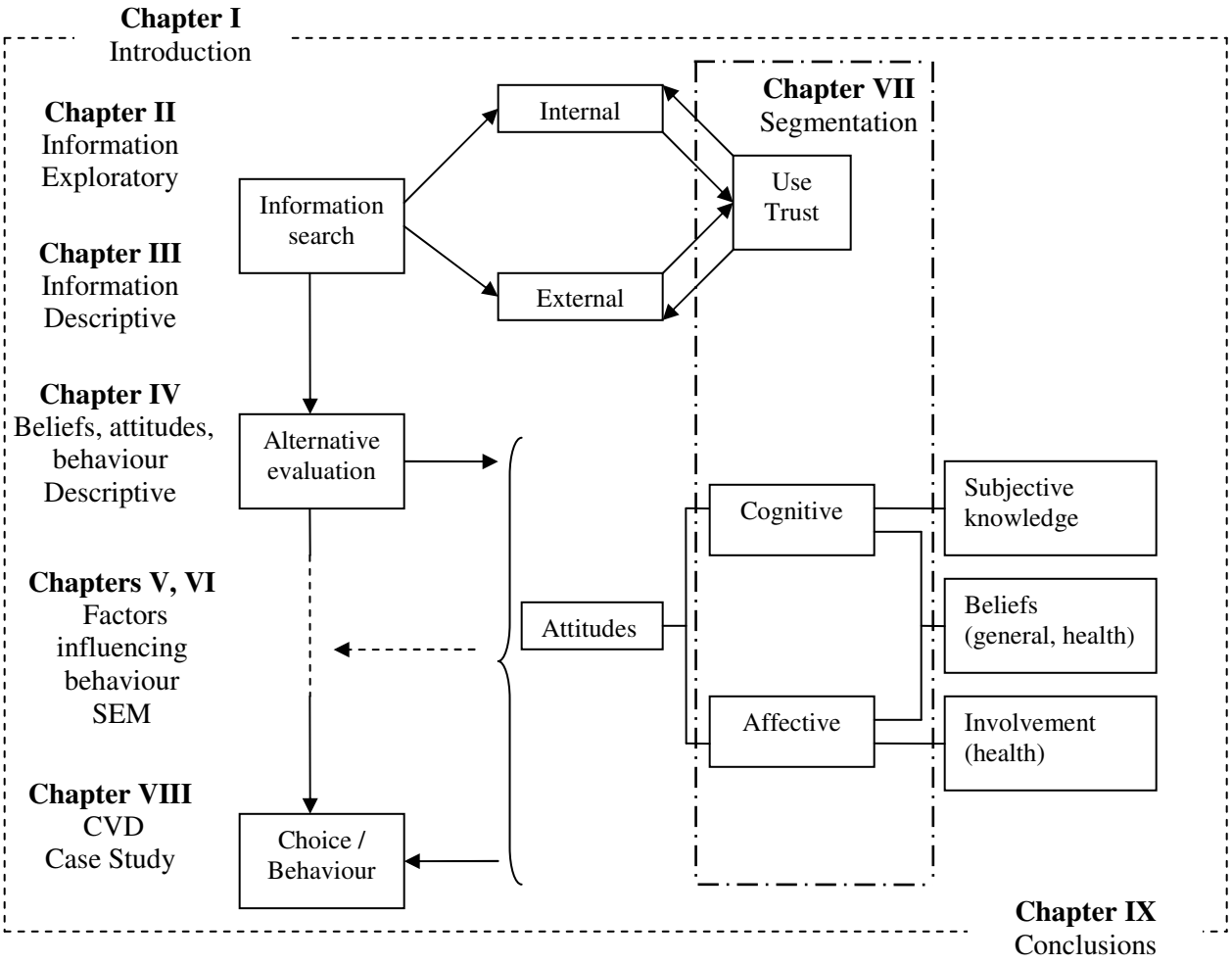

Figure I-3. Thesis structure related to the conceptual framework

Chapter III continues with the investigation of the information search stage of the consumer decision process. It provides a descriptive analysis of consumers' subjective and objective knowledge, use of and trust in information sources, and use of and interest in information cues based on primary data obtained from a consumer survey carried out in five European countries. Cross-cultural validation of the constructs related to available and potential information is provided.

Table I-3. Main constructs used in the thesis related to the chapters

	Chapter						
	II	III	IV	V	VI	VII	VIII
Interest in information cues	X	X					
Use of on-label information cues	X	X					
Use of information sources	X	X					
Trust in information sources	X	X					
Subjective knowledge	X	X			X	X	X
Objective knowledge	X	X			X	X	X
Health involvement				X	X	X	X
Interest in healthy eating				X	X	X	X
Subjective health				X		X	X
Satisfaction with life				X		X	X
Risk perception				X		X	
Attitude			X		X	X	X
Behaviour	X	X	X	X	X	X	X

Chapter IV bridges to the next stage of the consumers' decision making process, namely alternative evaluation. As information is acquired through search and further processed, the outcome is formation of beliefs, stored in a long-term memory. The belief specifies the consequences of behaviour persons make in terms of each evaluative criterion which is used. The sum of all these beliefs and evaluations represents an attitude toward the behaviour (Engel et al., 1995). It provides insights from literature, exploratory study and consumer survey on consumers' beliefs and attitudes toward fish consumption. The focus is specifically on potential motives and barriers for fish consumption. Furthermore, consumers' behavioural patterns with respect to fish are described.

Chapter V and *Chapter VI* focus on factors that are likely to influence the last stage of consumer decision-making process, i.e. behaviour/choice (focuses on attitudes, more specifically on cognitive and affective dimensions of attitude). In light of the potential nutritional-toxicological conflict related to seafood consumption, *Chapter V* aims at exploring whether and to what extent consumers' health beliefs, health involvement and risk perception with regard to fish associate with fish consumption. Additionally, cross-

cultural validation of the constructs related to health beliefs and risk perception is provided. *Chapter VI* builds further on the model developed in *Chapter V* and assesses the impact of affective (belief that eating fish is healthy, interest in healthy eating and health involvement) and cognitive (subjective and objective knowledge about fish) determinants on fish consumption behaviour. Two unique models are conceptualised and validated by means of structural equation modelling (LISREL).

Chapter VII identifies and profiles three consumer segments on the basis of their utilisation of and trust in information sources. These three clusters differ in their knowledge level, behaviour towards fish consumption, use of potential and existing information cues, health beliefs and risk perception, and finally socio-demographic composition, which yields opportunities for targeted information provision efforts.

Chapter VIII consists of a specific case study dealing with cross-cultural differences in fish consumption and motives for fish consumption among people from households with versus without a medical history of cardiovascular diseases. The rationale for this specific focus in our analysis is that risks of cardiovascular diseases can be lowered through adherence to dietary and lifestyle recommendations, among which is the recommendation for eating two portions of fish a week (of which one should be fatty fish). This case study exemplifies the need for nutrition education and more effective communication about fish, not only to the people facing or having faced chronic diseases, but also to the broader public.

Finally, *Chapter IX* provides the general discussion and conclusions. The most important findings of this doctoral research are discussed; and conclusions, implications and recommendations from the different research parts are tied together. Finally, a list of all references cited in this thesis is presented.

Chapter II

Consumer interest in fish information and labelling: exploratory insights

Abstract

Consumers' cognitive mechanisms and their perception of product properties are markedly affected by information. This chapter focuses on consumers' information needs and interests related to fish. The objective is to explore consumers' use of internal and external information sources and their use of information cues with regard to fish. Qualitative exploratory research was performed in May 2004 through focus group discussions in two European countries: Belgium and Spain. Personal sources are found as the most important information sources with regard to fish. Although a majority of consumers use mandatory information cues on fish labels, they express doubts whether information provided on the labels can be trusted. People who are more experienced and have higher familiarity with fish, seem to be more efficient in searching and using information. Instead of providing one message for the consumers, segmentation and targeted information provision is recommended.

This chapter is compiled and adapted from:

Pieniak, Z., Verbeke, W., Fruensgard, L., Brunsø, K. & Olsen, S.O. (2004). Determinants of fish consumption: Role and importance of information. *Polish Journal of Human Nutrition and Metabolism*, 31 (Suppl.2), 409-414.

Pieniak, Z., Verbeke, W., Brunsø, K. & Olsen, S.O. (2007). Consumer interest in fish information, traceability and labelling: exploratory insights. *Journal of International Food and Agribusiness Marketing,* 19 (2&3), 117-141.

1 Introduction

Consumers' cognitive mechanisms and their perception of product properties is markedly affected by information (Caporale & Monteleone, 2004). According to Wiener (1954) "information is a name for the content of what is exchanged with the outer world as people adjust to it and make adjustments felt upon it". Therefore by providing information, e.g. through sending a message like an advertisement, public health recommendation or information on a product label, consumers' intention or behaviour can be influenced. Providing simply more information to consumers does not necessarily mean better informed consumers, as has been recognised both with respect to non-food (de Garidel-Thoron, 2005; Dranove et al., 2003) and food products (Verbeke, 2005). This relates to the risk of information overload and potential adverse effects resulting from consumer indifference when confronted with too much information (Salaün & Flores, 2001). Information is likely to be effective only when it addresses specific information needs, matches with specific interests and can be processed and used by its target audience. Kim and Douthitt (2004) notice that 'information overload' is increasingly important in explaining today's consumer behaviour. The complexity and diversity of a plethora of information obtained from various sources confuses consumers and hampers their decision-making. Hence, insights in consumer needs for and interest in information are required before the needs can be addressed effectively.

To our knowledge, only a few studies concerning information sources and labelling concentrated specifically on fish. Kaabia and Angulo (2001) found that increased information available to consumers about the relationship between diet and health, had a negative impact on red meat consumption and a positive, although relatively small, impact on poultry and fish consumption. A study by Scholderer and Grunert (2001; 2003) investigated a generic advertising campaign that was launched in 1996 in Denmark and aimed at promoting higher consumption of fresh fish from a public health perspective. Series of television spots together with supplementary materials distributed through retailers and the introduction of modified atmosphere-packed fresh fish filets in the supermarkets resulted in an increase of both the intention to buy fresh fish and reported

fish purchase. Also relatively little research is available about the type of information consumers seek on product labels (Bernues et al., 2003; Verbeke & Ward, 2006; Wandel, 1997) and how consumers use food labels (Abbott, 1997; Capps, 1992). None of these studies focused specifically on consumer's use of fish label information.

This exploratory study will concentrate on consumers' interest in information related to fish. The objective is to explore consumers' use of and trust in internal and external information sources and their use of information cues with regard to fish. First, a conceptual framework of the role of information in consumer decision-making towards food is presented. Next, methods and results from qualitative exploratory consumer research about the use and role of fish information are reported. Finally, a discussion and conclusions are set forth and the implications for future research and managerial practice are provided.

2 Towards a conceptual framework

The purpose of the conceptual framework is to pull together relevant concepts about the role of information in consumer decision-making and to link them together in ways applicable to consumer interest in fish information. The backbone of the framework is the classical decision making process by Engel et al. (1995). In this paper we are going to concentrate on the second decision making step, namely information search.

2.1 Internal search: memory, prior experience and knowledge

Bettman (1979) suggests that an internal search is usually performed initially, and is followed by an external search if there is insufficient information in a person's memory to make a decision. Internal search occurs when consumers use information already stored in memory, such as prior knowledge (Bettman & Park, 1980; Brucks, 1985) and experience (Bettman & Park, 1980). Knowledge assessment is viewed as a judgment process in which individuals scan memory for cues that will help them with their product-class knowledge (Park et al., 1994). Some empirical evidence supports the view that prior

knowledge positively affects information processing activities (Moorman et al., 2004; Punj & Staelin, 1983; Radecki & Jaccard, 1995). Conversely, other studies have found a negative relationship between knowledge and information search (Anderson et al., 1979; Moore & Lehmann, 1980). In general, consumer knowledge is a relevant and significant construct that influences how consumers gather and organise information, and ultimately, what products they buy and how they use them (Alba & Marmorstein, 1987).

Two knowledge constructs can be distinguished: perceived knowledge and objective knowledge (Bearden et al., 2001; Brucks, 1985; Park & Lessig, 1981; Park et al., 1994). Although findings about the impact of knowledge on information processing are often contradictory, for instance whether or not perceived (subjective or self-assessed) knowledge is a better predictor than objective (factual) knowledge (Radecki & Jaccard, 1995), there is a consensus that knowledge is a key construct in information processing. Mattila and Wirtz (2002) reported that subjective knowledge is strongly linked with consumers' use of personal sources and internal information stored in memory, whereas objective knowledge seems to catalyse consumers' external information search.

Product-related experience, or familiarity, is defined by Alba and Hutchinson (1987) as "the number of product-related experiences that have been accumulated by the consumer". In previous studies, product-related experience was investigated as accumulated purchases (Anderson et al., 1979), product usage (Johnson & Russo, 1984), and experience (Bettman & Park, 1980; Park et al., 1994). The findings from a number of studies regarding the relationship between experience and amount of information search have been inconsistent (Brucks, 1985). Some studies have found a negative relationship between amount of product experience and amount of external information search (e.g. Moore & Lehmann, 1980; Swan, 1969). Others postulated that prior experience and knowledge encourages information search by making it easier to process new information (Punj & Staelin, 1983). Bettman and Park (1980) found that consumers with moderate knowledge about the product and moderate experience do more processing of available information in the choice situation itself (e.g. on packages) as compared to the high or

low knowledge group. Moorthy et al. (1997) found, consistent with earlier laboratory findings (Johnson & Russo, 1984), that there is a hump-shaped relationship between search activity and consumer's purchase experience. Nevertheless, in general searching the memory for product-related information is fast and requires relatively little cognitive effort (Punj & Staelin, 1983).

2.2 External search: personal, media, and impersonal and independent sources

External search involves seeking information from the environment such as package information, brochures, advertisements, newspapers, economic operators (manufacturers, farmers and retailers), friends and others. Consumers use different information sources depending on the type of information they are seeking (Raab et al., 1989). Previous research has identified a large number of factors influencing the extent of external information search (Schmidt & Sperng, 1996). Kiel and Layton (1981) examined different dimensions of information seeking and have proposed to divide the sources of information into retailer, media and interpersonal contact. Capps (1992) in his discussion states that the most used sources by consumers for nutrition and health information are: people (health professionals, dieticians, and home economists), media (radio, television, newspapers) and labels (food packages and label). Also, Caswell and Padberg (1992) stress the important role of food labels as an external information source. Finally, Mattila and Wirtz (2002) distinguish three external information sources: personal, impersonal neutral and mass media sources. Based on the aforementioned studies and taking into account the type of product we are concentrating on; we propose a classification with four types of external information sources: personal, mass media, impersonal and independent, and product label. The latter will be covered under a separate heading.

The personal source of external information is often rated by consumers as the most important (e.g. Price & Feick, 1984; Thorelli, 1971), especially if the information seeker perceives a high risk (e.g. Roselius, 1971). Early sociological studies – dated far prior to the information technology era – indicated that person-to-person communication was more effective than impersonal mass media sources in changing opinions and

transmitting information (Knower, 1935; Wilke, 1934). Personal source of information refers to word-of-mouth communication, thus information obtained by consumers from opinion leaders (Gilly et al., 1998), health professionals, nutritionists and dieticians (Capps, 1992), as well as from friends, relatives, peers or acquaintances (Price & Feick, 1984). In general, word-of-mouth communication refers to the face-to-face messages that are passed between exchange partners (Mowen, 1993).

The second source of external information is mass media, thus information obtained from impersonal advocate, i.e. from advertising or publicity through print, Internet, television, radio or billboards (Mattila & Wirtz, 2002) or just from reading books, magazine and newspaper articles. This source of information about food has received growing attention during the last decades and accounts for the major share of today's food product information. The media play a unique role in transmitting information to mass audiences and supply most of the information people use nowadays. A relatively recent pan-European survey confirmed that mass media play an important role as a source of information about healthy eating (Holgado et al., 2000). Additionally, Verbeke (2005) states that mass media are probably the most important source of information today about food quality and safety. Findings from the Eurobarometer survey show that media reports on food safety reach a large majority of consumers (Eurobarometer, 2006).

The third source of external information is impersonal and/or independent sources, like government, consumer and environmental organisations, scientists, public authorities, or economic operators such as manufacturers or the food industry. Although those sources of information are not very highly used, e.g. de Almeida et al. (1997) report use of consumer organisations and government agencies on the level of 8% as a source of nutritional information; they are usually highly trusted among consumers (de Almeida et al., 1997; Frewer et al., 1996b; Hunt & Frewer, 2001; Rosati & Saba, 2000).

2.3 Use and interest in information cues on-label and/or on-package

Another source of external information is the product label, either as a part of the food package or the label on-shelf (Capps, 1992). De Almeida et al. (1997) reported that food labels are one of the most used and trusted sources of information by European food

consumers. Also other studies indicated that consumers have in general positive attitudes towards food labels (Caswell & Padberg, 1992; Wandel, 1997). Labels are seen primarily as an item of direct consumer information. However, labels are designed for their impact on the whole food marketing chain rather than simply as a piece of consumer information (Caswell & Padberg, 1992). Food labelling is one of the most common routes to deliver the message about the quality to consumers. Wandel and Bugge (1997) stressed that providing information through appropriate labelling is becoming increasingly important in a food market where direct contact with the personnel over the counter is declining. Nevertheless, several studies have shown that food labels may be of little use, because lack of knowledge and inability to perform simple inference-making leads to failure in decoding the information (Capps, 1992; Fullmer et al., 1991; Grunert, 2005; Schapira et al., 1990). Another recognised problem with regard to food labels is the risk of information overload and potential adverse effects resulting from consumer indifference or misunderstanding when confronted with too much information cues on the package or label (Salaün & Flores, 2001; Verbeke, 2005).

2.4 Trust in information sources

Salaün and Flores (2001) state that information received by consumers must be reliable and trustworthy in order to be effective. Thiede (2005) argues that trust plays a crucial role in the utilisation of provided information. The value of information becomes zero – or even negative – if it is not trusted. Therefore, trust is an important antecedent to information-effectiveness. Trust is defined as "the extent to which one believes that others will not act to exploit one's vulnerability" (Morrow et al., 2004). Many information-related studies have investigated the relationship between trust in food safety and risk perception (Frewer et al., 1996b; Liu et al., 1998; Rosati & Saba, 2004; Slovic, 1992). Findings of the Eurobarometer survey show that consumer organisations, physicians or doctors, and scientists are the most trusted sources when it comes to providing information about food risks, followed by public authorities (Eurobarometer, 2006). Frewer and Miles (2003a) found that medical sources were the most trusted, and industry sources the least trusted, to convey information about food risks to the public. Lobb (2005) suggested that consumers use their perceived trust in suppliers of

information as a factor influencing their food purchase decisions. Worsley and Lea (2003) showed that trust and usage of information sources are positively related. They suggest that while trust may be positively predicting usage, usage may not be linearly related to trust. However, more research is advised in the relationship between trust and usage of different sources by various social groups.

2.5 Information processing

The step following internal and eventually also external search is information processing. Different approaches to information processing exist. According to Engel et al. (1995), information is processed in five steps: exposure, attention, comprehension, acceptance and retention. The heuristic-systematic model by Chaiken (1980; 1987) proposes two different ways (modes) that people use to process information. The systematic mode is a more comprehensive mode with extensive processing and use of information, whereas the heuristic mode involves the use of simple decision rules to reach judgments. Petty and Cacioppo (1986) in the Elaboration Likelihood Model of Persuasion argued that individuals process persuasive messages in one of two ways: the "central" or "peripheral" route. The "central route" is the active information processing, while the "peripheral route" is characterised by utilising external cues surrounding the information.

2.6 Influencing factors

The conceptual framework is completed with factors influencing the decision making process, thus information search and processing as well. Based on one of the earliest presented models of consumer behaviour towards food (Pilgrim, 1957) and on a review of factors affecting food acceptance and behaviour (Shepherd, 1990), Steenkamp (1997) proposed a classification with three types of influencing factors: environmental factors, person-related factors and properties of the food. Since in this specific case, our focus is on fish only, it is expected that the "properties of the food"-factor is neutral. However, this factor may affect the consumer decision making process, for instance when consumers are confronted with new emerging information, e.g. about the origin of fish (farmed/wild). Person-related factors pertain to demographic variables, psychological

factors, like uncertainty, involvement, and knowledge (Verbeke, 2005), and biological factors, like taste and smell preferences or body weight. Finally, environmental factors pertain to marketing stimuli, like branding, quality labels or advertisements; economic variables, like income and price of the product; socio-cultural influences and situational influences, like day or moment, place of consumption. The resulting conceptual framework as discussed in the previous paragraphs is presented in Figure II.1.

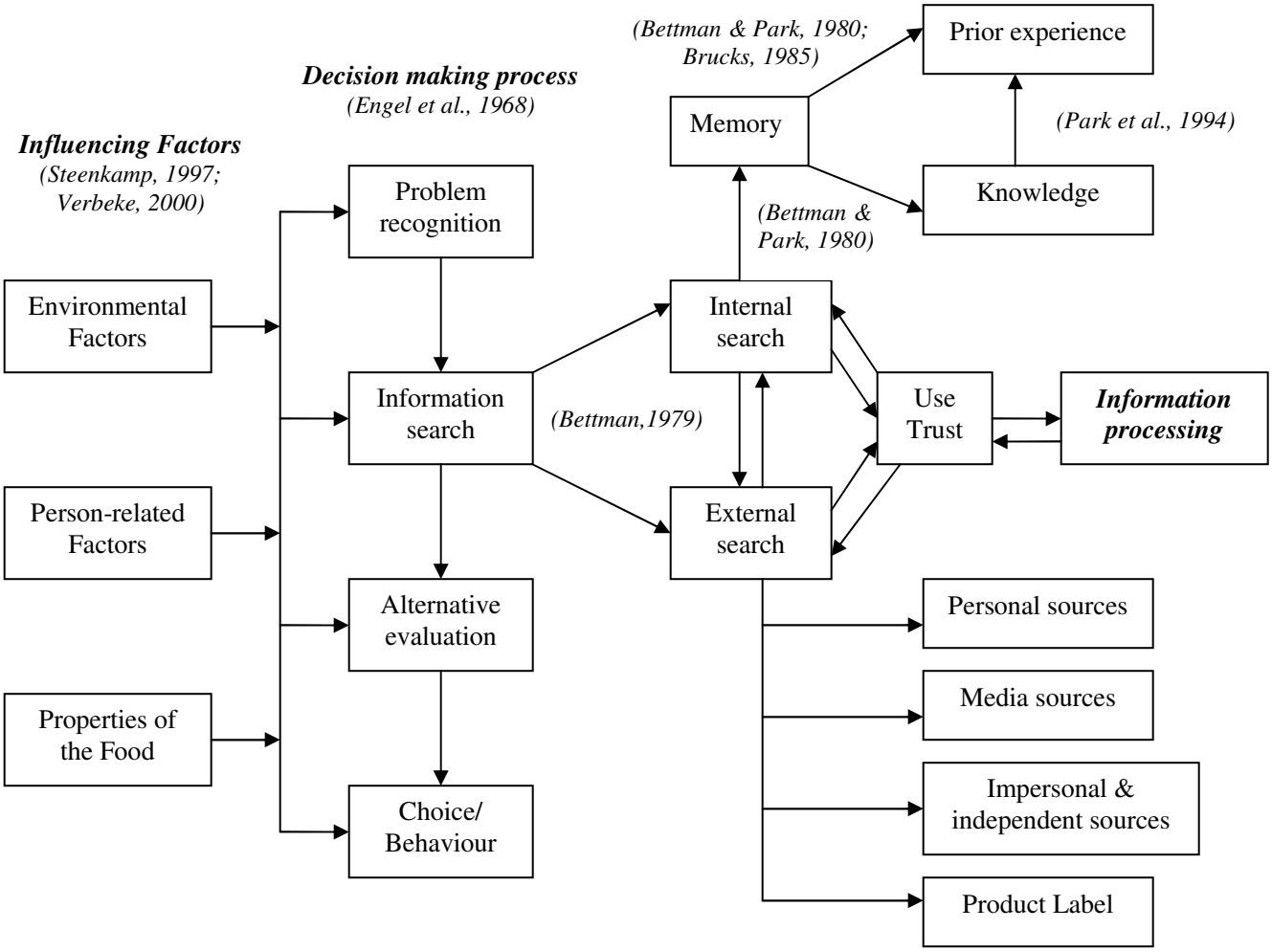

Figure II 1 Conceptual framework for analysing consumer information processing

3 Research method and data sources

Qualitative exploratory research has been performed in May 2004 through focus group discussions in two European countries: Belgium and Spain. Focus groups are an established way of obtaining deeper insights into beliefs and subjective meaning structures of consumers. It is essential that focus groups are neither too homogeneous, which could result in not achieving any social exchange nor too heterogeneous which could result in too many conflicts or the suppression of opinions. Therefore it was decided to segment the participants according to their fish consumption level. We wanted to investigate consumers' interest in information related to fish in both a heavy user country and a light user country. Spain has the second highest fish intake in the world with a consumption of 40 kg/capita/year, while Belgium is among the countries with the lowest consumption of fish in Europe with an intake of 10 kg/capita/year (Brunsø, 2003). The countries were therefore evident choices for this exploratory research.

In total, six focus group discussions were conducted: three in each of the country. It was chosen to have one heavy user group and two light user groups in both Spain and Belgium in order to get an in-depth knowledge of the barriers that prevent consumers from eating fish[3] (an insight which we expected to get primarily from the light users). Due to the very different consumption levels in the two countries, the definition of heavy users and light users varies considerably. It was assumed that a heavy user in Spain consumes fish four to five times a week while a heavy user in Belgium consumes fish at least once a week. A Spanish light user consumes fish only once or twice a week while the Belgian light user consumes fish less than once a week. In both Belgium and Spain professional marketing research agencies assisted in conducting the focus group discussions. Participants were recruited from the local area by telephone. In Spain it was chosen to carry out the group discussions in two different cities (Madrid and Bilbao) in order to account for any regional differences between a coastal and non coastal area. In Belgium all groups were carried out in Ghent. The selected respondents received a letter

[3] This study focuses on finfish consumption only, i.e. including fresh, deep-frozen, canned and smoked finfish, though excluding shellfish and other seafood like algae.

detailing the venue and time. Respondents were not a priori informed about the subject of the focus groups. The aim was to recruit 8 to 10 participants for each of the six focus groups. Consumers were only admitted for participation if they were women, responsible for purchasing and preparing fish in their own household. Both young and old consumers were recruited, provided that they fulfilled the screening criteria. Details about the composition of each focus group are provided in Table II-1.

Table II-1. Overview of the focus group discussions

Day (2004)	Place	Number of participants	User type	Fish consumption	Participants' age			
					Min.	Max.	Mean	Standard deviation
May 5 18h-20h	Madrid	9	Light users	1-2 times/ week	24	55	41.3	9.1
May 6 18h-20h	Bilbao	9	Heavy users	Min. 4 times/ week	27	58	43.5	11.5
May 6 20h-22h	Bilbao	8	Light users	1-2 times/ week	27	51	42.4	9.9
May 4 14h-17h	Ghent	8	Light users	Max. once/ week	30	57	46.4	8.5
May 4 18h-21h	Ghent	6	Light users	Max. once/ week	25	50	34.7	11.4
May 6 14h-17h	Ghent	8	Heavy users	Min. 1-2 times/ week	25	52	44.5	9.9

An interview guide used for structuring the group discussions was initially developed by the research team, then translated to the respective languages of the countries and strictly adhered to in Spain and Belgium. The interview guide was divided into four major parts covering (1) general involvement in food and fish, (2) attitudes towards fish in general (shopping of fish, quality of fish, habits and cooking skills), (3) information about fish (traceability and labelling) and, finally (4) barriers for eating more fish. All question items were presented in an open-ended format in order to obtain as much information as possible, and to stimulate interaction among participants. Only questions related to

information about fish are dealt within this paper. All sessions lasted between 150 and 180 minutes, were facilitated by a professional moderator and were attended live in a neighbouring room by the researchers. Additionally, the sessions were videotaped and transcribed literally for subsequent analyses. Detailed accounts of the individual groups were written immediately after the groups were performed. The responsible researchers in both countries provided an English translation. Transcripts were analysed systematically by coding responses and examining for common themes according to content analysis procedures (Morgan & Krueger, 1997; Miles & Huberman, 1994). Responses were independently coded by members of the research team according to coding categories that were generated from the interview guide and research objectives. Afterwards, the research team reviewed the coded transcripts, identified response patterns, generalised and selected representative quotations exemplifying those generalisations. In the empirical findings' section, the resulting response patterns are presented and illustrated with verbatim statements from the focus group participants.

4 Empirical Findings

4.1 Internal search: knowledge and experience

Following the conceptual framework of this study, internal search is all information already stored in the memory. The information in the memory comes from either the previous experience, namely fish purchase and/or consumption, or knowledge respondents gained about fish. All respondents have ever experienced eating fish. Nevertheless, different dimensions with regard to prior experience may be distinguished: different species, forms of processing, places of purchase, preparation, place of consumption. Some consumers, especially elderly and Spanish, prepare fish always at home. They enjoyed talking about it and sharing information about their experience. Others only consume fish when visiting restaurants. Additionally, some, mostly Belgian participants associated eating fish with holidays: *"Travel to the coast, nice weather, close to the sea…than you always eat fish" (Belgium).* This experience is stored in the memory and influences the decision making process. Some respondents declared to eat fish only

on Fridays, as a kind tradition for them: *"I prepare fish on Friday; it is an old Catholic tradition that my mother used to do when I was a child and now I do the same for my family"; "Friday, it's a fish day" (Belgium).* In this particular case, fish consumption is habitual and the information search process is characterised by internal search only.

With regard to consumers' knowledge about fish, first of all, fish is perceived as a very healthy product, regardless the species. The consumption of fish is perceived as essential to obtain a balanced diet. The main arguments for the healthy qualities of fish – as mentioned by the focus group participants – are the small content of fat and cholesterol and the fact that fish is perceived as very digestive. Remarkably, only one respondent mentioned fish as a source of omega-3 polyunsaturated fatty acids. On the contrary, several respondents talked about the risk of contaminants in fish. They have mostly heard about it on television. Spanish participants have very extended knowledge about fish quality and about how to evaluate fish quality. These consumers look for some important quality indicators while shopping: *"Fish must be bright-eyed, have pink gills, look fresh and smell well" (Spain).*

In general, it may be concluded that Spanish consumers have better knowledge and more experience with fish as compared with Belgian consumers. As expected, Spanish participants consume fish mostly at home and much more frequently compared with the Belgian ones.

4.2 External search

As indicated in the conceptual framework, four sources of external information search may be distinguished: personal, mass media, impersonal (and/or independent) and product label. Below, the usage of these information sources will be discussed.

4.2.1 Use of personal, media and other information sources

Personal sources were observed as an important way of obtaining external information. Both in Spain and in Belgium the salesman (fishmonger) is very often a source of confidence and plays an important role as an adviser and opinion leader. Belgian consumers pointed to the practical dimension of this information: "*The salesman tells me how to prepare the fish; what fish combines best with other fish; what vegetables and sauces I need to prepare and finally what wine I should serve with the fish I prepared*" *(Belgium)*. In this particular case, the salesman (retailer) is clearly perceived as an opinion leader, i.e. a person with superior product knowledge and experience (Gilly et al., 1998).

Additionally, and particularly in Belgium, word-of-mouth advertisement most of all from friends, relatives or acquaintances is seen as one of the most important information sources. During all three focus group discussions with Belgian consumers, many participants pointed at one particular shop after being advised to shop there by friends and relatives; some even informed other participants who were not yet aware of this shop.

Spanish respondents have not recently remarked any media information regarding fish. By the time the research was carried out, no public health or generic advertising campaigns with regard to fish consumption were running in Spain. In general, the fish intake in Spain is already at a high level; therefore probably campaigns to promote fish consumption are not common. However, even Spanish respondents think that this kind of information is needed. In Belgium, although a health campaign promoting fish consumption was running during the period of data collection, none of the respondents have spontaneously referred to it. In general, there was a feeling among participants that not much advertising about fish exists and that little information about fish is available. Advertising is not perceived by heavy users as a source of information about fish: *"Advertising is not information; if you want to know and learn something about fish, you have to search yourself for information" (Spain)*. Moreover, *"If some stories or information is published, then it tends to be mainly negative. Good news is no longer shown – you have to really search for it" (Belgium)*. Participants were convinced that

there are much more scandals with regard to meat, and they believed that as a result, more effort is made to advertise meat, so as to counterbalance the negative press. One participant believed that there is no need for more information about fish. She stated that there is already too much information, even about fish: *"People are too much manipulated and influenced by the information they receive. When more information about fish would be provided, its primary aim would be to influence consumers to eat more fish, rather than to inform people in an objective manner" (Belgium).* The heavy users group stated that appropriate advertisement (understood as public health campaigns) could be successful in promoting fish consumption towards children, especially when reference people or opinion leaders would be involved: *"Famous people, for instance sportsmen or royals should give the good example; it should be shown that these people also eat fish, which may have a favourable impact on both mothers' and children's motivations towards serving or eating fish" (Spain).*

4.2.2 Use of potential and existing on-label information cues

The focus group discussions also explored consumer awareness, interest and use of information cues on fish labels. The most important on-label information cues for Spanish consumers are: name of the fish, expiry date, and price. In Belgium, expiry date as an indication of freshness and shelf life, price, cooking recommendations, nutritional information and eventual, content of harmful substances emerged as most important information cues. There were no specific differences between young and older respondents with respect to their preferred on-label information cues. Furthermore, in both Spanish light user groups the "date of death" (catch date) was stated as an important information cue, but to a lesser extent as compared with the previous information cues. Other issues mentioned by the Spanish consumers were: animal welfare, nutritional information, production date, information on quality control and cooking recommendations. All these issues were however considered dispensable and the last three as nice to have only as an ideal situation. Additional issues mentioned by the Belgian respondents with regard to fish labelling were: production and packaging date;

weight and name of the fish. Moreover, Belgian heavy users indicated that they would like to receive information about the origin of fish, meaning both capture area and information whether the fish is wild or farmed: *"For me, it is important to know the origin of fish because then I have an idea of the cleanliness of the water where the fish was caught. For me, this is an indication for eventual contamination and safety risks" (Belgium).*

Furthermore, because of an increasing role of traceability as an information system also for fish (e.g. Børresen et al., 2003), consumers' interest in traceability as an additional on-label information cue was investigated. None of the Spanish respondents, neither the light users nor the heavy users recognised the word "traceability". However, when the concept was explained it was quite well understood. In Belgium both the word and the concept were understood, which most likely is the result of the debates and initiatives about traceability in the meat chain. However, the awareness of this specific concept is very low. One Belgian participant stated that traceability may have the opposite effect*: "It is better to not know anything about the fish…; if you know where it comes from, you may not want to eat it anymore" (Belgium).*

In general there is no perceived need for comprehensive information about fishing methods and processing. Both heavy and light users agree that reading all information from the label is very time consuming, difficult to understand and ultimately only loosely related to the intrinsic fish quality. Additionally, Spanish respondents do not show any interest in this information: *"They can write whatever they want on the label… I am not going to read it anyway" (Spain); "I really do not care very much… whether this fish comes from the north or from the south; I don't care since this tells nothing about the quality…" (Spain).* On the other hand, Belgian participants displayed somewhat more interest in information, thus they are keener on extrinsic attributes like information that may help them to evaluate fish quality. In this case, information cues perform the function of a heuristic or easy decision rule that help the less experienced Belgians to evaluate fish quality and form quality expectations. Spanish respondents feel more

confident with evaluating fish quality, because of their experience, and hence they may be less dependent on using extrinsic information cues to form quality expectations.

4.2.3 Trust in information sources

In general, most of the respondents, particularly light users, do not trust labels and their need for information is low: *"Can information and labels after all be trusted?" (Belgium); "Is it true what is written on the packages or on the labels?" (Spain).* Moreover, Belgian consumers express serious doubts whether traceability is feasible and can be trusted in the particular case of wild fish. In the case of farmed fish perceived feasibility is higher: "*Fish swim around all over the ocean… how to control this and how to provide a trustworthy guarantee about the origin or history of wild fish?" (Belgium*).

On the other hand, consumers trust that the fish has been inspected by an independent or government control organisation before reaching the retail stage. This may explain why traceability and a detailed level of information are not considered that important. The respondents simply do not think that quality control is a consumer's task or responsibility. They expect government and public institutions to take care of quality and they trust that these institutions perform the jobs they are assigned to. Another explanation could relate to the predominantly healthy image of fish – consumers are yet convinced and do not need more information with regard to health benefits or the nutritional value of fish. Many respondents, both in Spain and in Belgium express that they would rather not know too many details. This way, it seems that people start to worry when they are informed and, therefore, there seems to be a potential risk of raising unnecessary concerns or constructing a crisis by suddenly providing more information than consumers are used to receive: *"… at the time the fish reach the stores it has all been controlled; or at least, it should have been decently controlled…if we could not even trust this, where would this all end up?" (Spain)*; *"In Europe there are so many controls that the food must be good; there are so many safety norms, regulations, as well as*

regulatory and controlling bodies that we do not really have to think that we get rubbish on our plates" (Belgium).

4.2.4 Influencing factors

Three types of influencing factors are proposed in the conceptual framework. Since this study focuses on finfish only without comparisons to other food categories, the influence of food properties can hardly be evaluated. Results from these focus group discussions confirm our expectations, since participants did not differentiate information depending specifically on the species or type of fish (fresh versus frozen or processed). In consumers' minds, fish is simply fish when it comes down to search of information or use of information cues. The information search process will be influenced only in the case of lack of on-label information (e.g. in a fish monger shop), which is usually compensated by personal information sources in such a situation.

There was no indication about major differences in information based on the person-related factor. Some age differences were observed, with younger respondents requesting more information about cooking recommendations (e.g. how to prepare the fish and what sauce to prepare with the fish) than older consumers, who were more experienced.

With respect to biological factors, Spanish respondents and heavy users from Belgium displayed stronger taste and smell preferences towards fish. Knowing that taste is one of the most important barriers to purchase and consume fish (e.g. Myrland et al., 2000; Trondsen et al., 2003) we may expect that consumers with more positive taste attitudes will be more interested in the search of fish information. Indeed, Spanish respondents are somewhat more demanding as far as information is concerned: "*I think that more information about fish is necessary… but only if it would not make fish more expensive*" *(Spain).*

4.2.5 Information processing

It is assumed that consumers use different types or routes of information processing for fish: the classical information processing model (IPM) with internal and external information search; the elaboration likelihood model with central and peripheral processing; the heuristic-systematic model with systematic and heuristic mode. It is however difficult or even inappropriate to conclude which model is the most used by the consumers as our exploratory study does not give sufficient information concerning this issue. Nevertheless, several examples of different information processing modes were mentioned during the focus group discussions. For instance, participants who indicated to eat fish every Friday out of habit or as a religious obligation, considered fish consumption as a routine decision and they processed information about fish via the "peripheral" route (Petty & Cacioppo, 1986). Some participants used the rotation of fish and the number of people waiting in the cue in a fishmonger shop as a heuristic for quality and freshness, rather than using on-label or external information to form quality expectations: "*In my fishmonger shop there are always many people and you have to wait a long time but that's how I know that the fish is fresher than in another shop or in the supermarkets" (Belgium)*. Or also, "*Suppliers constantly bring in new fresh fish at the same rate as the fish is sold to the customers in the shop" (Belgium)*. Thus, as already indicated, heuristics not only allow consumers to make fast decisions in complex situations or in situations of uncertainty but also when their motivation to process information and think of potential consequences is low (Chen & Chaiken, 1999; Tversky & Kahneman, 1974).

5 Conclusions

Moore and Lehmann (1980) suggest that people who are interested, and probably more experienced as well, in a product category have more information stored in the memory (or at leased stored in a more complex way) than others. The results of this exploratory study support this theory. Spanish women are more experienced, report much higher consumption, and they have better knowledge with regard to fish comparing to the Belgian women. The Spanish are more likely to rely on memory, and less likely to rely

on external information. Despite their higher involvement with fish, and higher fish consumption, Spanish consumers seem not to engage heavily in external information search. One possible explanation is that experienced consumers have already sufficient knowledge about fish and therefore do not feel a strong need to acquire additional information from external sources. A second explanation holds that more experienced consumers perform information search more efficiently because they know what fish attributes they should be looking for. In this respect, our exploratory findings would fit with the hypothesis that knowledge allows more efficient information search and processing (Bettman & Park, 1980; Brucks, 1985).

Additionally, Blair and Innis (1996) found that consumer knowledge is a well-known determinant in evaluating product quality. In this study, Spanish women are found not only to have higher general knowledge about fish, but particularly a more extended knowledge about fish quality, fish recipes and the way of its preparation. Furthermore, they are very confident about this particular knowledge. Hence, this exploratory study confirms that prior knowledge increases consumer's confidence in his/her own evaluations (Alba & Hutchinson, 2000; Anderson et al., 1979; Moore & Lehmann, 1980). In contrast, light users feel more uncertain about evaluating fish quality. Therefore, we would expect that light users will be more interested in both, information directly related to fish quality (such as quality mark or safety guarantee), information that facilitates/simplifies their fish quality evaluation, and information about preparation and cooking of fish.

Personal sources are found to be the most important external information sources with regard to fish. This confirms previous studies by for instance Thorelli (1971) and Price and Feick (1984) where particularly in a risk situation, personal sources of information were reported as the most important. For some respondents – more so in Belgium than in Spain – fish is indeed perceived as a risky food. Consumers with a higher risk perception were found to consult more personal information sources, such as the fish monger, which has previously also been found with respect to meat in Belgium (Verbeke & Vackier,

2005). Based on this evidence, we expect that use of personal sources as information about fish will be the highest among respondents with high risk perception related to fish and higher for respondents from countries with a low tradition of fish consumption (here Belgium).

In general, mass media seemed not to have a major influence on consumers' information search with regard to fish. Although many contradictory information appears in the media (mostly on television) with regard to fish (Verbeke et al., 2005), consumers did not indicate to pay much attention on it. Independent information sources or economic operators were not mentioned by any of the consumers during the discussions.

A large majority of the respondents use mandatory information cues on fish labels, such as expiry date, price and fish species. Additionally, they are interested in information on the nutritional composition, cooking recommendations, production date and quality control. However, mostly Belgian respondents, express certain doubts whether information provided on the labels can be trusted. This could be explained by the fact that Belgian consumers experienced in the past several food safety crises, such as dioxin or BSE, which increased their concerns about food safety and yielded uncertainty or distrust in information provided by government or the food chain. Confirming previous studies (Salaün & Flores, 2001; Verbeke, 2005), respondents are anxious of obtaining too much information or simply being overloaded with information on-labels or on-packages. Therefore, future quantitative research is advised in order to obtain an in-depth understanding of fish information cue and information source usage by consumers. Apart from being aware of the relative lack of active external information search with regard to fish among consumers and knowing that consumers' interests in product information and labelling are not homogenous, production companies or policy makers should take into account the need and use of information of specific target audiences. This calls for particular attention toward market segmentation based on information needs, followed by targeted information provision. As noticed above, consumers with less knowledge about fish should most likely be informed about quality and safety aspects with regard to fish. Some practical information, e.g. cooking recommendations or method of preparation of

fish should be provided to consumers in countries (or consumer markets) with low tradition of fish consumption. On the other hand, more detailed on label information should be provided for consumers with higher knowledge about fish. Generally, managers should limit the amount of information given on labels and provide appropriate information to consumer groups after taking into account different consumer profiles including cross-national differences and product usage profiles.

Chapter III

Consumer knowledge, use, interest and trust in information sources and cues

Abstract

This chapter continues with the investigation of the information search stage of the consumer decision process. Results of consumers' use of and trust in information sources, use and interest in information cues based on subjective and objective knowledge is provided based on primary data obtained from a consumer survey carried out in five European countries. Constructs related to information have been cross-culturally validated. In general, the findings displayed a rather wide diversity in consumer's use of and trust in different sources of information related to fish. Personal sources of information were found as the most utilised and trusted by respondents. High usage of label information cues and interest in the majority of potential information cues was reported. Socio-demographic differences between measures related to information have been found.

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1 Introduction

1.1 Use and trust of information sources and media

Information on food topics and nutrition is widely available from a variety of different sources, ranging from pervasive mass media, through economic operators (farmers, manufacturers, and retailers), public authorities, consumer organisations, scientists, to physicians and doctors. Consumers are constantly exposed to a myriad of messages that are often contradictory (de Almeida et al., 1997), especially with respect to food quality and safety issues. There is evidence that the public uses different information sources in different situations, depending on the product choice faced, the type of information being communicated and the type of potential issue or hazard in question (Gutteling & Wiegman, 1996; Jungermann et al., 1996; Richardson et al., 1994). Verbeke (2005) pointed out that probably the most important information source regarding food quality and safety in general is the mass media, with advertising being the most widely used tool.

Most of the studies that have been conducted on the information sources utilised by consumers concentrated particularly on information pertaining to nutrition and health (de Almeida et al., 1997; O'Keefe et al., 1998; Worsley & Lea, 2003) and food safety issues (Burger & Waishwell, 2001; Frewer & Miles, 2003b; Kornelis et al., 2007; Rosati & Saba, 2004; Verbeke et al., 1999b). Results are consistent that for the health-related food issues, the family doctor (Hiddink et al., 1997; van Dillen et al., 2004), health professionals (de Almeida et al., 1997; Holgado et al., 2000), or mass media (de Almeida et al., 1997; Holgado et al., 2000) were preferred as information source over other potential sources. In the case of food safety issues, mass media (Bocker & Hanf, 2000; Burger & Waishwell, 2001; Rosati & Saba, 2004), friends (Burger & Waishwell, 2001; Rosati & Saba, 2004) , personal physicians and relatives (Rosati & Saba, 2004) were the most used information sources.

Information addressed to consumers must be reliable and trustworthy (Salaün & Flores, 2001). Frewer et al. (1996a) have demonstrated that consumers discriminate between sources of (food safety) information in terms of perceived trustworthiness. Effective communication about food risks and safety is influenced by the extent to which people perceive the source to be reliable. Hence, trust plays a crucial role in the utilisation of

provided information (Thiede, 2005). However, there is no unique definition of trust. Morrow, Hansen and Person (2004) define trust as "the extent to which one believes that others will not act to exploit one's vulnerability". Trust has also been conceptualised as a multidimensional construct by a number of authors (Frewer et al., 1996a; Peters et al., 1997; Renn & Levine, 1991), though with a varying number of dimensions or components of trust. Frewer et al. (1996a) indicate that trust consists of 'accuracy', 'knowledge', and 'concern with public welfare'. Three factors were suggested by Peters et al. (1997): 'knowledge and expertise', 'openness and honesty', and 'concern and care', whereas Renn and Levine (1991) found five dimensions of trust to be relevant: 'competence', 'objectivity', 'fairness', 'consistency' and 'faith'. The relationship between trust in risk information and perception of food safety has been extensively investigated in media and information related studies (Frewer et al., 1996a; Liu et al., 1998; Lobb et al., 2007; Rosati & Saba, 2004; Slovic, 1992). Findings of the Eurobarometer (2006) survey show that consumer organisations, physicians or doctors, and scientists are the most trusted sources when it comes to providing information about food risks, followed by public authorities. The media and particularly economic operators received a low level of trust (Eurobarometer, 2006). Those results support previous findings. Rosati & Saba (2004) found that consumer and environmental organisations were judged the most trusted. Similarly, consumer and environmental organisations (Frewer et al., 1996a; Hunt & Frewer, 2001; Rosati & Saba, 2004) together with television documentaries and high quality newspapers (Hunt & Frewer, 2001) were reported as the most trustworthy information sources about use of generic engineering in food production, while tabloid newspapers, government ministries and food industry (manufactures and supermarkets) were the least trusted.

1.2 Use of and interest in information cues

Food labels are one of the most used and trusted sources of information by Europeans (de Almeida et al., 1997). Food labels are an important source of information to consumers (Caswell & Padberg, 1992; Wandel, 1997), who have in general positive attitudes towards labels. Furthermore, food labels are often believed to perform a function as

heuristics or easy decision rules (Gigerenzer & Todd, 1999; Tversky & Kahneman, 1974). Nevertheless, several studies have shown that food labels may be of little use, because lack of knowledge and low ability to perform simple inference-making leads to failure in decoding the information (Fullmer et al., 1991; Grunert, 2005; Schapira et al., 1990). Another recognised problem with regard to food labels is risk of information overload and potential adverse effects resulting from consumer indifference or misunderstanding when confronted with too much information on the package or label (Salaün & Flores, 2001; Verbeke, 2005). Relatively little research is available about the type of information consumers seek on labels (Bernues et al., 2003; Wandel, 1997) and how consumers use food labels (Abbott, 1997; Capps, 1992). Bernués et al. (2003) found that the origin/region of production and deadline (consumed by) information for beef and lamb were the most important information cues to appear on a label. Additionally, the system of production, traceability and quality control are of increased consumers' interest. In this context, Verbeke and Ward (2006) reported that consumers are selective in the attention they pay to different label cues. Whereas information campaigns were shown to favourably change consumer attention to some information cues on meat labels, like quality marks or indications of origin, consumer's attention to less familiar cues like the traceability codes were not affected by information campaigns.

1.3 Knowledge and information processing

Consumer knowledge is a relevant and significant construct that influences how consumers gather and organise information, and ultimately, what products they buy and how they use them (Alba & Hutchinson, 1987). Since previous studies have shown that knowledge is a multidimensional construct (Aurier & Ngobo, 1999; Brucks, 1985; Mitchell & Dacin, 1996; Park et al., 1994), two knowledge components are distinguished: subjective or perceived knowledge and objective or factual knowledge (Brucks, 1985; Park & Lessig, 1981). Individual's knowledge base has been proven to be associated with information needs and information processing, e.g. label use (Bettman & Park, 1980; Drichoutis et al., 2005; Lusk et al., 2004; Macinnis & Jaworski, 1989). Although findings about the impact of knowledge on information processing are often contradictory (e.g.

Radecki & Jaccard, 1995), there is a consensus that knowledge is an important construct in information processing. Knowledge assessment is viewed as a judgement process in which individuals scan memory for cues that will help them with their product-class knowledge (Park et al., 1994). Previous studies (Aurier & Ngobo, 1999; Brucks, 1985) have found that consumer knowledge positively affects personal search (objective product category information and subjective expertise) and in-store comparisons (objective product category information). Bettman and Park (1980) stated that knowledgeable consumers have both the motivation and ability to seek information. Furthermore, a positive relationship between knowledge and need for cognition (NFC) has been reported (e.g. Tidwell et al., 2000). Need for cognition, i.e. the tendency for an individual to engage in and enjoy thinking, or also, to derive intrinsic enjoyment from engaging in effortful information processing, had been introduced by Cacioppo & Petty (1982). Previous studies have specifically investigated the relationship between objective knowledge and NFC (Condra, 1992; Wolfe & Grosch, 1990). It has been proven that people high in NFC have a broader or more accessible knowledge base than those low in NFC. What is more, this knowledge has the potential to facilitate performance on cognitive tasks (Cacioppo et al., 1996; Tidwell et al., 2000).

1.4 Socio-demographics and information processing

Previous studies have shown that there are large demographic and socio-economic differences with regard to the use of and trust in information sources about food in general (e.g. de Almeida et al., 1997; Holgado et al., 2000). Gender, education and age were found to be significant in the choice of information sources in a study by Holgado et al. (2000). Females were more likely than males, and people with higher education were more likely than those with lower education, to select health professionals and mass media as the main sources of information for making food choices. Furthermore, a greater proportion of retired people selected health professionals as the main information source on food choice compared with those working full time. Those results support the findings from a previous study (de Almeida et al., 1997), where women and people with a higher level of education used health professionals more frequently as a source of

information on healthy eating. Additionally, the use of health professionals as information source increased with age. In the same study the use of advertising, books, food packages, magazines, relatives/friends, and supermarkets decreased with increasing age. Finally, a higher level of education was also associated with an increased use of information from magazines, newspapers, food packages, friends, books, government, and consumer organisations.

Also trust in information sources is markedly affected by socio-demographic factors. Frewer et al. (1999) demonstrated that education is a key variable in trust: trust in government sources increases with education; and trust in the food industry, friends and sensationalist sources declines with an increase in education level. Lobb et al. (2007) emphasise the role of education in communication strategy effectiveness after a food scare: education enhances the positive effect of trust in information provided by public authorities (such as the Food Standards Agency) and reverses the negative influence of other people (education makes the negative effect less negative). Furthermore, the influence of education on the trust in certain information sources was confirmed by a study of Holgado et al. (2000). As the educational level increased, respondents were more likely to select newspapers and health professionals as trusted sources of information. Additionally, age differences in the trust in information sources were found. Younger respondents trusted health professionals and newspapers more than older people.

With regard to the usage of food labels, Wandel (1995) reported that the typical food label reader is a middle-aged woman with high education. Evidence suggests that in general women are more likely to read food labels (Wandel, 1997) and particularly nutritional labels (McLean-Meyinsse, 2001; Nayga, 1996; Wang et al., 1995). Coulson (2000) found that older consumers are more likely to read nutritional food labels. In contrast, Bender and Derby (1992) found that younger consumers are more likely to use nutritional food labels.

As shown above, demographic and socio-economic differences with regard to the use of food labels, utilisation and trust in information sources exist. Therefore, providing standard information for all consumers may not be the best communication strategy

because of apparent segment-specific interests (Cordell, 1997; McCarthy et al., 2005; Verbeke, 2005).

1.5 Purpose of the study

The purpose of this study and chapter is threefold. First, this paper intends to test for cross-cultural validity of variables related to information and knowledge. Second, it explores consumers' use of and trust in information sources as well as their use of mandatory and potential fish information cues. Third, it assess European consumers' objective and subjective knowledge about fish and investigates whether providing more information aiming at increasing objective or subjective knowledge would help to increase the consumption of fish.

2 Materials and methods

The empirical research is based on conclusive research with fish consumers in five European countries: Belgium, Denmark, the Netherlands, Poland and Spain. The conclusive research consisted of a cross-sectional consumer survey carried out at the end of 2004. Representative for age and region (within each country) sample of 4786 respondents was used for analysis. Methodological aspects and sample description are provided in *Chapter I*, section 4.2.

2.1 Measures

2.1.1 Use and trust of information sources

First, respondents were asked about their use of different information sources (mass media and non-mass media) in order to obtain information about fish. A 7-point Likert scale ranging from "never" (1) to "very often" (7) was used. The non-mass media sources included in this questionnaire were: family and friends, food and fish industry, consumer organisation, government, scientists, fishermen/fish farmers, supermarkets, fish monger, doctor and dietician (Pieniak et al., 2007c; Rosati & Saba, 2004); whereas the mass

media included in this question were: newspapers, television, radio, advertising, and public health recommendations. These media sources were considered as the most frequently involved in communicating benefits, potential risks and other information about fish. The items were mixed in order to avoid systematic response bias. Not only the use, but also the trust in different information sources was investigated. In order to measure trust (Rosati & Saba, 2004) the respondents were asked to rate each of the above mentioned information sources to the question 'To what extent do you trust information about fish from the following sources?' on 7-point Likert scales ranging from "completely distrust" (1) to "completely trust" (7).

2.1.2 Use of information cues

Respondents were asked to report how often they use eight information cues that (can) appear either on the package or on the supermarket shelf or on the product label for fish. These were: "fish species/name"; "price"; "weight"; "expiry date"; "date of capture"; "nutritional composition"; "brand name"; "capture area". Use of these cues was measured on a 7-point Likert scale ranging from "never" to "always". Those eight items were chosen based on the results from the exploratory study. They were the most often used cues by the respondents taking part in the focus group discussions in Spain and in Belgium. Additionally, focus group participants believed that these cues are or should be mandatory. In fact most of those cues are mandatory, either for fresh food in general (price, weight, expiry date), or fish in particular (species, capture area).

Consumers were finally asked about their interest in emerging information cues. Nine possible information cues were selected, based also mainly on the results of the focus group discussions: "method of preparation"; "wild/farmed"; "health benefits"; "recipes"; "safety guarantee"; "quality mark"; "batch number for product identification"; "environmental friendly"; "fish welfare". Moreover, four information cues with specific relevance for farmed fish were included: "country of origin"; "feed used during farming"; "fed with genetically modified feed"; and "colorants used". The respondents had to indicate to what extent they are interested in each of the included potential information cues. A 7-point Likert scale ranging from "not interested" (1) to "very interested" (7) was

used. Since our exploratory focus group discussions included participants from a low and high fish consumption country and within each country both low and heavy users, we believe to have covered quite a spectrum of potential responses. Therefore, it is assumed that respondents from Denmark, the Netherlands and Poland would point to the same information cues when probed about fish information.

2.1.3 Knowledge measures

Three statements were included to assess consumer's subjective or perceived knowledge. We asked respondents to rate how they agree with the following statements: "My friends consider me as an expert on fish" "I have a lot of knowledge about how to prepare fish for dinner" and "I have a lot of knowledge about how to evaluate the quality of fish". For all items, a 7-point Likert scale ranging from "totally disagree" to "fully agree" was used. This measure is consistent with measures used in previous studies (e.g. Brucks, 1985; Park et al., 1994). The internal reliability consistency was assessed using Cronbach's alpha (see *Chapter I*, section 4.3). The Cronbach's alpha value of the subjective knowledge for the total sample was 0.89, whereas the internal reliabilities across countries were as follows: in Belgium α=0.88, Denmark α=0.90, the Netherlands α=0.89, Poland α=0.87, and finally in Spain α=0.87.

Next, consumer's level of objective knowledge about fish was measured with five statements that are either true or false. We assumed that these five statements are common knowledge among at least half of the population. Three of the statements were false: "More than half of the fish we can buy is farmed fish" (the market share of aquacultured fish is in the range of 25-30% depending on the definition and data source); "Fish is a source of dietary fibre" (fish does not contain any dietary fibre, although many consumers believe so because of some fish's fibrous texture), and "Cod is a fatty fish" (cod is classified as a lean fish). The two other statements were true: "Fish is a source of omega-3 fatty acids"; and "Salmon is a fatty fish". For the five statements, a "true" / "false" scale was used (Park et al., 1994). We opted for not including a "don't know"

answer, which forced respondents to think and make up their mind about the proposed statements.

Five questions assessed need for cognition (NFC). The items were adapted from questions on the short form of the NFC scale (Cacioppo et al., 1984). They were selected from the 34-items NFC scale as the five items with the highest factor loadings (Cacioppo & Petty, 1982). In a previous study, Steward, Schneider, Pizarro & Salovey (2003) have used only three items with the highest factor loading from the NFC scale. The internal reliability of the five NFC items was tested using Cronbach's alpha which for these items was 0.80. The internal reliability of the NFC scale across countries is: Belgium (α=0.79), Denmark (α=0.75), the Netherlands (α=0.75), Poland (α=0.71), Spain (α=0.78).

2.1.4 Fish consumption

Fish consumption behaviour was a self-reported item and it was measured as total fish consumption frequency per week, which we have defined as the sum of fish consumed at home and fish consumed out of home. The respondents were asked how often do they eat fish both at home and out of home. A 9-point frequency scale ranging from "never" to "daily or almost every day" was used. These variables were recoded into frequencies per week (e.g. "never" became 0; "once a week" became 1; and "daily or almost daily" became 6.5 and so on) and aggregated in order to obtain one behavioural variable, namely total fish consumption frequency (per week).

Intention to consume fish was measured as a frequency estimate, which has yet been proven to improve the predictive ability of intention (Courneya, 1994; Sutton, 1998). The respondents were asked to estimate how many times during the coming 14 days they plan, expect or desire to eat fish for their main course. A 15-point frequency scale ranging from "0 times" to "14 times or more" was used.

2.2 Cross-cultural validity

The present data were collected in five different EU member states, which implies some concerns related to the cross-cultural validity of the collected information. In a cross-cultural data set, direct comparison of distances between observations (as done in cluster analysis) is only meaningful if the observed variables **x** from which the distances are computed measure their underlying quantities ξ on a set of common interval scales $\boldsymbol{f}$**:** $\mathbf{x} = \boldsymbol{\tau} + \boldsymbol{\Lambda}\xi$ with invariant location and scale parameters $\boldsymbol{\tau}$ and $\boldsymbol{\Lambda}$ such that differences in ξ can be meaningfully inferred from differences in **x** (Krantz et al., 1971). These invariance assumptions are testable by constraining a multi-group confirmatory factor analysis model with structured means in such a way that the factor loadings and item intercepts are invariant across groups. If the constraints hold, invariance of scale parameters can be inferred from invariance of factor loadings $\Lambda_1=\Lambda_2= \ldots =\Lambda_G$ ("metric invariance"), and invariance of location parameters can be inferred from invariance of item intercepts $\tau_1=\tau_2= \ldots =\tau_G$. If both constraints hold simultaneously ("scalar invariance"), a set of common interval scale exists, and direct comparisons of means and distances across groups are meaningful (applications and extensions in Little, 1997; Meredith, 1993; O'Sullivan et al., 2005; Scholderer et al., 2004; Scholderer et al., 2005; Steenkamp & Baumgartner, 1998).

The use of variables *use of information sources* and *trust in information sources* for descriptive analysis in present chapter and for active segmentation criteria further on in *Chapter VII* had not been designed to form unidimensional scales. Hence, common-factor representations with multiple loadings of each item were chosen as models of the 15 use of information sources items (3 factors) and the 15 trust in information sources items (3 factors). Scalar invariance was imposed on both models by constraining factor loadings ($\Lambda_B=\Lambda_{DK}=\Lambda_{NL}=\Lambda_{PL}=\Lambda_{SP}$) and item intercepts ($\tau_B=\tau_{DK}=\tau_{NL}=\tau_{PL}=\tau_{SP}$) to be invariant across the five country-specific samples. The model parameters were estimated by means of robust maximum likelihood (Satorra & Bentler, 1988) using LISREL 8.72. The goodness-of-fit statistics indicated that the scalar invariance assumption was acceptable for the use of information sources items (Satorra-Bentler χ^2 = 3517.45, df = 479, RMSEA = 0.08) and

the trust in information sources items (Satorra-Bentler χ^2 = 3274.09, df = 476, RMSEA = 0.08). Hence, common interval scales can be assumed to exist for these items, and direct comparisons of means and distance measures across countries will be meaningful.

The same procedure was followed for the different validation criteria: use of information cues (8 items, represented by 2 common factors), interest in information cues (13 items, 3 factors), objective knowledge (5 items, 1 factor), subjective knowledge (3 items, 1 factor), need for cognition (5 items, 1 factor), and intention to consume fish (3 items, 1 factor). Unfortunately, the goodness-of-fit statistics indicated that scalar invariance was unacceptable for all validation criteria. In a next step, the invariance constraints on the item intercepts were dropped, and metric invariance models were estimated. The goodness-of-fit statistics indicated that the metric invariance assumption was acceptable for the use of information cues items (Satorra-Bentler χ^2 = 840.21, df = 115, RMSEA = 0.08), the objective knowledge items (Satorra-Bentler χ^2 = 204.03, df = 41, RMSEA = 0.06), the subjective knowledge items (Satorra-Bentler χ^2 = 32.22, df = 8, RMSEA = 0.06), the need for cognition items (Satorra-Bentler χ^2 = 174.01, df = 41, RMSEA = 0.06), and the intention items (Satorra-Bentler χ^2 = 19.98, df = 8, RMSEA = 0.04), and tentatively acceptable for the interest in information cues items (Satorra-Bentler χ^2 = 3099.38, df = 335, RMSEA = 0.09). Taken together, it can be concluded that the nature of the underlying factors is invariant across countries, and that the responses vary in terms of the same scale units, but that the items measuring the validation criteria are additively biased across countries. Scholderer et al. (2005) have shown that, when at least two items can be found for each factor that are invariant with respect to loadings and intercepts, the raw data can be corrected for the bias. The bias will be eliminated by standardising all validation criteria within countries before further analyses are conducted. The corrected data can then be used in all further analyses.

2.3 Data analysis

Data were further analysed using the statistical software SPSS version 12.0. First, missing data were imputed by means of the EM (expectation-maximization) algorithm and the standardising procedure was conducted for all validation criteria. Second,

bivariate analyses including cross-tabulation and comparison of means, i.e. independent samples t-test and One-Way ANOVA were used to detect differences in the use of information sources and cues, use of information cues and consumers' knowledge between different socio-demographic groups. Third, Pearson's correlation coefficients between the knowledge constructs and behaviour towards fish consumption were calculated.

3 Empirical findings

3.1 Use of and trust in fish information sources

In order to explore the most highly used and trusted as well as the least used and trusted information sources, the mean use and trust scores for each source related to fish were calculated and presented in Table III-1.

Table III-1. Mean scores and standard deviation (SD) for use of and trust in information sources; information sources ranked according to use level (n=4,786)

Information sources	Use Mean (SD)	Trust Mean (SD)
Fish monger	3.96 (1.92)	4.93 (1.52)
Family and friends	3.76 (1.74)	5.21 (1.45)
Supermarkets	3.24 (1.73)	3.84 (1.52)
TV	3.05 (1.71)	3.74 (1.45)
Public health recommendations	3.03 (1.89)	4.68 (1.62)
Advertising	2.85 (1.70)	3.33 (1.50)
Fish/food industry	2.71 (1.65)	4.15 (1.50)
Doctor	2.70 (1.90)	4.96 (1.65)
Newspapers	2.60 (1.63)	3.77 (1.42)
Fishermen	2.56 (1.76)	4.44 (1.61)
Dietician	2.45 (1.86)	4.66 (1.74)
Consumer organisation	2.31 (1.55)	4.42 (1.61)
Radio	2.24 (1.54)	3.53 (1.49)
Scientists	2.06 (1.50)	4.25 (1.71)
Government	1.82 (1.30)	3.56 (1.70)

Information from personal and commercial sources, such as fish monger (μ=3.96), family and friends (μ=3.76) and supermarkets (μ=3.24) were the most used for fish. The independent sources, such as government, scientists, radio and consumer organisation were the least used sources to provide information. Overall, European consumers displayed the highest level of trust in personal information sources about fish. These include among others doctors (μ=4.96), dieticians (μ=4.66), fishmonger (μ=4.93) and family or friends (μ=5.21). Trust levels were significantly lower for mass media and economic operators like retailers and industry advertisements, but on average they were not alarmingly low. In general, respondents' scores on the use of information sources were lower compared with the scores on the trust in those sources. None of the mean use scores exceeded the mid-point of the scale, whilst most of the mean trust levels did.

Comparison of use of information sources between the countries revealed significant differences (Table III-A1, see Appendix at the end of Chapter III). Effect sizes, as an estimate of the proportion of variance in the dependent variable (i.e. behaviour and attitudes in this case) explained by an independent variable (i.e. country code), are expressed as partial eta-squared. The partial-eta measure has been included in the analysis, as our sample-size is large and therefore even trivial effects can have impressive looking p-values. The effect size value indicates how strongly two or more variables are related, or how large the differences between groups are (Levine & Hullett, 2002). The partial eta-squared values show that differences between the five countries are significant with greater importance/effects for use of doctor ($F=273.65$, $p<0.001$, partial eta-squared=0.187), family and friends ($F=120.53$, $p<0.001$, partial eta-squared=0.095), dietician ($F=97.01$, $p<0.001$, partial eta-squared=0.078), fish monger ($F=65.57$, $p<0.001$, partial eta-squared=0.054) and public health recommendations ($F=63.77$, $p<0.001$, partial eta-squared=0.053) as information sources about fish. Spanish respondents displayed the highest use of personal (particularly health-related and commercial) information sources about fish, such as fish monger, doctor and dietician as information sources about fish. Additionally, they scored high on the use of the majority of information sources, e.g. of supermarkets, public health recommendations, family and friends, fish/food industry or government, showing higher usage and simply interest in information about fish in

comparison with the other countries. Polish consumers indicated relatively high, whilst Danish and Dutch respondents relatively low usage of doctor, dietician, public health recommendations, family and friends and fish or food industry in comparison with the other countries. Belgian consumers showed moderate usage of health-related information sources; slightly high usage of supermarkets and government and lower usage of family and friends, fish/food industry and fish monger as information sources about fish compared with the other countries.

Table III-A2 displays consumers' use of information sources depending on gender and age. In general, women were found to use all of the information sources more frequently than men. Particularly, significant differences were observed for the usage of health-related (doctor, dietician, public health recommendations) and commercial (radio, television, advertising, supermarkets, and fish monger); with women scoring considerably higher than men. Next, the youngest respondents (below 25 years of age) indicated the lowest, whereas the oldest respondents (above 55 years of age) the highest usage of family and friends as information source about fish. Generally, the oldest respondents reported the highest usage of the majority, and significantly higher usage of health-related information sources, as well as consumer organisation, newspapers, and radio in comparison with the other two age groups.

Next, Table III-A3 presents consumers' use of information sources depending on education and income. Higher educated consumers used significantly more health-related information sources, as well as newspapers, scientists, radio, family and friends, and fish monger as information source about fish than consumers who had moderate and lower education. Comparison of income levels indicated that respondents with the highest income level used significantly more often newspapers and supermarkets as information sources about fish, whilst respondents with the middle income level reported the highest usage of fishmonger and public health recommendations as information sources about fish.

Table III-A4 displays cross-country comparisons of consumers' trust in information. The differences between the five countries were significant with greater importance/effects for trust in government ($F=492.99$, $p<0.001$, partial eta-squared=0.305), consumer organisation ($F=277.23$, $p<0.001$, partial eta-squared=0.199), supermarkets ($F=193.46$, $p<0.001$, partial eta-squared=0.148), scientists ($F=184.71$, $p<0.001$, partial eta-squared=0.140), fish monger ($F=103.52$, $p<0.001$, partial eta-squared=0.085), and newspapers ($F=100.63$, $p<0.001$, partial eta-squared=0.079) as information sources about fish. In general, Polish respondents were the most suspicious; they held the lowest trust in almost all information sources (only except trust in family and friends). On the contrary, Spanish and Danish respondents reported more trust in information sources about fish compared with respondents from the other countries. Particularly, Spaniards scored the highest on trust in supermarkets, fish monger, family and friends, doctor and advertising, whereas Danes scored the highest and Belgians relatively high on trust in more independents information sources about fish, such as consumer organisation, newspapers, government and scientists. Dutch respondents displayed rather moderate level of their trust in information sources about fish.

Considering gender differences, the findings of this study indicated that women had more trust in the fifteen information sources about fish compared with men (Table III-A5). Furthermore, older respondents held lower trust in information sources about fish than younger respondents. Hence, although older people reported higher usage of information sources, they were more suspicious when it came upon trust. The youngest respondents held the highest trust commercial sources, such as supermarkets and fish monger. Additionally, consumers below 25 years of age scored the highest, whilst those between age of 25 and 55, the lowest on trust in government and newspapers. Consumers younger than 55 years of age trusted significantly more in family and friends, and fish/food industry in comparison with the oldest respondents.

In general, respondents with middle and higher income held higher trust, whereas consumers with lower income reported lower trust in the majority of information sources about fish. With regard to education, higher educated respondents held the highest trust in

almost all significant information sources. Only for advertising, supermarkets and fish/food industry lower educated respondents scored significantly higher than the other respondents. Furthermore, unskilled educated consumers scored significantly lower for the trust in scientists, government, newspapers and consumer organisations in comparison with the other educational groups of respondents (Table III-A6).

3.2 Use of information cues about fish

Expiry date, price, species name and weight were the most used information cues on seafood labels, packages or shelves (Table III-2). Consumers were most familiar with these cues and they felt able to derive clear quality expectations from the information these cues convey. Other cues like capture area, brand, nutritional information or date of capture were far less used. The likely reasons are consumer's lack of familiarity with this information, and lack of trust in these cues that signal typical credence attributes, i.e. attributes that consumers can hardly verify themselves, even upon purchase or during consumption of the product.

Table III-2. Mean scores and standard deviation (SD) for use of information cues

Use of standard information cues	Mean (SD)
Expiry date	6.25 (1.49)
Price	5.81 (1.57)
Fish species/name	5.73 (1.64)
Weight	5.47 (1.70)
Date of capture	4.21 (2.19)
Nutritional composition	4.13 (1.95)
Brand name	3.98 (1.93)
Capture area	3.27 (1.96)

European consumers claimed a high interest in additional seafood information (Table III-3). The analysis of the interest in potential information cues showed that respondents from all countries were most interested in a fish safety guarantee (mean μ on 7-point scale = 5.51) and in quality marks (μ= 5.43). The least interesting cue for the consumer

was the batch identification number (μ= 4.04) and information on the feed used during farming (mean = 4.25). The strongest interest was displayed for a safety guarantee and a quality mark for seafood. Whereas consumers showed little interest in a batch identification number – how could they ever interpret or use this direct indication of traceability? – their interest in information cues that logically can result from traceability (namely a safety or quality guarantee) was extremely strong. Consumer interest in information from traceability was determined by several factors. Interest in information from traceability was higher among consumers who have a high level of trust in fish information. It was also stronger among consumers who find ethical issues (i.e. preservation of natural fish stocks and fish welfare) more important, and among consumers who perceive more health and safety risks from consuming fish.

Table III-3. Mean scores and standard deviation (SD) for interest in information cues

Interest in potential information cues	Mean (SD)
Safety guarantee	5.51 (1.57)
Quality mark	5.43 (1.58)
Recipes	5.29 (1.60)
Health benefits	5.16 (1.62)
Method of preparation	5.10 (1.67)
Colorants used	4.96 (1.95)
Environmental friendly	4.85 (1.71)
Fed with genetically modified feed	4.74 (2.03)
Wild/farmed	4.72 (1.73)
Country of origin	4.64 (1.85)
Fish welfare	4.62 (1.78)
Feed used during farming	4.25 (1.95)
Batch number for product identification	4.04 (1.92)

Cross-country comparison of consumers' use of information cues displayed the lowest usage of all mandatory information cues by Dutch respondents (Table III-A7). On the contrary, Poles reported the highest usage of price, weight, fish species name, brand name and nutritional composition; whilst Danes the highest usage of expiry date, date of

capture, and nutritional composition across the countries. Spanish respondents displayed the highest usage of capture area and the lowest use of expiry date, the latter corresponding with their greatest experience and familiarity with evaluating freshness and quality of fish. Belgian consumers reported moderate to rather low usage of these standard information cues as compared to the other countries. Noteworthy, the partial eta-squared values were on a very low level (below 0.06), suggesting that the differences between the countries were rather small and the significance is rather a result of a large sample size.

Table III-A8 presents consumers use of information cues depending on gender and age. Generally, women and the oldest respondents (above 55 years of age) used significantly more frequent standard information cues than men and younger consumers. Both the oldest and middle aged consumers used fish species name, expiry date and date of capture more often than the youngest group of respondents.

Higher educated consumers indicated to use fish species name and capture area more frequently than the other respondents (Table III-A9). On the other hand, moderate educated (skilled) respondents reported higher usage of expiry date, whereas lower educated respondents, significantly higher usage of brand name in comparison with consumers from the other education classes. Next, respondents with lower and middle incomes displayed higher, whereas consumers with higher income reported lower use of price, date of capture, nutritional composition and capture area as standard information cues. Only in the case of expiry date, consumers with higher income indicated higher usage of this information cue in comparison with respondents from the other two income groups.

Comparison of consumers' interest in potential information cues between countries revealed significant differences (Table III-A10). In general, Dutch respondents displayed the lowest interest in all potential information cues. On the contrary, Danish consumers indicated the strongest interest in information cues related to the origin of fish (wild/farmed, batch number for product identification, country of origin, colorants used),

sustainability issues (environmental friendly, fish welfare, feed used during farming, and fed with genetically modified feed), but also method of preparation, safety guarantee and, together with Belgian respondents, quality mark. Polish respondents reported the highest interest in health benefits and the lowest in fish welfare, whilst Spanish consumers were the most interested in health benefits, wild/farmed and feed used during farming. Nevertheless, significant differences were of rather little effects (partial etas-squared below 0.082).

Table III-A11 presents consumer interest in potential information cues depending on gender and age. Women and the oldest respondents were found to be the most interested in potential information cues. Middle aged consumers displayed very strong interest in information whether the product is environmental friendly and whether farmed fish has been fed with genetically modified feed. The youngest respondents showed the lowest interest in potential information cues compared with older respondents.

Consumers with middle income reported the highest interest in method of preparation, and recipes (Table III-A12). Furthermore, both middle and higher incomes respondents displayed higher interest in fish sustainability (country of origin, feed used during farming, fed with genetically modified feed and colorants used) than respondents with lower income. With regard to education, a general tendency might be observed: the higher respondents' education, the stronger their interest in potential information cues. Therefore, higher educated consumers showed the strongest interest in all proposed information cues. Particularly, they were significantly more interested in fish origin (i.e. information whether fish is wild or farmed; country of origin and use of colorants), health benefits, quality mark and sustainability aspects (feed used during farming, whether fish was fed with genetically modified feed). Only for recipes, higher educated respondents scored significantly lower than skilled respondents.

3.3 Knowledge measures

3.3.1 Objective knowledge

Table III-4 displays percentage of correct answers given on five items comprising objective knowledge for the total sample and cross country. The most common knowledge was that "fish is a source of omega-3 fatty acids" (77% correct in the total sample), followed by "salmon is a fatty fish" (71.8% correct in the total sample), whereas most of the respondents failed to provide a correct answer ("no" in this case) to the statement that "fish is a source of dietary fibre" (59.7% wrong in the total sample).

Table III-4. % correct answers on the objective knowledge items, comparison between countries.

	Country					Pearson Chi-Square	Total sample
	Belgium	***Denmark***	***Netherlands***	***Poland***	***Spain***		
More than half of the fish we can buy is farmed fish	31.3	56.1	54.3	34.6	46.6	193.455	44.8
Fish is a source of dietary fibre	33.5	59.8	28.6	33.9	40.4	256.160	40.3
Cod is a fatty fish	64.1	76.6	63.4	51.3	59.2	153.962	63.1
Fish is a source of omega-3 fatty acids	69.5	90.9	71.8	67.9	81.3	218.483	77.0
Salmon is a fatty fish	75.1	83.4	54.9	64.5	77.1	233.365	71.8

All differences significant at the p-value < 0.001

Respondents from Denmark had the highest factual knowledge about fish. Danes gave on average 3.67 correct answers on five questions asked (Table III-5); for all included items the majority of Danish respondents gave a correct answer. Danes accounted for 57.2% of the respondents who answered all objective knowledge items correctly, who constituted 10.7% of the total sample. Danes were followed by Spaniards and further by Dutchmen and Belgians with respect to objective knowledge. Polish respondents displayed the lowest objective knowledge about fish, with an average of only 2.52 correct answers on

five questions asked. The partial eta-squared value indicated that cross country differences for objective knowledge were of relatively moderate effect.

Table III-5. Consumers' knowledge about fish, cross-country comparisons (n=4786)

	Country					F-value	Partial Eta Squared
	Belgium	Denmark	Netherlands	Poland	Spain		
Objective knowledge*	2.73 [b]	3.67 [d]	2.73 [b]	2.52 [a]	3.05 [c]	172.93	.130
Subjective knowledge**	3.25 [b]	3.40 [b]	2.96 [a]	3.77 [c]	3.79 [c]	56.20	.044
Need for cognition**	4.71 [c]	5.45 [e]	4.95 [d]	3.94 [a]	4.17 [b]	281.40	.196

a, b, c, d, e indicate significantly different means using Tukey HSD Post Hoc on a 5-point scale (* 0=none answers correct; 5=all answers correct) an a 7-point scale (**1= totally disagree; 7= totally agree)

Table III-6 presents consumers knowledge about fish depending on gender and age. In this section, only findings related to objective knowledge will be discussed. Subjective knowledge and need for cognition will be discussed in section 3.3.2 and 3.3.3 of this chapter. Women indicated significantly higher objective knowledge about fish than men. Furthermore, factual knowledge was found to increase with age as follows: the older the respondent, the higher their objective knowledge about fish.

Table III-6. Consumer knowledge about fish depending on gender and age (n=4786)

	Gender		t	p	Age (years)			F	p-value
	Male	Female			<25	25-55	>55		
Objective knowledge*	2.89	2.99	2.312	0.021	2.78 [a]	2.96 [b]	3.11 [c]	12.257	< 0.001
Subjective knowledge**	3.47	3.46	0.181	0.856	3.30 [a]	3.40 [b]	3.78 [c]	27.179	< 0.001
Need for cognition**	4.73	4.61	2.627	0.009	3.25 [b]	3.40 [c]	2.96 [a]	6.792	0.001

a, b, c indicate significantly different means using Tukey HSD Post Hoc on a 5-point scale (* 0=none answers correct; 5=all answers correct) an a 7-point scale (**1= totally disagree; 7= totally agree)

Next, Table III-7 displays consumers' knowledge about fish depending on income levels. Respondents from the upper income class revealed the highest factual knowledge about fish, whereas analyses of the separate items showed that consumers with the lowest incomes scored significantly lower on almost all objective knowledge items, except for the item: "more than half of the fish we can buy is farmed fish" than consumers with higher incomes.

Table III-7. Consumers' knowledge about fish depending on income (n= 4786)

	Income			F	p-value
	Lower (25%)	Middle (50%)	Upper (75%)		
Objective knowledge*	2.82 [a]	2.99 [b]	3.07 [b]	12.464	< 0.001
Subjective knowledge**	3.41	3.47	3.49	0.939	0.392
Need for cognition**	4.48 [a]	4.67 [b]	4.72 [b]	12.455	< 0.001

a, b indicate significantly different means using Tukey HSD Post Hoc on a 5-point scale (* 0=none answers correct; 5=all answers correct) an a 7-point scale (**1= totally disagree; 7= totally agree)

Finally, higher educated respondents reported significantly higher objective knowledge in general, and in particular higher correct knowledge about the items: "fish is a source of dietary fibre"; "fish is a source of omega-3 fatty acids"; and "salmon is a fatty fish" than lower educated consumers (Table III-8).

Table III-8. Consumers' knowledge about fish depending on education (n= 4786)

	Education			F	p-value
	Unskilled	Skilled	Higher		
Objective knowledge*	2.97 [a]	2.90 [a]	3.13 [b]	8.098	< 0.001
Subjective knowledge**	3.53 [b]	3.37 [a]	3.51 [b]	6.566	0.001
Need for cognition**	4.43 [a]	4.80 [b]	4.75 [b]	46.423	< 0.001

a, b indicate significantly different means using Tukey HSD Post Hoc on a 5-point scale (* 0=none answers correct; 5=all answers correct) an a 7-point scale (**1= totally disagree; 7= totally agree)

3.3.2 Subjective knowledge

Consumers estimated their knowledge about fish as rather poor (mean on 7-point scale = 3.46). Polish and Spanish consumers reported the highest subjective knowledge, whilst Dutch consumers estimated their knowledge about fish as the lowest one (Table III-5). Subjective knowledge was found to increase with age: the older the respondent, the higher their own estimation about their fish knowledge (Table III-6). Consumers with moderate education (skilled) reported significantly lower subjective knowledge, than respondents with lower as well as higher education (Table III-8). No significant differences between gender and income levels were found for subjective knowledge.

3.3.3 Need for cognition

Generally, people scored above the neutral point of the scale (mean on 7-point scale = 4.64) on the need for cognition construct. Danish consumers scored the highest (μ=5.45) followed by Dutch (μ=4.95) and Belgian (μ=4.71) ones, which indicates that these consumers were more likely to process information more carefully and systematically considering the content of the message and evaluating the merits of the arguments. Additionally, they are more likely to have a broader or more accessible knowledge base (Condra, 1992), which has the potential to facilitate performance on cognitive tasks (Cacioppo et al., 1996; Tidwell et al., 2000) than those low in NFC. Polish consumers scored the lowest (μ=3.94) on the NFC construct (Table III-5). Men scored significantly higher on the NFC construct than women. With respect to age, people between 25 and 55 years of age scored the highest, followed by the youngest consumers and the oldest ones (Table III-6). Furthermore, comparison of the income and education levels revealed significant differences (Tables III-7 and III-8). Consumers with middle and upper incomes displayed significantly higher need for cognition than consumers with lower incomes. Similar tendency was found for education; higher educated and skilled respondents scored the lowest on the NFC construct in comparison with lower educated respondents.

3.3.4 Associations between knowledge and behaviour towards fish

Next, the correlation coefficients between the knowledge constructs, behavioural intention and behaviour toward fish were calculated and displayed in Table III-9. Behaviour toward fish was measured as total fish consumption frequency per week, which we have defined as the sum of fish consumed at home and fish consumed away from home. All correlations had the expected positive sign, indicating that higher knowledge associates with higher fish consumption (frequency or intention). The strongest correlation was found between behaviour and intention (r=0.533) and between intention and subjective knowledge (r=0.356). The latter correlation indicates that people who believe that their fish knowledge is high are more likely to plan, desire or expect to eat fish in the following days.

Table III-9. Bivariate correlation coefficients between measured constructs for the total sample

	Objective knowledge	Subjective knowledge	Need for cognition	Intention	Behaviour [1]	Behaviour [2]
Objective knowledge	1					
Subjective knowledge	0.097**	1				
Need for cognition	0.144**	*ns*	1			
Intention	0.113**	0.356**	*ns*	1		
Behaviour [1]	0.120**	0.294**	*ns*	0.533**	1	
Behaviour [2]	0.044**	0.104**	0.054**	0.195**	0.222**	1

ns= not significant
[1] fish consumption at home
[2] fish consumption out of home
*** correlation is significant at the 0.01 level (2-tailed)*
** correlation is significant at the 0.05 level (2-tailed)*

The correlation coefficient between subjective and objective knowledge for the total sample (n=4,786) was found to be significant but very small (r=0.097), thus what people believe to know about fish matches only poorly with their actual objective knowledge. Our results support the findings from the study by Radecki and Jaccard (1995) where also

a weak relationship between actual knowledge and perceived knowledge was observed. However, the same analysis across the countries showed that only for the respondents from Belgium (r=0.161), Denmark (r=0.123) and the Netherlands (r=0.182) the correlation coefficient between the objective and subjective knowledge was significant. In the case of Spanish and Polish respondents – the two samples with the highest subjective knowledge – objective knowledge is not correlated with subjective knowledge.

With regard to the correlations between knowledge and behaviour, the subjective knowledge was found to have a moderate and positive correlation with fish consumption at home both in the total sample (r=0.294) (Table III-9) and in all five countries (Table III-10), meaning that respondents who perceived their fish knowledge as high, ate more fish at home.

Table III-10. Correlation between knowledge and fish consumption across countries

	Knowledge	Belgium (n=852)	Denmark (n=1110)	Netherlands (n=809)	Poland (n=1015)	Spain (n=1000)
Consumption at home	Objective	0.161**	0.157**	0.101**	*ns*	0,077*
	Subjective	0.329**	0.250**	0.285**	0.201**	0.299**
Consumption out of home	Objective	0.077*	*ns*	*ns*	-0.069*	*ns*
	Subjective	0.208**	*ns*	0.112**	0.130**	0.135**
Total fish consumption	Objective	0.171**	0.154**	0.104**	*ns*	*ns*
	Subjective	0.365**	0.218**	0.271**	0.214**	0.300**

*** correlation is significant at the 0.01 level (2-tailed)*
** correlation is significant at the 0.05 level (2-tailed)*
ns= not significant

This correlation was the strongest in Belgium and in Spain. Additionally, subjective knowledge was significantly, but lower correlated with fish consumption out of home in four of the countries (Table III-10), namely Belgium, the Netherlands, Poland and Spain. Objective knowledge was found to be insignificant as determinant of fish consumption at home in Poland and away from home in Denmark, the Netherlands and Spain. For the

total fish consumption subjective knowledge was significantly correlated with consumption frequency in all countries, whereas objective knowledge only in Belgium, the Netherlands and Denmark. Thus, our results support the findings by Radecki and Jaccard (1995) that subjective knowledge is a better predictor of behaviour (in our case fish consumption frequency) than objective knowledge.

4 Discussion and conclusions

In general, the study showed a rather wide diversity in consumer's use of and trust in different sources of information related to fish. It confirms previous studies (e.g. de Almeida et al., 1997; Kornelis et al., 2007), where various sources of information were used and trusted by consumers. In this study, the most frequently used information sources by consumers were personal: family and friends and fish monger. The 'personal influence' source has consistently been shown to play a more decisive role in influencing behaviour than advertising and market-dominated sources (Engel et al., 1995). However, analysis of the partial eta-squared showed that use of doctor was the most discriminating across countries as compared with the other information sources. This source was also one of the most trusted information sources, together with the other health-related ones, i.e. dietician and public health recommendations. Additional analyses have shown that people with the strongest interest in those health-related sources (in this case, respondents using public health recommendations) paid also more attention to health and nutrition-related information. Particularly, they used more on-label information about the nutritional composition of fish ($r=0.33$; $p<0.001$) and were more interested in obtaining information about health benefits ($r=0.317$; $p<0.001$). This finding emphasises the need to ensure that health professionals communicate not only information related to health, but also related to food, healthy diets and the role of fish. Doctors and dieticians should be involved in dissemination of information on food, nutrition (e.g. nutritional composition of fish, sources of omega-3 acids, etc.) and heath (e.g. health benefits from eating fish). In this study, consumers who trust and use health professionals as their information source reported also the highest fish consumption.

Our results supported previous findings (deAlmeida et al., 1997; Holgado et al., 2000), where women used health related (doctor, dietician, public health recommendations) and mass-media/commercial (radio, television, advertising, supermarkets, and fish monger) information sources more frequently than men, perhaps because women may give priority to health habits from which the whole family can benefit (Goldberg, 1992; Holgado et al., 2000). Additionally, many studies suggested a higher interest in information about nutrition among women and this is consistent with the large number of articles about nutrition topics (including beneficial role of fish consumption on human health) appearing in women's lifestyle magazines (Barnekow-Bergkvist et al., 1998; Holgado et al., 2000). Furthermore, women were found to trust more in information sources about fish, which supports other results (Holgado et al., 2000).

The findings that higher use (and trust) of the majority of information sources was positively associated with education were also consistent with findings in other studies (deAlmeida et al., 1997; Kornelis et al., 2007).

In part, the results are inconsistent with previous European research where the use of some information sources about healthy eating decreased with age, namely advertising, books, magazines, friends and supermarkets (deAlmeida et al., 1997). In our study, older respondents claimed to use health-related information sources, but also consumer organisations, newspapers and radio more frequently than younger respondents. In part, the results are also consistent with previous research, where younger subjects were found to trust more in newspapers, government agencies, TV/radio and food packages than older ones (deAlmeida et al., 1997).

Confirming previous findings from literature, depending on the message one wants to communicate the consumers, different media and sources of information should be used (Gutteling & Wiegman, 1996; Jungermann et al., 1996; Richardson et al., 1994). The results of this research suggest that it is crucial to combine people's use of information sources with their trust in them (Thiede, 2005). It is important to understand people's choices of certain information sources when in fact they do not really trust these (e.g. commercial or economic operators) and/or although other information sources (e.g. health professionals) are highly trusted, they are not really utilised. Such an insight would

help those involved in the communication and promotion of fish to be more aware of the real obstacles and reasons why people, despite public health recommendations and a healthy fish image (Verbeke et al., 2005) still do not consume, in many cases, fish in line with dietary recommendations. In general, this study confirms the results of previous studies (e.g. Caswell & Padberg, 1992; Wandel, 1997) that labels in general are good, market effective, sources of information. Respondents displayed the highest use of expiry date, price, fish species/name and weight from fish labels. Moreover, they show the strongest interest in safety guarantee, quality mark, recipes and health benefits as potential information cues. Furthermore, the results of this study suggest that it is important to distinguish between people's actual and subjective knowledge. Subjective knowledge is found to be a better predictor of behaviour than objective knowledge, in this particular case, of fish consumption frequency, which confirms previous studies (Radecki & Jaccard, 1995). Particularly, subjective knowledge was found to be a good determinant of total fish consumption in all countries, whereas the objective knowledge was found to be insignificant as determinant of fish consumption frequency in Poland and Spain, which are the two countries with the highest subjective knowledge. Therefore, future research is required in order to investigate the role of both subjective and objective knowledge in determining fish consumption.

Finally, experimental studies exploring/confirming whether the provision of more information about fish would help to increase fish consumption, are encouraged. Structured choice experiments, such as conjoint-like experiments (Louviere & Woodworth, 1983) were shown to force consumers to trade-off product attributes (including fish information cues) against one another, which leads to more reliable estimates of relative valuations (or utilities) (Auger et al., 2003; Louviere et al., 2000) than would be obtained in cases where such constraints on choice are not imposed.

Table III-A1 Consumer use of information sources, cross-country comparisons (n=4786)

Use of information source	Country					F-value	Partial Eta Squared
	Belgium	Denmark	Netherlands	Poland	Spain		
Family and friends	3.36 [b]	3.47 [b]	3.07 [a]	4.43 [d]	4.27 [c]	120.531	.095
Fish/food industry	2.41 [a]	2.38 [a]	2.53 [a]	3.24 [c]	2.92 [b]	51.477	.043
Consumer organisation	2.47 [c]	2.06 [a]	2.33 [b]	2.14 [a]	2.62 [c]	22.619	.017
Newspapers	2.57 [b]	2.69 [b, c]	2.29 [a]	2.82 [c]	2.56 [b]	12.855	.011
Government	1.89 [c]	1.75 [b]	1.97 [c]	1.45 [a]	2.10 [d]	37.210	.031
Scientists	2.13 [c]	1.85 [a]	1.90 [a, b]	2.02 [b, c]	2.38 [d]	19.421	.015
Fishermen/fish farmers	2.48 [c]	2.32 [b]	2.14 [a]	2.90 [d]	2.90 [d]	37.336	.030
Television	2.86 [a]	3.10 [b]	2.74 [a]	3.17 [b, c]	3.31 [c]	16.633	.014
Supermarkets	3.33 [c]	3.14 [b]	3.00 [b]	2.83 [a]	3.88 [d]	55.816	.045
Fish monger	3.50 [a]	3.86 [b]	3.60 [a]	3.96 [b]	4.75 [c]	65.571	.054
Doctor	2.60 [c]	1.63 [a]	2.15 [b]	3.09 [d]	3.96 [e]	273.652	.187
Advertising	2.78 [b]	2.93 [b, c]	2.62 [a]	2.83 [b]	3.03 [c]	7.678	.006
Public health recommendations	2.84 [b]	2.76 [b]	2.42 [a]	3.43 [c]	3.58 [c]	63.770	.053
Dietician	2.18 [b]	1.94 [a]	2.01 [a]	2.77 [c]	3.25 [d]	97.008	.078
Radio	2.17 [b]	2.08 [b]	1.92 [a]	2.46 [c]	2.50 [c]	25.316	.022

a, b, c, d, e indicate significantly different ($p<0.001$) means using Tukey HSD Post Hoc on a 7-point scale (1= never; 7= very often)

Table III-A2. Consumer use of information sources depending on gender and age (n=4786)

Use of information source	Gender				Age (years)				
	Male	Female	t-value	p-value	<25	25-55	>55	F-value	p-value
Family and friends	3.59	3.81	3.624	< 0.001	4.06 [c]	3.77 [b]	3.52 [a]	15.772	< 0.001
Fish or food industry	2.63	2.73	1.720	0.085	2.74	2.70	2.72	0.192	0.825
Consumer organisation	2.25	2.33	1.667	0.096	2.28	2.28	2.44	3.831	0.022
Newspapers	2.58	2.61	0.550	0.582	2.44 [a]	2.60 [a, b]	2.68 [b]	3.372	0.034
Government	1.76	1.85	2.072	0.038	1.82	1.83	1.79	0.294	0.745
Scientists	2.05	2.06	0.231	0.817	2.08	2.03	2.15	2.169	0.114
Fishermen/fish farmers	2.61	2.55	0.991	0.322	2.53	2.54	2.66	1.817	0.163
Television	2.90	3.10	3.494	< 0.001	3.05	3.06	3.03	0.110	0.895
Supermarkets	2.95	3.33	6.382	< 0.001	3.36	3.24	3.17	1.810	0.164
Fish monger	3.65	4.06	6.090	< 0.001	4.00	3.94	4.02	0.835	0.434
Doctor	2.43	2.78	5.706	< 0.001	2.91 [b]	2.60 [a]	2.94 [b]	14.517	< 0.001
Advertising	2.70	2.90	3.451	0.001	2.84	2.84	2.90	0.439	0.644
Public health recommendations	2.74	3.13	6.175	< 0.001	3.03 [a, b]	2.98 [a]	3.23 [b]	6.134	0.002
Dietician	2.15	2.54	6.566	< 0.001	2.54	2.40	2.60	4.721	0.009
Radio	2.13	2.27	2.833	0.005	2.11 [a]	2.22 [a, b]	2.37 [b]	5.035	0.007

a, b, c indicate significantly different means using Tukey HSD Post Hoc on a 7-point scale (1= never; 7= very often)

Table III-A3. Consumer use of information sources depending on education and income (n= 4786)

Use of information source	Education					Income				
	Unskilled	Skilled	Higher	F	p-value	Lower (25%)	Middle (50%)	Upper (75%)	F	p-value
Family and friends	3.76 [a]	3.70 [a]	3.96 [b]	5.858	0.003	3.74	3.75	3.77	0.136	0.872
Fish or food industry	2.75	2.67	2.72	1.343	0.261	2.66	2.75	2.67	1.552	0.212
Consumer organisation	2.35	2.29	2.31	0.882	0.414	2.30	2.36	2.24	2.555	0.078
Newspapers	2.54 [a]	2.63 [a, b]	2.73 [b]	3.844	0.021	2.49 [a]	2.63 [b]	2.66 [b]	4.015	0.018
Government	1.84	1.80	1.86	0.609	0.544	1.81	1.84	1.80	0.517	0.596
Scientists	1.99 [a]	2.05 [a]	2.30 [b]	10.894	< 0.001	2.03	2.06	2.08	0.353	0.703
Fishermen/fish farmers	2.58	2.53	2.65	1.025	0.359	2.60	2.58	2.50	1.114	0.328
Television	3.08	3.00	3.13	2.013	0.134	3.06	3.10	2.97	2.171	0.114
Supermarkets	3.27	3.19	3.33	1.888	0.152	3.06 [a]	3.30 [b]	3.29 [b]	8.614	< 0.001
Fish monger	4.02 [b]	3.85 [a]	4.13 [b]	7.012	0.001	3.70 [a]	4.02 [c]	4.09 [b]	15.749	< 0.001
Doctor	2.90 [b]	2.47 [a]	2.84 [b]	27.749	< 0.001	2.69	2.73	2.64	0.980	0.375
Advertising	2.89	2.81	2.87	0.955	0.385	2.78	2.90	2.82	2.257	0.105
Public health recommendations	3.04 [a]	2.97 [a]	3.26 [b]	5.837	0.003	2.96 [a]	3.11 [b]	2.98 [a]	3.231	0.040
Dietician	2.60 [b]	2.29 [a]	2.50 [b]	14.082	< 0.001	2.44	2.49	2.37	1.769	0.171
Radio	2.26 [a, b]	2.19 [a]	2.35 [b]	2.991	0.050	2.22	2.25	2.24	0.160	0.852

a, b, c indicate significantly different means using Tukey HSD Post Hoc on a 7-point scale (1= never; 7= very often)

Table III-A4. Consumer trust in information sources, cross-country comparisons (n=4786)

Trust in information source	Country					F-value	Partial Eta Squared
	Belgium	Denmark	Netherlands	Poland	Spain		
Family and friends	4.93 [b]	5.42 [c, d]	4.73 [a]	5.30 [c]	5.52 [d]	49.455	.044
Fish/food industry	3.97 [b]	4.36 [c]	4.34 [c]	3.66 [a]	4.43 [c]	48.637	.043
Consumer organisation	4.64 [b]	4.96 [c]	4.71 [b]	3.09 [a]	4.78 [b]	277.225	.199
Newspapers	3.93 [b]	4.11 [c]	3.92 [b]	3.02 [a]	3.92 [b]	100.631	.079
Government	3.93 [c]	4.38 [e]	4.17 [d]	1.87 [a]	3.61 [b]	492.986	.305
Scientists	4.59 [c]	4.80 [d]	4.39 [b]	3.08 [a]	4.46 [b, c]	184.707	.140
Fishermen/fish farmers	4.54 [b]	4.54 [b]	4.42 [b]	3.87 [a]	4.85 [c]	52.128	.045
Television	3.86 [b]	4.06 [c]	3.87 [b]	3.08 [a]	3.85 [b]	73.411	.063
Supermarkets	4.10 [c]	3.96 [b]	3.96 [b]	2.82 [a]	4.46 [d]	193.463	.148
Fish monger	5.01 [b]	5.18 [c]	4.96 [b]	4.15 [a]	5.36 [d]	103.523	.085
Doctor	5.18 [c]	5.16 [c]	4.79 [b]	4.19 [a]	5.47 [d]	94.988	.076
Advertising	3.39 [b]	3.36 [b]	3.48 [b]	2.75 [a]	3.69 [c]	56.312	.049
Public health recommendations	4.64 [c]	4.92 [d]	4.45 [b]	4.17 [a]	5.17 [e]	60.833	.053
Dietician	4.79 [b]	4.97 [c]	4.77 [b]	3.92 [a]	4.91 [b, c]	65.005	.055
Radio	3.62 [a, b]	3.91 [d]	3.53 [b]	2.87 [a]	3.73 [c]	77.560	.065

a, b, c, d, e indicate significantly different ($p<0.001$) means using Tukey HSD Post Hoc on a 7-point scale (1= completely distrust; 7= completely trust)

Table III-A5. Consumer trust in information sources depending on gender and age (n=4786)

Trust in information sources	Gender				Age (years)				
	Male	Female	t-value	p-value	<25	25-55	>55	F-value	p-value
Family and friends	5.09	5.25	3.103	0.002	5.36 [b]	5.25 [b]	4.98 [a]	15.496	<0.001
Fish or food industry	3.98	4.21	4.340	< 0.001	4.29 [b]	4.17 [b]	4.02 [a]	5.321	0.005
Consumer organisation	4.32	4.45	2.405	0.016	4.32	4.46	4.34	3.023	0.049
Newspapers	3.65	3.81	3.047	0.002	3.65 [a]	3.82 [b]	3.64 [a]	7.684	<0.001
Government	3.53	3.57	0.674	0.501	3.45 [a]	3.61 [b]	3.42 [a]	5.560	0.004
Scientists	4.20	4.26	0.974	0.330	4.17	4.29	4.15	2.758	0.063
Fishermen/fish farmers	4.29	4.49	3.606	< 0.001	4.57 [b]	4.45 [a, b]	4.35 [a]	2.852	0.058
Television	3.61	3.78	3.336	0.001	3.61 [a]	3.76 [b]	3.72 [a, b]	2.380	0.093
Supermarkets	3.56	3.93	7.219	< 0.001	3.96 [b]	3.85 [a, b]	3.75 [a]	3.078	0.046
Fish monger	4.67	5.01	6.262	< 0.001	5.06 [b]	4.93 [a, b]	4.84 [a]	3.419	0.033
Doctor	4.75	5.02	4.649	< 0.001	4.94	4.95	5.00	0.301	0.740
Advertising	3.12	3.39	5.377	< 0.001	3.38	3.32	3.31	0.326	0.722
Public health recommendations	4.46	4.75	5.134	< 0.001	4.71	4.70	4.60	1.225	0.294
Dietician	4.36	4.76	6.559	< 0.001	4.64	4.68	4.61	0.717	0.488
Radio	3.40	3.57	3.335	0.001	3.36 [a]	3.57 [b]	3.48 [a, b]	4.871	0.008

a, b indicate significantly different means using Tukey HSD Post Hoc on a 7-point scale (1= completely distrust; 7= completely trust)

Table III-A6. Consumer trust in information sources depending on education and income (n= 4786)

Trust in information source	Education					Income				
	Unskilled	Skilled	Higher	F	p-value	Lower (25%)	Middle (50%)	Upper (75%)	F	p-value
Family and friends	5.20 [a]	5.17 [a]	5.36 [b]	4.267	0.014	5.13 [a]	5.23 [a, b]	5.26 [b]	2.742	0.065
Fish or food industry	4.22 [b]	4.08 [a]	4.13 [a, b]	4.112	0.016	4.11 [a]	4.22 [b]	4.07 [a]	5.041	0.007
Consumer organisation	4.32 [a]	4.45 [a]	4.61 [b]	8.617	< 0.001	4.27 [a]	4.52 [b]	4.40 [b]	9.390	<0.001
Newspapers	3.68 [a]	3.81 [b]	3.92 [c]	8.596	< 0.001	3.66 [a]	3.83 [b]	3.76 [a, b]	6.050	0.002
Government	3.45 [a]	3.63 [b]	3.64 [b]	6.541	0.001	3.39 [a]	3.54 [b]	3.66 [b]	9.821	<0.001
Scientists	4.07 [a]	4.32 [b]	4.55 [c]	22.840	< 0.001	4.03 [a]	4.35 [b]	4.28 [b]	14.103	<0.001
Fishermen/fish farmers	4.47	4.40	4.45	0.940	0.391	4.40 [a, b]	4.50 [b]	4.37 [a]	3.054	0.047
Television	3.74	3.74	3.69	0.316	0.729	3.66 [a]	3.79 [b]	3.72 [a, b]	2.912	0.054
Supermarkets	3.92 [b]	3.76 [a]	3.83 [a, b]	5.566	0.004	3.73 [a]	3.90 [b]	3.86 [b]	4.652	0.010
Fish monger	4.95	4.89	4.99	1.399	0.247	4.79 [a]	4.99 [b]	4.95 [b]	7.006	0.001
Doctor	4.93 [a]	4.94 [a]	5.11 [b]	3.208	0.041	4.81 [a]	5.03 [b]	4.98 [b]	6.774	0.001
Advertising	3.46 [b]	3.24 [a]	3.17 [a]	14.885	< 0.001	3.29	3.36	3.29	1.399	0.247
Public health recommendations	4.62 [a]	4.65 [a]	4.98 [b]	13.045	< 0.001	4.54 [a]	4.77 [b]	4.66 [b]	8.082	<0.001
Dietician	4.61 [a]	4.69 [a, b]	4.77 [b]	2.551	0.078	4.54 [a]	4.72 [b]	4.68 [b]	4.049	0.017
Radio	3.54	3.49	3.62	1.729	0.178	3.44 [a]	3.60 [b]	3.49 [a]	4.958	0.007

a, b, c indicate significantly different means using Tukey HSD Post Hoc on a 7-point scale (1= completely distrust; 7= completely trust)

Table III-A7. Consumer use of information cues, cross-country comparisons (n=4786)

Use of information cues	Country					F-value	Partial Eta Squared
	Belgium	Denmark	Netherlands	Poland	Spain		
Fish species name	5.86 [b, c]	5.83 [b]	5.10 [a]	5.99 [c]	5.75 [b]	39.644	.034
Price	5.73 [b]	5.71 [b]	5.25 [a]	6.26 [d]	5.98 [c]	54.281	.045
Weight	5.46 [b]	5.52 [b]	4.84 [a]	5.87 [c]	5.55 [b]	43.626	.037
Expiry date	6.43 [b]	6.62 [c]	5.86 [a]	6.51 [b, c]	5.77 [a]	72.689	.060
Date of capture	4.53 [c]	4.89 [d]	3.79 [a]	3.70 [a]	4.08 [b]	54.645	.044
Nutritional composition	4.04 [b]	4.22 [c]	3.78 [a]	4.29 [c]	4.22 [c]	9.753	.008
Brand name	3.77 [b]	3.96 [c]	3.55 [a]	4.41 [d]	4.09 [c]	26.419	.022
Capture area	3.20 [b]	3.41 [c]	2.77 [a]	3.27 [b, c]	3.58 [d]	21.370	.018

a, b, c, d indicate significantly different ($p<0.001$) means using Tukey HSD Post Hoc on a 7-point scale (1= never; 7= always)

Table III-A8. Consumer use of information cues depending on gender and age (n=4786)

Use of information cues	Gender				Age (years)				
	Male	Female	t-value	p-value	<25	25-55	>55	F-value	p-value
Fish species name	5.60	5.77	3.085	0.002	5.58 [a]	5.74 [b]	5.77 [b]	2.459	0.086
Price	5.68	5.85	3.229	0.001	5.82	5.79	5.88	1.045	0.352
Weight	5.27	5.53	4.528	< 0.001	5.24 [a]	5.46 [b]	5.66 [c]	10.068	< 0.001
Expiry date	6.20	6.27	1.328	0.184	5.89 [a]	6.28 [b]	6.36 [b]	17.589	< 0.001
Date of capture	4.13	4.24	1.512	0.131	3.82 [a]	4.21 [b]	4.45 [b]	12.967	< 0.001
Nutritional composition	3.77	4.24	6.952	< 0.001	3.94 [a]	4.09 [a]	4.38 [b]	10.271	< 0.001
Brand name	3.78	4.04	3.870	< 0.001	3.83 [a]	3.95 [a]	4.17 [b]	6.098	0.002
Capture area	3.20	3.29	1.400	0.162	3.09 [a]	3.24 [a]	3.48 [b]	7.445	0.001

a, b, c indicate significantly different means using Tukey HSD Post Hoc on a 7-point scale (1= never; 7= always)

Table III-A9. Consumer use of information cues depending on education and income (n= 4786)

Use of information cues	Education					Income				
	Unskilled	Skilled	Higher	F	p-value	Lower (25%)	Middle (50%)	Upper (75%)	F	p-value
Fish species name	5.58 [a]	5.83 [b]	5.89 [b]	15.236	< 0.001	5.69	5.79	5.66	2.754	0.064
Price	5.82	5.77	5.91	2.085	0.124	5.93 [b]	5.88 [b]	5.60 [a]	19.874	< 0.001
Weight	5.46	5.46	5.52	0.292	0.747	5.48	5.53	5.40	4.033	0.018
Expiry date	6.17 [a]	6.36 [b]	6.18 [a]	8.572	< 0.001	6.22 [a]	6.32 [a, b]	6.41 [b]	5.298	0.005
Date of capture	4.22	4.20	4.10	0.802	0.449	4.17 [a, b]	4.30 [b]	4.09 [a]	4.111	0.016
Nutritional composition	4.17	4.10	4.02	1.768	0.171	4.16 [b]	4.18 [b]	3.99 [a]	4.150	0.016
Brand name	4.04 [b]	3.94 [a, b]	3.85 [a]	2.834	0.059	3.98	4.00	3.93	0.592	0.553
Capture area	3.27 [a]	3.20 [a]	3.43 [b]	3.533	0.029	3.28 [a, b]	3.33 [b]	3.15 [a]	3.448	0.032

a, b, c indicate significantly different means using Tukey HSD Post Hoc on a 7-point scale (1= never; 7= always)

Table III-A10. Consumer interest in potential information cues, cross-country comparisons (n=4786)

Interest in potential information cues	Country					F-value	Partial Eta Squared
	Belgium	Denmark	Netherlands	Poland	Spain		
Method of preparation	5.04 [b]	5.56 [c]	4.78 [a]	5.03 [b]	4.99 [b]	29.780	.023
Wild/farmed	4.57 [b]	5.07 [c]	4.03 [a]	4.57 [b]	5.21 [c]	69.287	.058
Health benefits	5.14 [b]	5.08 [b]	4.32 [a]	5.35 [c]	5.76 [d]	99.357	.082
Recipes	5.41 [c]	5.73 [d]	4.84 [a]	5.31 [c]	5.08 [b]	42.262	.036
Safety guarantee	5.59 [b]	5.79 [c]	4.74 [a]	5.66 [b, c]	5.63 [b]	63.336	.053
Quality mark	5.66 [c]	5.65 [c]	4.83 [a]	5.39 [b]	5.53 [b, c]	40.984	.035
Batch number for product identification	3.78 [b]	5.07 [c]	3.38 [a]	3.93 [b]	3.83 [b]	116.008	.082
Environmental friendly	4.76 [b]	5.43 [c]	4.16 [a]	4.88 [b]	4.85 [b]	66.780	.053
Fish welfare	4.58 [b]	5.23 [c]	4.19 [a]	4.29 [a]	4.69 [b]	52.602	.040
Country of origin	4.44 [b]	5.15 [d]	3.90 [a]	4.73 [c]	4.82 [c]	59.696	.049
Feed used during farming	4.07 [b]	4.50 [d]	3.48 [a]	4.28 [c]	4.76 [e]	56.692	.049
Fed with genetically modified feed	4.54 [b]	5.21 [d]	3.95 [a]	4.85 [c]	4.93 [c]	50.846	.042
Colorants used	5.13 [b]	5.34 [c]	4.15 [a]	5.04 [b]	5.00 [b]	48.592	.041

a, b, c, d, e indicate significantly different ($p<0.001$) means using Tukey HSD Post Hoc on a 7-point scale (1= not interested; 7= very interested)

Table III-A11. Consumer interest in potential information cues depending on gender and age (n=4786)

Interest in potential information cues	Gender				Age (years)				
	Male	Female	t-value	p-value	<25	25-55	>55	F-value	p-value
Method of preparation	4.88	5.17	5.062	< 0.001	4.94 [a]	5.09 [a, b]	5.23 [b]	5.021	0.007
Wild/farmed	4.64	4.75	1.869	0.062	4.50 [a]	4.70 [b]	4.93 [c]	10.194	< 0.001
Health benefits	4.78	5.28	8.710	< 0.001	5.14 [a]	5.11 [a]	5.38 [b]	9.779	< 0.001
Recipes	4.98	5.39	7.161	< 0.001	5.17	5.30	5.34	1.754	0.173
Safety guarantee	5.22	5.60	6.627	< 0.001	5.35 [a]	5.50 [a, b]	5.66 [b]	6.776	0.001
Quality mark	5.12	5.53	7.250	< 0.001	5.24 [a]	5.41 [a, b]	5.59 [b]	7.994	< 0.001
Batch number for product identification	3.86	4.09	3.435	0.001	3.68 [a]	3.99 [b]	4.43 [c]	27.795	< 0.001
Environmental friendly	4.70	4.90	3.380	0.001	4.61 [a]	4.84 [b]	5.01 [b]	8.437	< 0.001
Fish welfare	4.38	4.69	5.058	< 0.001	4.44 [a]	4.57 [a]	4.92 [b]	16.520	< 0.001
Country of origin	4.59	4.66	1.088	0.277	4.46 [a]	4.59 [a]	4.95 [b]	15.755	< 0.001
Feed used during farming	4.16	4.28	1.869	0.062	4.05 [a]	4.23 [a]	4.46 [b]	7.531	0.001
Fed with genetically modified feed	4.65	4.76	1.546	0.122	4.48 [a]	4.72 [b]	4.94 [b]	8.039	< 0.001
Colorants used	4.89	4.98	1.453	0.146	4.64 [a]	4.93 [b]	5.26 [c]	17.831	< 0.001

a, b, c indicate significantly different means using Tukey HSD Post Hoc on a 7-point scale (1= not interested; 7= very interested)

Table III-A12. Consumer interest in potential information cues depending on education and income (n= 4786)

Interest in potential information cues	Education					Income				
	Unskilled	Skilled	Higher	F	p-value	Lower (25%)	Middle (50%)	Upper (75%)	F	p-value
Method of preparation	5.04	5.13	5.17	1.990	0.137	5.08 [a, b]	5.16 [b]	5.01 [a]	3.586	0.028
Wild/farmed	4.68 [a]	4.67 [a]	4.99 [b]	9.048	< 0.001	4.65	4.76	4.74	1.539	0.215
Health benefits	5.23 [b]	5.05 [a]	5.30 [b]	8.708	< 0.001	5.09	5.20	5.17	1.796	0.166
Recipes	5.19 [a]	5.41 [b]	5.24 [a]	9.328	< 0.001	5.22 [a]	5.37 [b]	5.22 [a]	5.243	0.005
Safety guarantee	5.45	5.55	5.58	3.063	0.047	5.44	5.55	5.51	1.666	0.189
Quality mark	5.32 [a]	5.50 [b]	5.52 [b]	8.315	< 0.001	5.37	5.46	5.43	1.324	0.266
Batch number for product identification	4.03	4.02	4.02	0.007	0.993	3.96	4.06	4.08	1.263	0.283
Environmental friendly	4.80	4.86	4.94	1.594	0.203	4.81	4.89	4.82	1.178	0.308
Fish welfare	4.61	4.60	4.63	0.038	0.963	4.66	4.65	4.53	1.939	0.144
Country of origin	4.63 [a]	4.58 [a]	4.86 [b]	5.805	0.003	4.49 [a]	4.69 [b]	4.69 [b]	5.363	0.005
Feed used during farming	4.27 [a]	4.17 [a]	4.45 [b]	5.408	0.005	4.12 [a]	4.30 [b]	4.30 [b]	4.027	0.018
Fed with genetically modified feed	4.66 [a]	4.74 [a]	4.95 [b]	4.833	0.008	4.57 [a]	4.78 [b]	4.82 [b]	5.483	0.004
Colorants used	4.83 [a]	5.04 [b]	5.17 [b]	9.670	< 0.001	4.85 [a]	4.97 [a, b]	5.04 [b]	2.768	0.063

a, b, c indicate significantly different means using Tukey HSD Post Hoc on a 7-point scale (1= not interested; 7= very interested)

Chapter IV
Consumers' attitudinal and behavioural patterns related to fish consumption

Abstract

The objective of this paper is to investigate consumers' attitudes and behavioural patterns related to fish consumption in five European countries (Belgium, Denmark, the Netherlands, Poland and Spain). Fish consumption is found to have a predominantly healthy, nutritious and safe image among consumers. Negative attitudes toward fish consumption were associated with the unpleasant physical properties (bones and smell) and price (the perception of fish as an expensive food product). Attitudinal and behavioural patterns related to fish consumption differ significantly depending on the country. What is important in one country may not be of such significance in the other.

This chapter is compiled and adapted from:

Pieniak, Z., Verbeke, W., Scholderer, J., Brunsø, K. & Olsen, S.O. (2007). Comparison between Polish and Western European fish consumers in their attitudinal and behavioural patterns. *Acta Alimentaria,* in press.

Verbeke, W., Sioen, I., Pieniak, Z., Van Camp, J., and De Henauw, S. (2005). Consumer perception versus scientific evidence about health benefits and safety risks from fish consumption. *Public Health Nutrition*, 8, 422-429.

Pieniak, Z., Verbeke, W., Fruensgard, L., Brunso, K. and Olsen, S. O. (2004). Determinants of fish consumption: Role and importance of information. *Polish Journal of Human Nutrition and Metabolism, 31*(Suppl.2): 409-414.

1 Introduction

Fish constitutes an important part of a healthy diet (Adams & Standridge, 2006; Mozaffarian & Rimm, 2006). Therefore, health authorities and the food industry have a joint interest in stimulating fish consumption. Despite some less favourable news about the potential adverse health impact of contaminants in fish (Kris-Etherton et al., 2003; Kris-Etherton et al., 2002), this food group maintains predominantly a healthy image among nutrition and food scientists, government and consumers (Brunsø, 2003; Gross, 2003), particularly as compared with meat as its main substitute for protein. Nevertheless, dietary recommendations of eating two portions of fish a week, of which at least one should be fatty fish, are not met by large groups of the population in many countries (Verbeke et al., 2005; Welch et al., 2002).

A number of previous studies concentrated on consumers' motives and barriers to increase fish consumption (Myrland et al., 2000; Nayga & Capps, 1995; Scholderer & Grunert, 2001; Trondsen et al., 2003) and on factors influencing seafood intake (Bredahl & Grunert, 1997; Leek et al., 2000; Verbeke & Vackier, 2005). The results show that fish availability, perceived difficulty in the preparation and cooking of fish, perception of fish as expensive compared to the other food types, unpleasant physical properties, such as bones, smell, and taste preference are the strongest barriers/inhibitors of fish consumption (Leek et al., 2000; Myrland et al., 2000; Nielsen et al., 1997; Olsen et al., 2007; Scholderer & Grunert, 2001). On the other hand, appreciation of fish taste emerges as the most important driver for eating fish, followed closely by health perception (Verbeke & Vackier, 2005)

Personal factors like age, gender, and region are also proven to be determinants of fish consumption. Generally, women display higher health consciousness and higher compliance with dietary recommendations (Beardsworth et al., 2002; Kubberod et al., 2002; Verbeke & Vackier, 2005), which is, in Belgium for instance, reflected in higher fish consumption in comparison with men (Verbeke & Vackier, 2005). Additionally, a

positive significant correlation between age and seafood consumption has been found in previous studies, indicating that a higher fish intake is reported with increasing age (Myrland et al., 2000; Olsen, 2003; Trondsen et al., 2004b; Verbeke & Vackier, 2005). Finally, Trondsen and colleagues (2004b), Myrland and colleagues (2000) and Verbeke & Vackier (2005) reported that the place of residence (coastal versus inland) is an important factor in explaining differences in seafood consumption. Coastal region was displayed as the region with the highest fish consumption.

The overall objective of this paper is to analyse and compare consumers' attitudes and behaviour toward fish in five European countries: Belgium, Denmark, the Netherlands, Poland and Spain. This chapter is included in this PhD thesis to provide an overview of the basic descriptive results and differences between countries with regard to their attitudinal and behavioural patterns related to fish. Although this part of the thesis remains purely descriptive, is is believed to be necessary to include it in order to providing the overall picture with basic insights into consumers' attitudes towards fish in Europe. Based on the Food Balance Sheets data provided by FAO (2006), Spaniards reported one of the highest fish intakes in Europe and in the world, whereas Danes, Belgians and Dutchmen stated moderate fish consumption levels, close to the European's average. Poles were among the countries with the lowest consumption of fish within Europe (see also *Chapter I*, section 1). First, this paper intends to compare behavioural patterns, such as frequency of fish consumption, intention to eat fish and fish consumption habit within five European countries. Second, it explores the attitudes toward eating fish in Belgium, the Netherlands, Denmark, Poland and Spain. Finally, it investigates the socio-demographic differences in fish consumption across the European countries.

2 Materials and methods

2.1 Data collection

First, in order to gain preliminary insights in the consumers' attitudes and beliefs, exploratory primary data were collected through qualitative focus group discussions in

May 2004 in Spain and Belgium. Methodology related to the exploratory research was described in *Chapter II*, section 3. Second, a quantitative cross-sectional consumer survey was carried out in November-December 2004 in five European countries: Belgium, Denmark, the Netherlands, Poland and Spain. The total sample consisted of 4,786 subjects (n=800-1,110 respondents per country). Methodological aspects and sample description of the consumer survey were provided in *Chapter I* section 4.2.

2.2 Measures

The questionnaire applied in the consumer survey measured a wide variety of constructs related to behaviour, attitudes and beliefs toward fish consumption. Underneath, description of the measures used in this study is provided.

2.2.1 Behavioural patterns

Fish consumption behaviour was a self-reported item and measured total fish consumption frequency per week, defined as the sum of fish consumed at home and fish consumed out of home. Intention to consume fish was measured by a frequency estimate, which has shown to increase the predictive ability of intention (Courneya, 1994; Sutton, 1998) (see *Chapter III*, section 2.1 for further details).

Verplanken and Orbell (2003) presented a 12-item self-report measure of habit, which includes subjective experiences of repetition as well as automaticity. This measure has shown good psychometric properties, and has been tested for convergent as well as discriminant validity (Brug et al., 2006; Honkanen et al., 2005; Verplanken et al., 2005). Only the most relevant items for our study have been included in our questionnaire, e.g. habit was measured by five items adapted from the Verplanken and Orbell scale (2003): *"Eating fish is something… (1) That belongs to my weekly routine; (2) I have been doing for a long time; (3) I have no need to think about doing; (4) That belongs to my monthly routine; (5) I do without thinking about it"*. Furthermore, three new items dealing with

habit from early life (childhood) have been added: *(1) "I am used to from my childhood"; (2) "I learned from my parents"; (3) "We often did at my home"*.

2.2.2 Attitudes toward fish consumption and health

Attitude as a global evaluative construct has been assessed or measured with different items and different methods (Krosnick et al., 2005). A self-reported measure with semantic differential formats running from the negative word connotation (1) to its positive antonym (7) has been used in this research. Respondents were presented with the sentence: "In the following we would like you to think about how you feel when you eat fish. Please indicate which word best describes how you feel". The bipolar adjectives were "*bad/good*", "*unsatisfied/satisfied*", "*unpleasant/pleasant*", "*dull/exiting*", "*terrible/delightful*", and "*negative/positive*" (Sparks & Guthrie, 1998).

Potential positive attitudes toward fish consumption have been measured using four items "*eating fish is… healthy*; *nutritious*; *safe*" and "*fish has a good taste*" Each item was answered on a 7-point Likert scale, ranging from (1) ''totally disagree'' to (7) ''totally agree''.

2.2.3 Barriers toward fish consumption

Potential barriers related with fish consumption have been measured using six items developed based on results from the exploratory study: "*fish for dinner is not substantial enough*", "*fish for dinner is expensive*", "*preparation of fish for dinner is very time-consuming*", "*I do not feel confident with evaluation if a fish is fresh and safe*", "*the bones in fish are unpleasant*" and "*fish has an unpleasant smell*" on a 7-point Likert scale ranging from "totally disagree" to "totally agree".

2.3 Data analysis

The collected data (n= 4,786) were analysed using SPSS 12. Bivariate analyses, i.e. independent samples t-tests and ANOVA F-tests with multiple comparisons (Post Hoc)

Tukey HSD test, were used to detect differences in consumers' behavioural and attitudinal patterns/ behaviour, beliefs and perception between different socio-demographic consumer groups. Unless explicitly mentioned, the decision rule for statistical significance was set at p-values lower than 0.05 or significance levels above 95%.

3 Results and discussion

3.1 Exploratory study

3.1.1 Fish consumption

In Belgium, fish consumption was spontaneously associated with dinning out and holidays (particularly on a coast), mostly because when dining out fish is already prepared *"no problem with unpleasant smell"*; *"at home you cannot prepare fish so good"; "pieces of meat in a restaurant are always too big"*. Furthermore, people matched eating fish with Fridays "*as a catholic family in the past, we ate fish every Friday*"; "*fish was obliged on Friday*". Fish was also often indicated as served when having a party or another kind of celebration. As opposed to Spain, where fish was a basic part of the daily diet, the Belgians perceived fish as something "chicque" – *"you can "show off" because you can show your guests how to prepare fish, maybe even with a good sauce to go with it"*. To some of the Belgians fish was associated with something that you have to learn to eat in order to obtain omega-3 fatty acids and a balanced diet *"…fish is not for everyday, we can live without it – except maybe those omega-3"*.

3.1.2 Motives for fish consumption

Both in Belgium and in Spain, fish was considered to be a very healthy product regardless the species, and the consumption of fish was perceived as essential to have a balanced diet. The majority of respondents indicated that fish contains less fat than meat *"fatty fish is leaner than the leanest meat" (heavy user, Belgium)*. Moreover, fish was seen as low in cholesterol and very easy to digest *"fish is digestive, you can eat fish at night, but not meat" (heavy user, Spain)*. The perception of fish as a healthy and

nutritious food was a major driver for fish consumption. It seemed that health determined fish consumption particularly among "light users". "Heavy users'" choice of fish seemed to be mainly determined by taste preferences and less a result of fish's healthy image. Furthermore, particularly in Spain, freshness was a fundamental issue *"fish completely looses its healthy qualities when it is not fresh enough" (Spain, heavy user).* In addition, the retailer played a primary role at the time of fish purchase.

3.1.3 Barriers for fish consumption

With regard to barriers, fish was perceived as an expensive product and price was one of the main barriers for its consumption *"fish is expensive and this is why many families do not buy it…"*; *"I eat fish in a restaurant when my parents pay because fish is really expensive" (light user, Belgium).* Other important barriers were the fact that fish does not deliver the same level of satiety as compared to meat *"if you buy a kilo of meat you have food for many persons…but with one kilo of fish… after removing the bones, the head, the skin… you have almost nothing left",* smell when cooking fish *"…after making a meal with fish, your kitchen and house will smell for hours"(Spain); "…the smell stays long at home; sometimes even for months" (Belgium)*, and the fact that most children did not like fish. In Spain lack of time, whilst in Belgium bones, were also perceived as major barriers for preparing fish.

3.2 Consumer survey

3.2.1 Fish consumption

Comparison of behavioural variables between the countries revealed significant differences (see Table IV-1). Effect sizes, as an estimate of the proportion of variance in the dependent variable (i.e. behaviour and attitudes in this case) explained by an independent variable (i.e. country code), are expressed as partial eta- squared values. The partial eta-squared values showed that differences between the five countries were significant with greater importance/effects for fish consumption at home (F=234.17,

p<0.001, partial eta-squared=0.173), total fish consumption (F=219.91, p<0.001, partial eta-squared=0.166), and intention to eat fish (F=25.71, p<0.001, partial eta-squared=0.158).

Dutch, Polish and Belgian respondents displayed rather low intention to eat fish (below the neutral point of the scale), whereas the highest intention to consume fish was found in Spain. With respect to the actual behaviour, three different constructs were measured: fish consumption at home, fish consumption out of home and total fish consumption. Spanish respondents reported the highest consumption of fish at home, followed by Danes and Poles, through Belgians to Dutchmen who scored significantly lower than consumers from any other country.

TableIV-1. Mean ratings on the behaviour variables, comparison between the countries

	Belgium (n=852)	Denmark (n=1,110)	Netherlands (n=809)	Poland (n=1,015)	Spain (n=1,000)	F-value	Partial Eta Squared
Intention to eat fish	3.80 [b]	4.25 [c]	2.99 [a]	3.82 [b]	5.54 [d]	25.709	.158
Habit	4.74 [b]	4.74 [b]	4.13 [a]	5.13 [c]	5.35 [d]	83.373	.083
Fish consumption							
At home	0.88 [b]	1.12 [c]	0.69 [a]	1.04 [c]	2.12 [d]	234.167	.173
Out of home	0.22 [b]	0.31 [c]	0.26 [b, c]	0.15 [a]	0.48 [d]	38.853	.038
Total	1.01 [b]	1.43 [c]	0.95 [a]	1.20 [b]	2.60 [d]	219.910	.166

a, b, c, d indicate significantly (p<0.001) different means of intention to eat fish and habit on a 7-point scale (1=totally disagree; 7=fully agree) and of fish consumption on a frequency scale (number of times per week) between the countries; 95% C.I.

Next, Polish respondents indicated the lowest fish consumption out of home compared to the other (all Western) European countries. We assume that dining out is still not very usual in Poland, certainly not in the countryside. Furthermore, when in a restaurant, fish is not particularly chosen over meat, in contrast with particular consumer segments in e.g. Belgium (Verbeke et al., 2007a). Most likely, these situational and habitual factors

explain the considerable difference in the consumption of fish out of home between Poland and all Western European countries included in this study. In the case of total fish consumption, consumers from Denmark and Spain scored highest, followed by Polish and Belgian respondents and finally by consumers from the Netherlands. On the other hand, Spanish respondents, followed by Polish respondents scored significantly higher on "habit of eating fish" compared to the consumers from Belgium, the Netherlands and Denmark.

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Table IV-2 presents socio-demographical differences in each country (and for the total sample) for fish consumption behaviour. Only in the Netherlands, women were found to have a significantly higher fish consumption frequency ($p<0.05$) than men. These results are in accordance with those of Verbeke and Vackier (2005) who only found a tendency for a higher percentage of Belgian women to eat fish once a week or more in comparison to men. Our results also indicated no significant difference in fish consumption frequency between genders in Poland, consolidating the findings obtained by Galiński et al. (2004). Significant differences in fish consumption frequency were found between age classes in Belgium, Denmark and the Netherlands. Older consumers reported higher fish consumption frequency in comparison with the younger ones. The results related to the Belgian sample support earlier findings by Verbeke and Vackier (2005), who revealed significantly lower scores among Belgian younger consumers for both intention to eat fish and fish consumption frequency in comparison with older age groups. Neither significant correlation nor a significant association between fish consumption frequency and age as categorical variable was found in Poland and in Spain. Our finding for Spain, a country with a substantial fish consumption tradition like in Norway, support the findingings by Olsen (2005), Myrland et al. (2000) and Trondsen et al. (2004b) who based on Norwegian consumer samples, reported no significant age effect on fish consumption.

A significantly higher fish consumption frequency was observed for the respondents who had higher education in Denmark and the Netherlands ($p<0.001$ and $p=0.049$). The results support the findings by Myrland et al. (2000) who found that people with

university education had higher fish consumption rates in Norway. With regard to income, respondents from Poland and from Spain, belonging to the middle income class claimed to eat significantly more fish than those from the lower or upper income classes. Finally, in Belgium, Denmark and the Netherlands people who did not have children in their households consumed more fish. On the contrary, Spanish families with children consumed significantly more fish than those without children. Although the latter tendency was observed for Polish families too, the difference was not significant.

Table IV-2. Socio-demographic differences in each country for fish consumption behaviour

Socio-demographics		Belgium (n=852)	Denmark (n=1,110)	Netherlands (n=809)	Poland (n=1,015)	Spain (n=1,000)	Total sample (n=4,786)
Gender	Female	1.12	1.40	1.10	1.21	2.63	1.27
	Male	1.03	1.51	0.83	1.17	2.39	1.55
	p-value	*0.233*	*0.369*	*0.017*	*0.581*	*0.187*	*<0.001*
	t-value	1.196	0.899	2.395	0.552	1.321	5.824
Age	< 25 years	0.93 [a]	1.05 [a]	0.75 [a]	1.37	2.51	1.62 [b]
	25-55 years	1.02 [a]	1.28 [a]	0.95 [a, b]	1.19	2.68	1.44 [a]
	> 55 years	1.38 [b]	1.93 [b]	1.16 [b]	1.14	2.33	1.59 [b]
	p-value	*< 0.001*	*< 0.001*	*0.018*	*0.211*	*0.101*	*0.003*
	F-value	11.582	16.333	4.047	1.560	2.295	5.965
Education	Unskilled	1.10	1.20 [a]	0.95 [a]	1.18	2.63	1.28 [a]
	Skilled	1.10	1.61 [b]	0.93 [a]	1.17	2.80	1.58 [b]
	Higher	1.14	1.72 [b]	1.38 [b]	1.34	2.44	1.84 [c]
	p-value	*0.922*	*< 0.001*	*0.049*	*0.285*	*0.155*	*<0.001*
	F-value	0.081	8.970	3.028	1.257	1.868	40.965
Income	Lower	1.22 [b]	1.41	1.03	1.09 [a]	2.43 [a]	1.40
	Middle	0.98 [a]	1.49	0.94	1.28 [b]	2.75 [b]	1.53
	Upper	1.22 [b]	1.35	0.86	1.19 [a, b]	2.48 [a, b]	1.48
	p-value	*0.001*	*0.478*	*0.292*	*0.066*	*0.031*	*0.052*
	F-value	6.586	0.738	1.232	2.731	3.475	2.967
Presence of children	No	1.17 [b]	1.58 [b]	1.02 [b]	1.14	2.47 [a]	1.46
	Yes	1.04 [a]	1.28 [a]	0.85 [a]	1.25	2.70 [b]	1.50
	p-value	*0.041*	*0.004*	*0.038*	*0.130*	*0.039*	*0.337*
	t-value	2.047	2.909	2.073	1.516	2.066	0.961

Socio-demographic differences in the total fish consumption level have been assessed through independent samples t-test (gender and presence of children) and ANOVA (age, education and income)

In Poland, the total fish consumption level did not differ substantially depending on consumers' socio-demographical profile. The same behavioural pattern was observed for women and men; respondents from different age groups, educational levels; and within families with or without children. And in Spain, the only differences were found between respondents with different income levels and families with or without children. In the other three European countries, fish consumption levels differed more strongly depending on the socio-demographics.

3.2.2 Potential motives for fish consumption

Figure IV-1 provides an overview of respondents' attitudes (both positive and negative) toward fish consumption. In general, consumers from all five countries considered fish as a healthy and nutritious product.

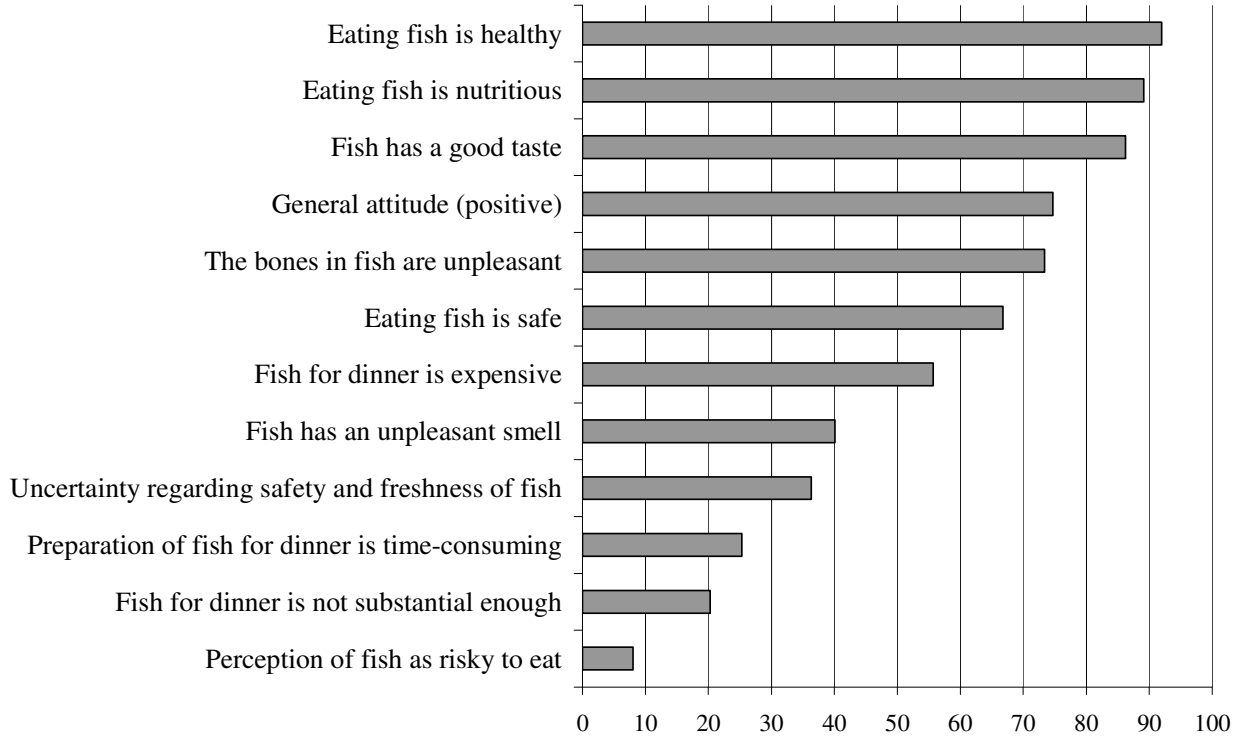


Figure IV-1. Attitudes toward fish consumption (n=4,786) (% respondents who scored 5 or more on 7-point scale)

The majority of the respondents (92%) agreed (score of 5 or more on a 7-point Likert scale) that eating fish is healthy; only 2.5% of the participants claimed the opposite. Additionally, 89.1% of the respondents agreed that eating fish is nutritious versus 3.4% who disagreed with this statement. Despite the overall overwhelming positive perception of fish in terms of health and its nutritional value, significant differences between nationalities were found ($p<0.001$) (Table IV-3).

Table IV-3. Mean ratings on the positive attitudes towards fish consumption, comparison between the countries

	Belgium (n=852)	Denmark (n=1,110)	Netherlands (n=809)	Poland (n=1,015)	Spain (n=1,000)	F-value	Partial Eta Squared
Eating fish is…							
Healthy	6.10 [b]	6.38 [d]	5.99 [a]	6.45 [d]	6.25 [c]	25.709	.016
Nutritious	5.74 [b]	6.30 [d]	5.62 [a]	6.17 [c]	6.22 [c, d]	62.259	.044
Safe	4.84 [a]	5.01 [b]	5.06 [b]	5.74 [d]	5.45 [c]	66.062	.055
General attitude	5.75 [c]	5.51 [b]	5.30 [a]	5.72 [c]	5.65 [c]	18.264	.016
Fish has a good taste	5.93 [b]	5.97 [b]	5.41 [a]	6.33 [c]	5.87 [b]	52.156	.032

The multiple comparisons (Post Hoc) Tukey HSD test was used to determine differences in attitudes toward fish between the countries. *a, b, c, d* indicate significantly different means on a 7-point scale

The partial eta-squared values showed that differences between the five countries were significant with greater importance/effects for the belief that eating fish is safe ($F=66.06$, $p<0.001$, partial eta-squared=0.055) and nutritious ($F=62.26$, $p<0.001$, partial eta-squared=0.044). Still, those values of partial eta-squared are very small, meaning that differences between countries with respect to their positive attitudes are not of such great importance. Polish and Danish respondents were most positive, whereas Dutch and Belgian respondents were least persuaded of the healthy and nutritious properties of fish. Additionally, fish was considered as a safe product to consume. About two thirds of the respondents (66.8%) agreed that eating fish is safe; 8.8% of the participants claimed the opposite; and 24.4% were rather undecided (neither agree/nor disagree). Comparison

between the countries showed that Poles and Spaniards reported stronger whereas Belgian, Danes and Dutchmen held weaker attitude toward fish safety.

Generally, respondents displayed very positive hedonic ratings with respect to fish. Almost three quarters of the consumers (74.7%) scored above the neutral point of the general attitude construct. Belgians, Poles and Spaniards scored the highest, whereas Dutchmen reported the lowest score on general attitude. Our results support those by Letarte et al. (1997) who reported that fish and seafood products are more frequently mentioned as "food likes" than as "food dislikes". Furthermore, fish was perceived as a product with a good taste. About 86% of the consumers agreed that fish has a good taste. Polish respondents were most strongly convinced of good fish taste in comparison with consumers from the other countries. Earlier findings indicated that taste preferences towards seafood are probably the most important predictors of behaviour (Bredahl & Grunert, 1997; Verbeke & Vackier, 2005)

Table IV-4 presents consumers' positive attitudes toward (potential motives for) fish consumption depending on gender and age. In general, women held more positive general attitude toward fish consumption and had stronger beliefs that eating fish is healthy and nutritious in comparison with men. On the contrary, men perceived eating fish as safer than women.

Table IV-4. Consumers' positive attitudes toward fish consumption depending on gender and age

	Gender		T	P	Age (years)			F	p-value
	Male	Female			<25	25-55	>55		
Eating fish is…									
Healthy	6.17	6.28	2.564	0.010	6.21	6.25	6.28	0.619	0.538
Nutritious	5.92	6.08	3.942	< 0.001	6.02	6.02	6.13	2.973	0.051
Safe	5.13	4.97	1.588	< 0.001	5.32 [b]	5.20 [a]	5.34 [b]	3.999	0.018
General attitude	5.52	5.62	2.268	0.023	5.72 [a]	5.91 [b]	6.07 [c]	10.143	< 0.001
Fish has a good taste	5.91	5.92	0.278	0.781	5.43 [a]	5.58 [b]	5.75 [c]	10.660	< 0.001

With regard to the age differences, the oldest respondents (>55 years of age) held in general the most positive attitudes about fish, followed by the middle age respondents (25-55 years of age). The youngest respondents had the least positive beliefs about eating fish. No significant differences in the health perception of eating fish have been found between respondents from different age classes.

Next, Table IV-5 displays consumers' positive attitudes toward fish consumption depending on income. No significant differences in the potential motives for fish consumption were found between respondents belonging to different income classes. Only one difference was found to be marginally significant (p=0.063): people belonging to the middle income group tended to perceive fish as healthier than consumers from the other two income groups (p=0.063).

Table IV-5. Consumers' positive attitudes toward fish consumption depending on income (n= 4786)

	Income			F	p-value
	Lower (25%)	Middle (50%)	Upper (75%)		
Eating fish is…					
Healthy	6.24	6.29	6.20	2.762	0.063
Nutritious	6.03	6.07	6.00	1.262	0.283
Safe	5.21	5.28	5.19	1.895	0.151
General attitude	5.59	5.60	5.59	0.048	0.953
Fish has a good taste	5.95	5.94	5.87	1.268	0.281

A significantly stronger belief that eating fish is nutritious and safe was observed for the respondents with the lowest education (p=0.025 and p=0.002). Respondents with higher and middle education tended to stronger agree with the statement that fish has a good taste (p=0.083) (Table IV-6).

Table IV-6. Consumers' positive attitudes toward fish consumption depending on education

	Education			F	p-value
	Unskilled	Skilled	Higher		
Eating fish is…					
Healthy	6.26	6.25	6.22	0.229	0.796
Nutritious	6.09 [b]	5.98 [a]	6.03 [a, b]	3.705	0.025
Safe	5.32 [b]	5.17 [a]	5.18 [a]	6.127	0.002
General attitude	5.58	5.63	5.51	2.434	0.088
Fish has a good taste	5.87	5.95	5.98	2.484	0.083

The multiple comparisons (Post Hoc) Tukey HSD test was used to determine differences in attitudes toward fish between the countries. *a, b* indicate significantly different means on a 7-point scale

3.2.3 Potential barriers for fish consumption

Generally, consumers had most negative negative attitudes toward unpleasant physical properties of fish, such as bones and smell, and to a lesser degree, toward the high price of fish and seafood (see Figure II-1). Almost three quarters of the respondents (73.4%) agreed that bones in fish are unpleasant versus 14.5% who disagreed with this statement. More than half of the respondents (55.7%) agreed that buying fish for dinner is expensive; 21% claimed the opposite; and 23% were rather undecided.

Table IV-7 presents comparison of the mean ratings on the potential barriers toward fish consumption between the countries. The partial eta-squared values show that differences between the five countries were significant with greater importance/effects for the belief that *"fish for dinner is not substantial enough"* ($F=112.95$, $p<0.001$, partial eta-squared=0.089) and *"fish for dinner is expensive"* ($F=93.30$, $p<0.001$, partial eta-squared=0.073). Belgian, Dutch and Polish consumers perceived fish bones as the most unpleasant, whereas Danes and Spaniards as the least unpleasant. Additionally, Polish and Belgian respondents displayed the strongest perception that buying fish for dinner is expensive. On the other hand, Dutch consumers scored lowest on this statement, close to

the midpoint point of the scale, meaning that they perceived eating fish neither expensive nor cheap. About 40% of the respondents agreed that fish has an unpleasant smell. Poles, Dutchmen and Spaniards reported the strongest belief that smell of fish is unpleasant.

Table IV-7. Mean ratings on the potential barriers towards fish consumption, comparison between the countries

	Belgium (n=852)	Denmark (n=1,110)	Netherlands (n=809)	Poland (n=1,015)	Spain (n=1,000)	F-value	Partial Eta Squared
Fish for dinner is not substantial enough	3.02 [b]	1.80 [a]	3.27 [c]	3.18 [b, c]	3.02 [b]	112.953	.089
Fish for dinner is expensive	5.25 [d]	4.06 [a]	4.94 [c]	5.12 [d]	4.24 [b]	93.303	.073
Preparation of fish for dinner is very time-consuming	3.37 [b]	3.05 [a]	3.82 [d]	3.65 [c]	3.37 [b]	29.882	.028
I do not feel confident with evaluation if a fish is fresh and safe	4.17 [c]	3.84 [b]	4.14 [c]	4.05 [c]	3.34 [a]	33.527	.028
Fish has an unpleasant smell	3.69 [a]	3.70 [a]	4.15 [b]	4.28 [b]	4.22 [b]	21.952	.020
The bones in fish are unpleasant	5.65 [b]	5.17 [a]	5.56 [b]	5.62 [b]	5.33 [a]	13.072	.011

The multiple comparisons (Post Hoc) Tukey HSD test was used to determine differences in attitudes toward fish between the countries. *a, b, c, d* indicate significantly different means on a 7-point scale (1=totally disagree; 7=fully agree)

One quarter of the consumers believed that preparation of fish for dinner is very time consuming. Dutch respondents scored highest on this statements, followed by Polish, Belgian and Spanish and finally, Danish respondents. About one third of the consumers did not feel confident regarding the evaluation whether fish is fresh and safe. Polish, Belgian and Dutch consumers felt the least confident, whereas Spanish and Danish respondents were the most confident regarding the evaluation of fresh fish quality. Only one fifth of the consumers (20.3%) indicated that eating fish for dinner is not substantial enough. Hence, it can be concluded that the expectation of lower satiety is not a major barrier when eating fish. Polish and Dutch respondents scored the highest, whereas Danish respondents the lowest on this item.

With regard to gender, significant differences were revealed for three potential barriers for fish consumption (Table IV-8). First, men perceived preparation of fish for dinner as more time-consuming than women ($p<0.001$). Next, female respondents evaluated smell ($p<0.001$) and bones ($p<0.001$) in fish as more unpleasant in comparison with male respondents.

Table IV-8. Consumers' potential barriers toward fish consumption depending on gender and age

	Gender		T	P	Age (years)			F	p-value
	Male	Female			<25	25-55	>55		
Fish for dinner is not substantial enough	2.90	2.79	1.676	0.094	3.19 [b]	2.78 [a]	2.74 [a]	10.609	< 0.001
Fish for dinner is expensive	4.69	4.68	0.089	0.929	4.58 [a]	4.66 [a, b]	4.81 [b]	3.209	0.040
Preparation of fish for dinner is very time-consuming	3.66	3.36	5.245	< 0.001	3.68 [b]	3.45 [a]	3.26 [a]	9.988	< 0.001
I do not feel confident with evaluation if a fish is fresh and safe	3.82	3.91	1.431	0.153	5.32	5.20	5.34	2.043	0.130
Fish has an unpleasant smell	3.78	4.08	4.614	< 0.001	4.28 [b]	4.01 [a]	3.84 [a]	7.985	< 0.001
The bones in fish are unpleasant	5.23	5.52	4.586	< 0.001	5.55 [b]	5.48 [b]	5.26 [a]	6.104	0.002

a, b indicate significantly different means on a 7-point scale (1=totally disagree; 7=fully agree)

With respect to age, significant differences revealed for almost all of the items. In general, the youngest consumers scored considerably higher on the majority of the items, meaning that they held stronger negative beliefs about fish than older respondents. This holds particularly for the beliefs "fish for dinner is not substantial enough"; "preparation of fish for dinner is very time consuming"; and "fish has an unpleasant smell". Only for the item "fish for dinner is expensive", the youngest respondents scored lowest, meaning that they perceived it as less expensive than elder respondents.

Additionally, comparison of potential barriers toward fish consumption between respondents from different income classes yielded significant differences (Table IV-9). Respondents belonging to the lower income class reported stronger agreement with the statement that fish for dinner is not substantial enough (p=0.001) and that fish for dinner is expensive (together with respondents belonging to the middle income class) (p<0.001). Furthermore, consumers with lower incomes felt less confident with evaluation whether fish is fresh and save than the other consumers did.

Table IV-9. Consumers' potential barriers toward fish consumption depending on income (n= 4786)

	Income			F	p-value
	Lower (25%)	Middle (50%)	Upper (75%)		
Fish for dinner is not substantial enough	3.00 [b]	2.75 [a]	2.75 [a]	7.283	0.001
Fish for dinner is expensive	4.85 [b]	4.72 [b]	4.46 [a]	15.513	< 0.001
Preparation of fish for dinner is very time-consuming	3.50	3.42	3.40	1.320	0.267
I do not feel confident with evaluation if a fish is fresh and safe	3.98 [b]	3.88 [a, b]	3.81 [a]	2.775	0.062
Fish has an unpleasant smell	4.04	4.01	3.97	0.332	0.718
The bones in fish are unpleasant	5.41	5.47	5.45	0.510	0.601

The multiple comparisons (Post Hoc) Tukey HSD test was used to determine differences in attitudes toward fish between income levels. *a, b, c, d* indicate significantly different means on a 7-point scale (1=totally disagree; 7=fully agree)

Finally, Table IV-10 presents consumers' potential barriers toward fish consumption depending on education. Higher educated consumers perceived fish for dinner as more expensive in comparison with lower educated consumers. Next, lower educated (unskilled) respondents felt the least confident with evaluation of fish as fresh and safe compared with moderately educated respondents (skilled). Additionally, moderately

educated (skilled) consumers perceived bones in fish as the most unpleasant in comparison with respondents from the other two education groups.

Table IV-10. Consumers' potential barriers toward fish consumption depending on education

	Education			F	p-value
	Unskilled	Skilled	Higher		
Fish for dinner is not substantial enough	2.89	2.81	2.71	2.295	0.101
Fish for dinner is expensive	4.68 [b]	4.82 [b]	4.31 [a]	19.877	< 0.001
Preparation of fish for dinner is very time-consuming*	3.51	3.41	3.36	3.961	0.019
I do not feel confident with evaluation if a fish is fresh and safe	3.77 [a]	4.02 [b]	3.92 [a, b]	9.036	< 0.001
Fish has an unpleasant smell*	4.09	3.91	4.04	4.419	0.012
The bones in fish are unpleasant	5.35 [a]	5.58 [b]	5.38 [a]	8.503	< 0.001

*Although the ANOVA F-test suggests that mean scores are significantly different, the Tukey HSD Post Hoc test reports only a marginal significance.

4 Conclusions

The results from the exploratory research carried out in Spain and Belgium have shown that fish, regardless the species, was considered to be a very healthy product and the consumption of fish was perceived as essential in a balanced diet. The perception of fish as a healthy, nutritious and tasty food was the most important motive for the consumption of fish both in Spain and in Belgium. These drivers were universal and did not differ across the different groups of consumers (low versus heavy fish consumers). In addition, the retailers' advice seemed to play a fundamental role at the time of fish purchase. Opposite to the motives, fish was perceived as an expensive product, with price being one of the main barriers for its consumption. Other important barriers were preparation time,

unpleasant smell when cooking fish, the presence of bones, the fact that fish did not deliver the same level of satiety as compared to meat and the dislike of fish among most children.

The positive attitude toward fish consumption was confirmed in the quantitative consumer survey for Belgium and Spain and could be extended for Poland, the Netherlands and Denmark. Additionally, the results from this study supported previous findings from literature where fish has invariably been demonstrated to have a healthy image (Brunsø et al., 2007; Olsen, 2003; Pieniak et al., 2007c; Verbeke et al., 2005). In our study, the negative attitudes towards fish consumption were associated with the unpleasant physical properties (mostly bones) and price (the perception of fish as an expensive food product). According to previous studies by Rozin and colleagues (Rozin, 1990; Rozin & Fallon, 1987; Rozin et al., 1991), negative attitudes toward food may result from negative sensory experience, from fear of bodily harm, and from negative symbolism associated to the thought of food or its origin. Hence, our results are in accordance to those found by Verbeke and Vackier (2005), who stated that taste and the healthy image of fish were two well-appreciated characteristics, while bones in fish and the price were identified as the most likely attitudinal barriers to more frequent fish consumption.

The results from our consumer survey show that attitudinal and behavioural patterns related to fish consumption differ significantly across countries. What is important in one country may not be of such significance in the other. The most considerable difference between the five European samples is the relation between attitudes and beliefs related to fish health and nutrition, versus the claimed intention and total fish consumption. Despite the most positive attitudes towards fish health and nutrition, Polish consumers reported relatively low total fish consumption, close to the level reported by Belgian consumers whose beliefs were significantly less positive.

A potential explanation could be that this discrepancy is due to a positive attitude, but an expensive product on the market. Since Polish consumers perceive fish as a very expensive food product. Furthermore, they are relatively negative about the unpleasant

physical properties of fish (smell and bones). They declare to like fish but also find preparation of fish very time-consuming. Another possible explanation for this discrepancy could be the impact of social-desirability response bias in self-reported research (see Moorman & Podsakoff, 1992, for review). Social desirability is generally viewed as the tendency of individuals to present themselves in a favourable light, regardless of their 'true feelings' about an issue or topic (Moorman & Podsakoff, 1992). Socially shared meanings, such as common norms, beliefs or values, can be grounded in language, geography, and history shared by people who live or have lived within the same social environment (Middleton & Jones, 2000; Triandis et al., 1990). Middleton and Jones (2000) suggested that Western and Eastern individuals are responding with a socially desirable response set consistent with the cultural dimensions predominant in their country of origin. In this sense, the different cultural background between a Central European country versus Western European countries might have yielded higher social desirability response and therefore higher inconsistency between attitude and behavioural intention in Poland.

Dutch respondents reported the lowest intention to eat fish and actual fish consumption at home, they scored lowest on all potential motives for fish consumption and highest on potential barriers for fish consumption (except for price). Fish consumption frequency in the Netherlands is higher among women, consumers aged over 55, higher educated and families living without children. Similarly in Denmark, elder consumers, higher educated and living in a family without children was found to consume fish more frequently. Finally in Belgium, elder respondents and those living without children ate more fish. These findings largely corroborate previous research by Verbeke and Vackier (2005) who found that fish consumption frequency increased with ageing on the one hand, and decreased with the presence of children in the household on the other hand. Notable contradictions with mainly Norwegian studies pertain to the role of children. The findings of our quantitative study indicated that especially within smaller Belgian, Dutch and Danish families, the presence of young children has a negative impact on fish consumption. The results of a Norwegian study (Myrland et al., 2000) revealed that the presence of school-aged children in the household influenced what kind of seafood was

consumed, while total fish consumption increased with increasing size of the household. Trondsen (2004a; 2003) suggested that presence of children younger than 18 years of age, particularly teenagers, associated with significant lower fish consumption frequency. Also, within a given household, the number of children and the children's age may operate as barriers to increased fish consumption. The difference with regard to the child's age influencing fish consumption frequency between ours and results from studies in other countries may be attributed to socio-cultural differences and differing behavioural patterns in general and toward fish consumption in particular.

Spain has by far the highest fish consumption with the average about 2.5 times a week, almost twice as often as Denmark, which had the second highest consumption. Furthermore, our results suggest that in Spain eating fish is probably more a habitual than an actively reasoned or planned behaviour. Relatively few associations were discovered in Spain between socio-demographic characteristics with total fish consumption. People with middle incomes and from families with children claimed to eat fish more frequently. Spaniards held very positive general attitudes toward fish consumption and were the most confident regarding the evaluation of fresh fish quality. However, their motivational aspects for eating fish were not tremendously stronger/different than in the case of the other countries. Fish is a part of the Mediterranean diet, a traditional food and therefore is highly consumed among almost all socio-demographic groups in Spain.

All in all we have found that the negative attitudes toward fish consumption were mostly associated with the presence of bones in fish. Based on this finding, the recommendation is that the industry should invest in the development and market introduction of boneless fish and seafood products. However, such products should not harm consumers' motives for fish consumption and particularly the healthy image fish has, i.e. these products should avoid be positioning and perceiving as related to foods with an unhealthy image. Furthermore, boneless products should be affordable, i.e. this development should not increase fish price considerably, since both in Poland and in Belgium, fish is already perceived as a very expensive food product.

Next, the fish industry could introduce on the market cheaper fish species. However, before marketing these, extensive market research may be needed in order to investigate whether more expensive fish species are not most favourable and eaten among consumers. Extension of the market share of those cheaper fish species would even decrease the fish consumption level. Furthermore, marketers could try to change price perception among consumers through appropriate communication efforts. This could be a valuable strategy in Belgium and in Poland.

In the Netherlands and Poland, special attention should be put on providing consumers with more convenient (ready-to-eat) fish products (and fish dishes), since the preparation of fish is there perceived as very time-consuming. Additionally, fish consumers could be provided with "easy" recipes and information about possible methods of fish preparation, e.g. placed in shops, in the newspapers or women magazines.

Furthermore, the findings of this study indicate that self-confidence with the evaluation of freshness and safety of fish is strongly related to expertise and product experience. Spanish and Danish respondents were found to be the most confident with fish quality evaluation and at the same time reported the highest fish consumption levels. Hence, the fish industry could focus its communication strategies on educating consumers about how to evaluate fish quality, which could increase consumers' ability and confidence in evaluating fresh fish quality.

Chapter V

Impact of consumers' health-related beliefs, health involvement and risk perception on fish consumption

Abstract

The purpose of this study was to investigate the impact of consumers' health beliefs, health involvement, and risk perception on fish consumption behaviour in five European countries. Cross-sectional data were collected through a pan-European consumer survey (n=4,786) with samples representative for age and region in Belgium, the Netherlands, Denmark, Spain and Poland. First, the cross-cultural validity and cross-cultural differences in health beliefs, health involvement and risk perception in relation to fish have been tested. Next, structural equation modelling (LISREL) was used in order to simultaneously estimate the strength and direction of hypothesised relationships between health beliefs, health involvement and risk perception in relation to fish consumption.

Health involvement links up indirectly with subjective health and with total fish consumption, in both cases through increased interest in healthy eating. Increased risk perception from fish consumption negatively influences consumers' subjective health, and total fish consumption, though the latter path is far less strong than the path from interest in healthy eating to total fish consumption. Finally, subjective health positively relates to satisfaction with life. This study focused on fish as a product category, and included only a limited number of attitudinal constructs. Further research using survey questionnaires could focus on a more specific product level, e.g. fish species or origin, and include additional constructs such as knowledge, convenience orientation or general attitudes. This study exemplifies the need for more effective communication about healthy eating and about fish consumption as a part of healthy eating patterns to the

broader public in order to better align fish consumption with public health recommendations. Additionally, the study provides cross-culturally validated measures of health beliefs, health involvement and risk perception in relation to fish.

This paper provides a unique model relating health beliefs, health involvement and risk perception to fish consumption, which has been tested and validated using a large pan-European consumer sample. Furthermore, all constructs used in the analyses have been cross-culturally validated across consumer samples taken from Belgium, the Netherlands, Spain, Denmark and Poland. This study is herewith the first of its kind linking health beliefs, health involvement and risk perception to fish consumption behaviour in a cross-cultural setting.

This chapter is based on:

Pieniak, Z., Verbeke, W., Scholderer, J., Brunsø, K., Olsen, S.O. (2008). Impact of consumers' health beliefs, involvement and risk perception on fish consumption: A study in five European countries. *British Food Journal*, in press.

1 Introduction

Several studies have proven that physical and sensory properties (bones, smell, and taste), together with price, availability, convenience, as well as personal involvement, and interest in health and nutrition are important factors that influence seafood consumption behaviour in general, and fish consumption in particular (Juhl & Poulsen, 2000; Leek et al., 2000; Myrland et al., 2000; Olsen, 2003; Olsen et al., 2007; Scholderer & Grunert, 2001; Trondsen et al., 2004a; Trondsen et al., 2003; Verbeke & Vackier, 2005). The image of fish among consumers is predominantly healthy and attitudes towards eating fish are strongly favourable (Olsen, 2003; Trondsen et al., 2004a). Fish is beneficial for human health, as it is an important source of a number of nutrients, particularly protein, retinol, vitamin D, vitamin E, iodine, selenium and the essential long-chain polyunsaturated fatty acids. On the other hand, fish may include contamination with pathogenic bacteria, viruses, toxins, chemical and other environmental hazards (Sumner & Ross, 2002). Recently, several studies concentrated on the question whether it is possible to follow dietary recommendations of eating two portions of fish a week, of which one should be fatty fish, without exceeding tolerable intakes of chemical contaminants (Mozaffarian & Rimm, 2006; Sioen et al., 2008a; Sioen et al., 2008b; Smith & Sahyoun, 2005). Their results showed that health benefits of eating fish outweigh the potential risks. Nevertheless, consumers may feel confused. In a Belgian study, gaps between consumer perception and scientific evidence related to fish were identified. Despite conclusive evidence about the content and positive effect of omega-3 fatty acids in fish, consumer awareness and beliefs about the fact that fish contains omega-3 fatty acids and that these nutrients are beneficial for human health were found to be rather poor (Verbeke et al., 2005).

Although health beliefs and (health) involvement have been reported to associate with fish consumption and despite the recommendation that models of food choice should incorporate multiple constructs, including risk perception as a decisional factor (Knox, 2000), to our knowledge, no study has investigated health beliefs (subjective health and satisfaction with life) together with involvement-related constructs (health involvement and interest in healthy eating) as well as risk perception in the same setting. In the era of

increased focus on potential risks versus health benefits of eating fish, the aim of the current study is to investigate to what extent health and risk constructs actually associate with fish consumption behaviour in different European countries.

The purpose of this study is twofold. First, this paper intends to test for cross-cultural differences and cross-cultural validity of constructs relating to health involvement, interest in healthy eating, subjective health, satisfaction with life, and risk perception in five European countries: Belgium, Denmark, the Netherlands, Poland and Spain. The second objective is to conceptualise and validate a model incorporating the above mentioned constructs and associate these constructs with fish consumption behaviour. Finally, based on the results from this modelling exercise, the aim is to explore and discuss to what extent health beliefs can be considered drivers to fish consumption.

2 Theoretical background

Several studies have yet suggested or demonstrated the existence of associations between constructs relating to health, risk, food and fish consumption, and consumer well-being. Whereas some links between perceptions and beliefs relating to health, risk and well-being are well-documented in literature, others are less straightforward. In particular, the directionality of relationships is often unclear. In order to shed light on these issues, the present study will first briefly review the links that have been documented so far.

In consumer behaviour research literature, the concept of involvement has been widely used. Involvement has been shown to have robust effects on explaining consumers' purchase and eating decisions (Beharrell & Denison, 1995; Marshall & Bell, 2004; Verbeke & Vackier, 2004; Zaichkowsky, 1985), including fish consumption behaviour in particular (Juhl & Poulsen, 2000; Olsen, 2001). Health involvement refers to the personal relevance and importance attached to health issues, based on inherent needs, values and interests (Zaichkowsky, 1985).

Diehr and Beresford (2003) demonstrated that a healthy diet was associated with better nutrition, better health behaviour, and in some cases also with better factual baseline health. Several cross sectional studies have shown a positive relationship between

following a recommended diet and better health perception (Blaxter, 1990; Manderbacka et al., 1999), although at least two other studies indicated that food intake patterns or quality of the diet did not associate with self-rated health (Goodwin et al., 2006; Osler et al., 2001). Based on previous studies, we anticipate finding a relationship between health involvement and subjective health, and between interest in healthy eating and subjective health.

However, interest in healthy eating and health involvement are not always drivers for purchasing and consuming a particular food with a predominantly healthy image, such as fish. A healthy diet may consist of a number of different foods, often excluding fish (Foxall et al., 1998), e.g. for the simple reason of disliking or being allergic to fish or seafood (Brunsø et al., 2007). Nevertheless, a positive relationship between (health) involvement (covering also aspects of pursuing a healthy diet, therefore also referred to as importance attached to healthy eating) and seafood consumption has yet been reported (Olsen, 2001, 2003). Furthermore, Verbeke and Vackier (2005) found that food involvement, or the perceived importance attached to food, was a significant factor in explaining fish consumption frequency and intention to eat fish. Additionally, product involvement was found to positively influence the frequency of product usage in the case of fish (Foxall et al., 1998; Juhl & Poulsen, 2000). Hence, we expect interest in healthy eating to associate with fish consumption frequency. Furthermore, since the aim of healthy eating is most likely to maintain health and prevent chronic diseases, such as cardiovascular diseases and cancers, we expect to find a relationship between health involvement and interest in healthy eating, as well as a direct relationship between health involvement and total fish consumption. Subjective health is an individual's assessment or self-rating of her/his health in general (Baron-Epel & Kaplan, 2001). Subjective health is considered to be a valid and reliable indicator of personal health, particularly in studies where other forms of health information are not included (Ferraro et al., 1997; Larue et al., 1979). Silvers and Scott (2002) reported a significant positive relationship between fish intake and self-reported mental health, which may have been driven by beliefs relating to the relatively high content of poly-unsaturated fatty acids in (fatty) fish. Therefore, a specific hypothesis is that fish consumption associates with subjective health in general.

Subjective well-being is a general construct with a cognitive dimension (Andrews & Withey, 1976), namely life satisfaction, and an affective dimension (Cummins, 2000; Ryff, 1989; Sagiv & Schwartz, 2000), namely feeling of happiness. Research has mainly focused on the affective component of well-being (Diener et al., 1991; Tellegen et al., 1999; Watson et al., 1988); whilst life satisfaction has received less attention (Diener et al., 1985). Life satisfaction has been defined as a "global evaluation by the person of her/his life" (Pavot et al., 1991). It refers to a conscious cognitive judgmental process, in which individuals assess the quality of their lives on the basis of their own criteria (Pavot & Diener, 1993; Shin & Johnson, 1978). This judgment includes the evaluation of one's health, wealth, friendship and romantic relationships (Diener et al., 1985). Furthermore, life satisfaction (also called satisfaction with life) has been used as an indicator of self-rated well-being (Munoz-Sastre & Ferriere, 2000). Subjective health is strongly correlated with subjective well-being (George & Landerman, 1984; Wilson, 1967). Brief *et al.* (1993) found that subjective health was positively associated with life satisfaction. Arrindell *et al*. (1991) reported that health status among others was correlated with satisfaction with life. Hence, we expect to find relationship between subjective health and satisfaction with life.

Consistent with recent relevant literature, risk perception is defined as people's cognitive and affective responses to hazards – food poisoning from eating fish in this particular case – consumers are or might be exposed to (Loewenstein et al., 2001; Raude et al., 2005; Slovic et al., 2005). This definition incorporates feelings, emotional components (e.g. uncertainty, worry, anxiety) and probabilistic-consequentialistic components (subjective risk assessment). Rozin *et al*. (1999) stated that food is a major contributor to physical well being and a source of pleasure, but also causing worry and stress. Concerns about diets with respect to health may produce worry and anxiety (Polivy & Herman, 2002). There are studies that show links between experiencing pleasure and good health, and between stress and poor health (Netter, 1996). Therefore, the expectation is that different emotions, such as worry and anxiety, which associate with risk perception, might correlate with subjective health, more specifically behave as a factor that reduces subjective health.

Recently consumers have been confronted a number of times with food safety incidents, such as among others BSE, dioxins, avian influenza, pesticide residues, genetically modified organisms or methyl mercury contamination in fish. As already mentioned before, such experiences can lead to anxiety among consumers. Previous studies reported declining meat consumption during beef safety crises (Verbeke et al., 1999a; Verbeke et al., 1999b). Risk perception also had a strong negative influence on chicken purchase likelihood (Yeung & Morris, 2006). Therefore, the hypothesis is that owing to increasing exposure to information about potential risks from eating fish, people might perceive higher risk of food poisoning from eating fish, which might associate with their fish consumption behaviour.

3 Method

3.1 Data collection

Information was obtained from randomly selected consumers from five European countries through survey questionnaires during November-December 2004. The countries included are Belgium, Denmark, the Netherlands, Poland and Spain. A total sample of 4,786 participants (n=800-1,100 respondents per country) was obtained. The sample was composed of 3,652 women (76.3%) and 1,134 men (23.7%). This gender distribution reflects the criterion that all respondents were the main responsible people for food purchasing within their household. A quota sampling procedure with age and region as main control variables was applied. The age of the respondents ranged from 18 to 84 years, with a mean of 42.7 (SD=12.6). Recruitment procedures differed between countries depending on cost efficiency, time effectiveness and best practice of the market research agencies that performed the fieldwork. In Denmark and Belgium, mail surveys were conducted, with a response rate of 79% (Denmark) and 53% (Belgium), respectively. In Poland and in Spain, the recruitment was conducted face-to-face in participants' homes, whereas in the Netherlands, data were collected electronically by means of a web-based survey. All questionnaires were self-administered by the participants without interference from researchers or interviewers.

3.2 Measures

A questionnaire was developed in English and further translated into Dutch and French (Belgium), Danish (Denmark), Dutch (the Netherlands), Polish (Poland) and Spanish (Spain) by professional translation services within each country. The back-translation method was used to verify the multilingual versions of the questionnaire. The questionnaires, measuring a wide variety of constructs with relation to fish including behaviour, attitudes and beliefs, knowledge, and use of information sources, have been pre-tested in the national languages through pilot studies.

Fish consumption behaviour was a self-reported item, which was measured as total fish consumption frequency per week, i.e. the sum of fish consumed at home and fish consumed out of home. A 9-point frequency scale ranging from "never" to "daily or almost every day" was used. This response scale was recoded into frequencies per week (e.g. "never" became 0; "once a week" became 1; and "daily or almost daily" became 6.5 and so on) and aggregated in order to compute one behavioural measure, namely total fish consumption frequency (per week).

Involvement is often measured by terms expressing importance, relevance, caring, concern, or interests associated with the attitude object, issue or action (O'Cass, 2000). "Important/unimportant" is, both in psychology and consumer behaviour, by far the most-used semantic differential for assessing involvement (Beatty & Kahle., 1988; Boninger et al., 1995a; Zaichkowsky, 1985). In our study where health was the attitude object, *health involvement* was measured using three items based on Zaichkowsky (1990): "Health is very important to me", "I care a lot about health", and "Health means a lot to me". All these items were scored on a 7-point Likert-scale anchored by totally disagree (1), neither agree nor disagree (4), and totally agree (7). This procedure for measuring involvement also with the (food) involvement scale suggested by Bell and Marshall (2003).

Interest in healthy eating was measured on a 7-point Likert scale using three items: "It is important to me that the food I eat on a typical day… (1) is good for my psychical and mental health; (2) keeps me healthy; and (3) is nutritious". Those items were adapted

from the Food Choice Questionnaire (Steptoe et al., 1995). Only the most appropriate and relevant items for the case of fish were included based on findings from exploratory focus group discussions (Brunsø et al., 2007; Pieniak et al., 2007c).

Four items with regard to *subjective health* were included, each to be answered on a 7-point Likert scale: "Compared with people at my age, my health is excellent"; "Compared with people at my age, my current physical health is excellent"; "I am as healthy as anyone I know at my age"; and "Compared with people at my age, my current mental health is excellent". The items were mainly based on the general health perception scale from the short-form health survey (Ware et al., 1993).

Satisfaction with life (SWL) was measured using a 7-point Likert scale consisting of four items: "I am satisfied with my life"; "The general conditions of my life are excellent"; "In most ways my life is close to my ideal"; and "If I could live my life over, I would change almost nothing", as developed by Diener *et al.*, (1985). This SWL scale is available in several languages and was suggested as a potential cross-cultural index of life satisfaction (Pavot & Diener, 1993).

Based on a review of literature related to risk perception (FifeSchaw & Rowe, 1996; Slovic et al., 1980) and the results from the exploratory focus group discussions (Brunsø et al., 2007; Pieniak et al., 2007c) three statements were chosen to assess *risk perception* related to fish consumption. One item with regard to chemical ("I do not want to eat fish too often because I am afraid of food poisoning from chemical contamination (heavy metals, dioxins, residues)"; and one with regard to bacterial contamination ("I do not want to eat fish too often because I am afraid of food poisoning from bacterial contamination (salmonella, campylobacter, listeria, botulism)" were included. Additionally, one general statement about possible food contaminations from eating fish ("I am very concerned about the possibility of getting ill from eating fish") was included. A 7-point Likert scale ranging from "totally disagree" (1) to "totally agree" (7) was used for all items.

3.3 Data analysis

First, data were analysed using the statistical software SPSS version 12.0. Missing data were imputed by means of the EM (expectation-maximization) algorithm. Due to the cross-cultural nature of the study, analysis of the measurement invariance and cross-cultural validity of the constructs requires attention. Therefore, a confirmatory factor analysis on the pooled sample, followed by five multi-group confirmatory factor analyses per construct, have been performed using the robust maximum likelihood procedure in LISREL 8.72.

The mean scores of the constructs across the countries were calculated and ANOVA F-tests with Tukey post hoc comparison of mean scores were used to detect differences in consumers' health beliefs, health involvement and risk perception across the countries. Next, the total sample has been randomly split into two equally sized subsamples (n=2,393). In the first subsample, the so-called "learning sample", the Tetrad IV program has been used to identify the best fitting causal structure and direction of paths between health beliefs, involvement, risk perception and fish consumption frequency. This procedure is deemed relevant since current empirical evidence mainly suggests what constructs "matter" in this specific case, but do not allow hypothesising all relationships and the directionality between the considered constructs. Then, in the second subsample, the so-called cross-validation sample, the model parameters have been estimated and the general fit of the model has been assessed by means of LISREL 8.72. With the use of structural equation modelling (LISREL), the examination of all the relationships between constructs and items is performed simultaneously, which is a substantial advantage compared with single equation modelling (Bollen, 1989).

4 Empirical findings

4.1 Measurement validity (invariance)

The data were collected in five different EU countries, which implies some concerns related to the cross-cultural validity of the collected information. In order to establish

whether direct comparison of measurement means (health beliefs and risk perception) across the countries are meaningful, measurement invariance needs to be tested. Additionally, in order to perform structural equation modelling and to pool the sub-samples, the procedure for testing measurement invariance as recommended by Steenkamp and Baumgartner (1998) has been followed (see also *Chapter III*, section 2.2).

Five independent multi-group confirmatory factor analysis models were estimated, for each of the constructs considered in this study: health involvement (3 items, 1 factor), interest in healthy eating (3 items, 1 factor), subjective health (4 items, 1 factor), satisfaction with life (4 items, 1 factor) and risk perception (3 items, 1 factor). The model parameters were estimated by means of robust maximum likelihood (Satorra & Bentler, 1988) using LISREL 8.72. The goodness-of-fit statistics indicated that the scalar invariance assumption was acceptable for the health involvement items (Satorra-Bentler $\chi^2 = 79.34$, df = 16, RMSEA = 0.064, GFI=0.99, CFI=0.99), the interest in healthy eating items (Satorra-Bentler $\chi^2 = 107.50$, df = 16, RMSEA = 0.077, GFI=0.98, CFI=0.99) and the risk perception items (Satorra-Bentler $\chi^2 = 112.27$, df = 16, RMSEA = 0.079, GFI=0.999, CFI=0.99). Hence, common interval scales can be assumed to exist for these items, and direct comparisons of measures' means across countries are meaningful. Unfortunately, the goodness-of-fit statistics indicated that scalar invariance was unacceptable for subjective health and for satisfaction with life. In a next step, the invariance constraints on the item intercepts were dropped, and metric invariance models were estimated. The goodness-of-fit statistics indicated that the metric invariance assumption was tentatively acceptable for the subjective health items (Satorra-Bentler $\chi^2 = 179.71$, df = 22, RMSEA = 0.09, GFI=0.98, CFI=0.99) and the satisfaction with life items (Satorra-Bentler $\chi^2 = 210.81$ df = 22, RMSEA = 0.09, GFI=0.99, CFI=0.98). Taken together, it can be concluded that the nature of the underlying factors is invariant across countries, and that the responses vary in terms of the same scale units, but that the items measuring the validation criteria are additively biased across countries (see Scholderer et al., 2005). This bias will be eliminated by standardising all validation criteria within countries before further analysis are conducted.

4.2 Confirmatory factor analysis and construct validity

Confirmatory factor analysis of the five latent constructs, namely health involvement, interest in healthy eating, subjective health, satisfaction with life and risk perception confirmed that all items in the measurement model reflect the theoretical constructs as expected and a five factor solution is best suited for the data. Standardised factor loadings and reliability estimates are presented in Table V-1.

Table V-1. Factor loadings and reliability estimates for construct measures related to seafood risk and health

Constructs and items	Factor loadings
Health involvement	(.94)
Health means a lot to me	.90
I care a lot about health	.91
Health is very important to me	.93
Interest in healthy eating	(.92)
It is important to me that the food I eat on a typical day is good for my psychical and mental health	.92
It is important to me that the food I eat on a typical day keeps me healthy	.89
It is important to me that the food I eat on a typical day is nutritious	.85
Subjective health	(.86)
Compared with people at my age, my health is excellent	.90
Compared with people at my age, my current psychical health is excellent	.86
I am as healthy as anyone I know at my age	.72
Compared with people at my age, my current mental health is excellent	.63
Satisfaction with life	(.85)
I am satisfied with my life	.85
The general conditions of my life are excellent	.83
In most ways my life is close to my ideal	.78
If I could live my life over, I would change almost nothing	.67
Risk perception	(.90)
I do not want to eat fish too often because I am afraid of food poisoning from bacterial contamination (salmonella, campylobacter, listeria, botulism)	.95
I do not want to eat fish too often because I am afraid of food poisoning from chemical contamination (heavy metals, dioxins, residues)	.85
I am very concerned about the possibility of getting ill from eating fish	.79
Total fish consumption frequency	1.00 (fixed)

Note: internal construct/composite reliabilities are reported in parentheses; All factor loadings are significant at $p< 0.001$. Fit-statistics for the pooled data: $\chi^2(109) = 977.86$, $p< 0.001$; RMSEA = 0.041; GFI = 0.97; CFI = 0.99.

The individual item loadings on the constructs were all highly significant with values ranging from 0.63 to 0.95 and *t*-values from 36.69 to 78.03. No cross loadings worth mentioning appeared. Hence, all the items were considered in the interpretation of the factors (Hair et al., 2006). Cronbach's alpha internal reliability coefficients ranged from 0.85 to 0.94, thus well above the threshold value for satisfactory scales.

Intercorrelations between the constructs are presented in Table V-2. All correlations were significant but below 0.60. To further assess the discriminant validity of the subset of measures, we adopted the procedure recommended by Hair et al. (2006). All variance-extracted estimates displayed in Table V-1 were greater than the corresponding interconstruct squared correlation estimates in Table V-2. Therefore, this test does not suggest problems with discriminant validity. In sum, the measures of proposed constructs are both reliable and valid, since sufficient convergent and discriminant validity was proven.

Table V-2. Correlations of constructs used in the study

Construct	1	2	3	4	5	6
1. Health involvement	1.00					
2. Interest in healthy eating	0.46	1.00				
3. Subjective health	0.15	0.27	1.00			
4. Satisfaction with life	0.10	0.22	0.58	1.00		
5. Risk perception	-0.05	-0.09	-0.09	-0.07	1.00	
6. Total fish consumption	0.08	0.20	0.10	0.07	-0.12	1.00

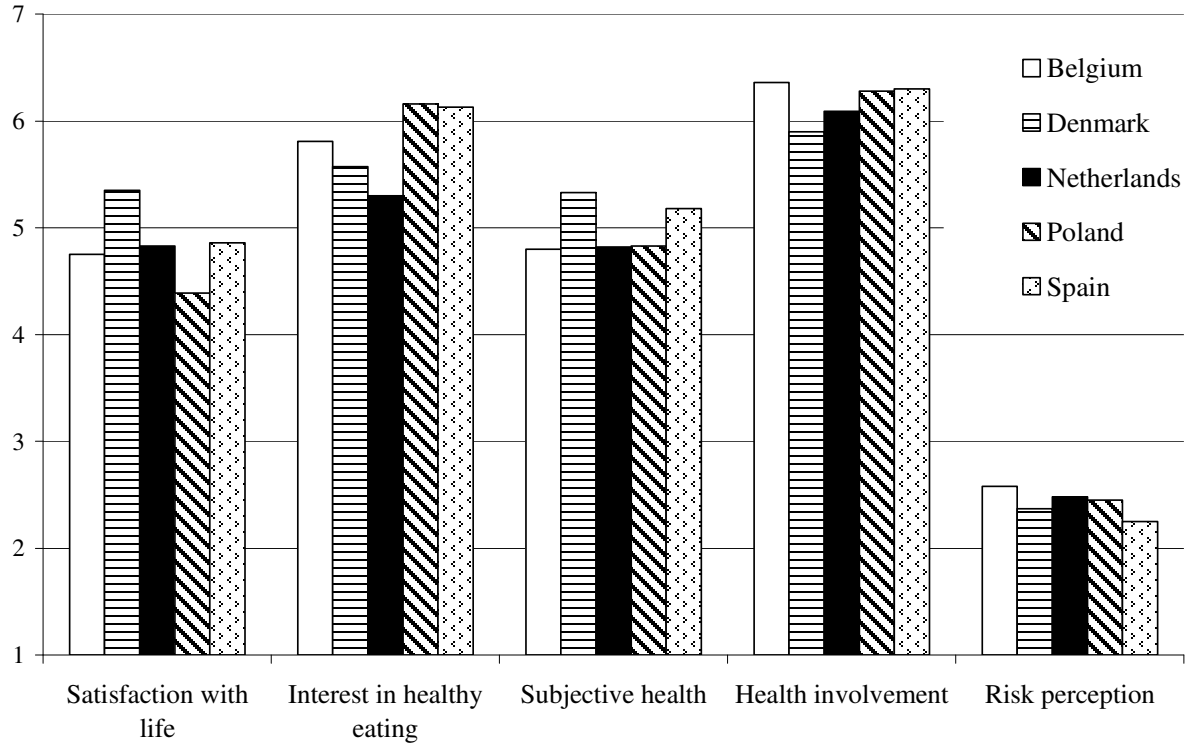
4.3 Cross-cultural differences

The cross-cultural differences can either be real differences related to the cultural background and the social and marketing environment in the different countries, or simply stem from different interpretations and response behaviours to the questions posed. In order to verify that the first explanation holds, i.e. to rule out the latter possibility that would basically indicate that scales have been interpreted differently in

different countries, cross-cultural validity of the data obtained has been tested and confirmed in the previous section. Metric invariance implies that the observed variables are measured according to the same scale units and these observed item differences are indicative of similar cross-national differences in the underlying construct.

In order to test whether there exist cross-cultural differences in health involvement, subjective health, satisfaction with life, risk perception and fish consumption between the countries, ANOVA F-tests were conducted. The tests revealed significant differences for all constructs. Polish respondents were the least satisfied with their life, whereas Danish consumers were the most satisfied with life. People living in the other three countries (Belgium, Netherlands and Spain) scored nearly on the same level, though lower than Denmark. Although in general, the respondents from all countries were interested in healthy eating (mean scores between 5.30 and 6.16), some differences were noticed. Consumers from Poland and Spain attached most interest to healthy eating, whereas consumers from the Netherlands displayed the lowest interest in healthy eating. Danish and Spanish consumers considered themselves healthier as compared to people from Belgium, the Netherlands and Poland.

In general, consumers from all countries did not consider their health and well-being as really excellent (mean scores between 4.80 and 5.33 on 7-points scale). Nevertheless, respondents from all countries reported high personal relevance attached to health (mean scores between 5.90 and 6.36). Consumers from Poland, Spain and Belgium were the most involved with health, whereas Danish consumers showed the lowest involvement with health. With regard to the risk perception construct related to fish, Danish and Spanish consumers scored the lowest, whereas Belgian and Dutch respondents scored the highest, meaning that the latter perceive fish as more risky to consume compared with the other respondents (Figure V-1).



FigureV-1. Cross-cultural comparison of health beliefs, health involvement, and risk perception in relation to fish consumption

4.4 Model determination

As already described above, in recent years lots of research has been done in the field of health beliefs and risk perception in relation to food consumption behaviour (Diehr & Beresford, 2003; Knox, 2000; Yeung & Morris, 2006). Nevertheless, although some paths and possible relationships between the considered constructs have been previously confirmed, a number of relationships have never been investigated before, specifically: (1) the relationships with fish consumption frequency; (2) the sequence of the variables in the model; and (3) the direction of relationships between the different variables; in this case between subjective health and satisfaction with life; and between health involvement and interest in healthy eating, when entered into one model together. Therefore, the use of the data-driven analysis procedure Tetrad is justified, since the Tetrad procedure

provides an idea of the best possible model fitting the data, which is then further validated through structural equation modelling using LISREL.

Tetrad is an analysis tool introduced by a team of researchers at Carnegie Mellon University[5] led by Spirtes, Glymour and Scheines (2000). Tetrad facilitates the development of new theories through the systematic development of causal relationships in datasets (Lee et al., 1997). More specifically, Tetrad tests sets of constraints on input data which, if they hold, allow the drawing of causal relationships. The algorithm performs an exhaustive set of Bonferroni-corrected tests of all possible univariate and multivariate mediation patterns in the data. The output is an equivalence class of models, also referred to as a "pattern". Recently, several researchers have applied the Tetrad tool in their studies (Bessler, 2003; Bessler & Lopper, 2001; Eshghi et al., 2007; Haigh et al., 2004).

To help the initial model development, the covariance matrix of the six constructs (satisfaction with life, subjective health, health involvement, interest in healthy eating, risk perception and total fish consumption) was inputted. Tetrad allows the user to specify which directional links are forbidden and which are known. In our specific case, we opted for not imposing any particular restriction. Based on the aforementioned literature review, only one straightforward "previous knowledge" issue has been defined, namely the link between subjective health and satisfaction with life. The results confirmed the majority of the paths identified through the literature review. Only the direct relationship between health involvement and total fish consumption has not been suggested. The resulting model, to be further validated by means of structural equation modelling (LISREL) is presented in Figure V-2.

[5] See also the Tetrad homepage at http://www.phil.cmu.edu/projects/tetrad/index.html.

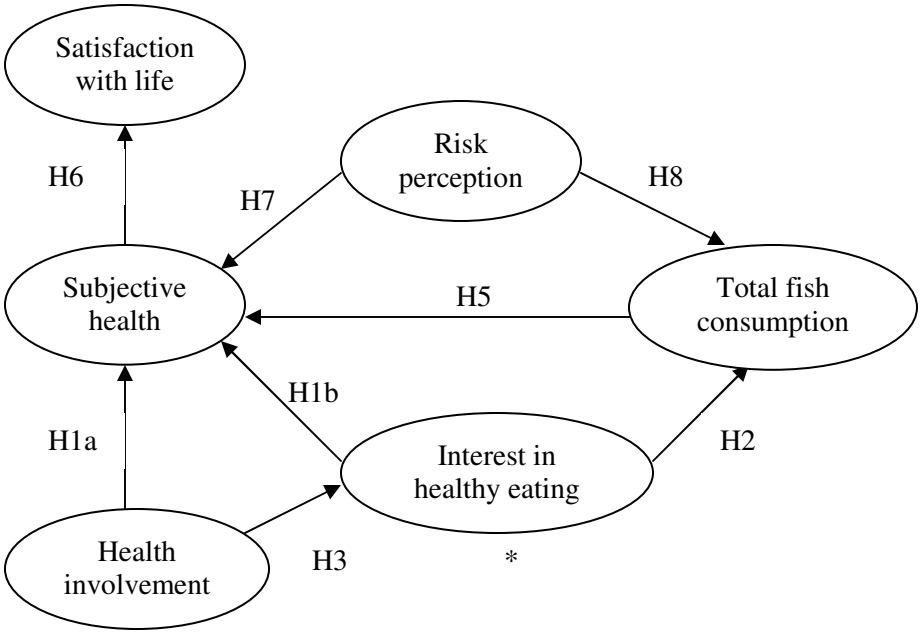


Figure V-2. Conceptual model relating health beliefs, health involvement and risk perception to fish consumption

* H4 direct relationship between health involvement and total fish consumption has not been found by Tetrad and is not included in the figure

4.5 Model validation

The hypothesised structural model was estimated by means of robust maximum likelihood. In general, the model performed well. The χ^2 for the model was 1861.32 with 162 degrees of freedom ($p<0.001$). However, due to the large sample size the χ^2 is not an appropriate measure of goodness-of-fit (Browne & Cudeck, 1993). Therefore, three other indices are reported: the Root Mean Square Error of Approximation (RMSEA) value was 0.066, which is below the recommended level of 0.08 (Browne & Cudeck, 1993); the Goodness of Fit Index (GFI) was 0.91 and the Comparative Fit Index (CFI) was 0.96, which both exceed the recommended level of 0.90 (Bollen, 1989). Also the other goodness-of-fit indices were satisfactory. Hence, it may be concluded that the model presented in Figure 2 fits the data well.

Standardised estimates of the paths are presented in Table V-3. Health involvement failed to have a significant effect on subjective health, indicating that the extent to which a person attaches importance to her/his personal health is not directly associated with the subjective evaluation of her/his personal health. On the other hand, the relationship between interest in healthy eating and subjective health is confirmed. Hence, it is not really *interest in health* in general, but rather the more concrete *interest in healthy eating* in particular that provides people with the subjective belief or feeling of being healthy.

Second, the results of the structural equation analysis supported that interest in healthy eating has a direct positive effect on total fish consumption, and additionally, that health involvement has a significant and relatively highly sized direct effect on interest in healthy eating. Since the relationship between health involvement and fish consumption has already been rejected in the exploratory Tetrad stage; interest in healthy eating can be upheld as a full mediator between health involvement and total fish consumption.

Third, the results also show that total fish consumption failed to significantly associate with subjective health, which indicates that people do not feel healthier or unhealthier because of eating fish frequently or infrequently.

Fourth, the relationship between subjective health and satisfaction with life is confirmed. People who feel healthier will actually be more satisfied with their life as well. This is the strongest association that has been found within our model (r=0.59).

Finally, the results of the structural model analysis also confirmed the important role of risk perception. Subjective health is found to be negatively affected by risk perception, meaning that people who perceive higher risk of food poisoning from eating fish felt themselves as less healthy. Additionally, risk perception of food poisoning from eating fish had a direct negative effect on total fish consumption. Although significant, this effect was rather weak.

Table V-3. Standardised solutions for hypothesised relationships in the conceptual model (n=2,393)

	Construct	Path	Construct	Standardised solution	t-value	p-value
H1a	Health involvement	→	Subjective health	.01	0.50	*ns*
H1b	Interest in healthy eating	→	Subjective health	.26	9.79	<0.001
H2a	Interest in healthy eating	→	Total fish consumption	.14	6.34	<0.001
H3	Health involvement	→	Interest in healthy eating	.46	13.32	<0.001
H5	Total fish consumption	→	Subjective health	.02	1.16	*ns*
H6	Subjective health	→	Satisfaction with life	.59	21.63	<0.001
H7	Risk perception	→	Subjective health	-.06	2.74	<0.001
H8	Risk perception	→	Total fish consumption	-.12	5.88	<0.001

ns = not significant. Goodness of Fit Statistics for the pooled data: $\chi^2(162) = 1861.32$, $p < 0.001$; RMSEA = 0.066; GFI = 0.91; CFI = 0.96.

5 Discussion

The objective of this study was twofold: first, to explore cross-cultural differences in health beliefs, health involvement and risk perception in relation to fish consumption. Second, to develop and validate a model in order to test the relationships between health involvement, interest in healthy eating, subjective health, satisfaction with life, risk perception, and fish consumption based on data obtained from consumers in five European countries.

The results indicate that the considered constructs, i.e. health involvement, interest in healthy eating, subjective health, satisfaction with life and risk perception, have a similar meaning and structural characteristics across cultures within Europe. Those constructs are proven to be cross-culturally valid. This means that observed differences are real differences, in the sense that they do not stem from cross-cultural differences in the interpretation of concepts.

Furthermore, our findings indicate that in general consumers are very involved with their health and very interested in healthy eating. However, significant differences in the health beliefs exist between countries. Danish respondents evaluated themselves as the healthiest and the most satisfied with their life; Polish respondents were the most

interested in healthy eating, whereas Belgian respondents were the most involved in health. Our results confirm findings from the pan-European Eurobarometer survey (Eurobarometer, 2007) where Danes were found to be the happiest and the most satisfied with their life. Although consumers in general perceive rather low risk of food poisoning from eating fish across the countries, Belgian and Dutch consumers perceived fish as slightly more risky to eat as compared to consumers from the other countries. This finding might result from higher and potentially confounding exposure of Benelux consumers to food safety incidents during the last decade (Verbeke & Van Kenhove, 2002; Verbeke & Viaene, 2001; Verbeke et al., 1999b).

To our knowledge, the present study was the first one to establish a cross-culturally valid model on health beliefs, involvement and risk perception constructs in the context of fish consumption. Our model was derived from a large consumer sample using the Tetrad methodology (Spirtes et al., 2000), and refined and validated using structural equation modelling. By using structural equation modelling we were able to estimate the strength and direction of direct and indirect relationships between the different constructs identified to be relevant based on literature review. The strongest relationship was found between subjective health and satisfaction with life, which is consistent with previous empirical findings (Arrindell et al., 1991; Brief et al., 1993); and between health involvement and interest in healthy eating. Although health involvement had no direct relationship with subjective health, health involvement had an indirect relationship through interest in healthy eating on subjective health and further on satisfaction with life. This contributes towards a deeper understanding of factors determining subjective perceptions and feelings of personal health in a food-health context.

Furthermore, the proposed model contributes to a better understanding of factors influencing fish consumption behaviour. Recommendations about healthy eating have been shown to influence consumers' beliefs about food and health as well as their food consumption decisions and eating patterns (Harel et al., 2001; Nayga, 2000). In our study, consumers' interest in healthy eating is shown to positively influence fish consumption behaviour, which confirms previous studies (Gempesaw et al., 1995; Olsen, 2001, 2003), and indicates that consumers perceive fish effectively as a part of healthy eating patterns. On the contrary, risk perception of food poisoning from eating fish negatively influences

fish consumption. Also this relationship has been reported previously, though more specifically in the case of beef (Verbeke et al., 1999a; Verbeke et al., 1999b) and poultry (Yeung & Morris, 2006) rather than for fish.

Interest in healthy eating and risk perception influenced consumers' self-rated health. On the one hand, people who are more interested in healthy eating evaluate themselves as healthier. One possible explanation for this significant link is that people who are involved in healthy eating do indeed follow dietary recommendations and/or adhere to so-called (or so-believed) healthy eating patterns. The positive relationship between following a healthy diet and better self-reported health has already been reported previously (Blaxter, 1990; Diehr & Beresford, 2003; Manderbacka et al., 1999).

On the other hand, consumers who perceived higher risk of food poisoning from eating fish felt themselves less healthy. This finding supports results from previous studies where links between pleasure experiences and good health, and between stress or worry and poor health were suggested (e.g. Netter, 1996). Total fish consumption and health involvement have not been found to be significant determinants of subjective health. A better understanding of factors influencing the way people assess their own health is important to improve public (subjective) health in a global objective of improving quality of life and subjective well being.

6 Conclusions

This paper provides a unique model relating health beliefs, involvement and risk perception to fish consumption, which was tested and validated using a large pan-European sample of consumers. Our findings indicate that European consumers are very interested in health and healthy eating. Health involvement is found to be an indirect driver of both subjective health and fish consumption, whilst interest in healthy eating emerges as a direct driver of fish consumption behaviour. Hence, reinforcing or confirming existing health beliefs might be important in the development of effective strategies for stimulating fish consumption. Furthermore, people do not perceive high risk of food poisoning from eating fish. Nevertheless, risk perception is significantly and negatively influencing fish consumption. This study exemplifies the need for more

effective communication about healthy eating and fish consumption as a part of healthy eating pattern to the broader public. Additionally, the findings provide cross-culturally validated measures of health beliefs (subjective health, satisfaction with life), involvement (health involvement and interest in healthy eating) and risk perception.

Further research to explore consumers' actual eating patterns in order to see whether people who are very interested in healthy eating actually follow the advocated healthy eating patterns is recommended. A limitation of our study is that it does not account for differences in knowledge between consumers. Moorman and Matulich (1993) indicated that health knowledge together with health motivation can lead to a raise in healthy behaviour. Furthermore, our study focused on fish as a product category, without differentiating between different fish species or fish from different origins (e.g. geographic, or wild versus farmed). Future research using similar survey questionnaires could focus on a more specific product level. Additionally, future research could focus particularly on chemical contaminants on the risk side, such as methyl mercury, polychlorinated biphenyls (PCBs) or dioxins, to see whether perceptions relating to specific chemical components have a similar impact on fish consumption as risk perception in general. Moreover, the model developed in this study is only one example for modelling complicated relationships between potential determinants of fish consumption and choice behaviour. In the future research additional variables, such as knowledge, convenience or more general attitudes, could be included and validated in more complex models. Finally, test for various degrees of invariance or equality in the model between the countries, using multiple group comparisons analysis, is encouraged. The role of explanatory variables in fish consumption behaviour could be compared between the five countries.

Chapter VI

Affective and cognitive determinants (health-related beliefs and knowledge about fish) of fish consumption

Abstract

The purpose of this study was to investigate the impact of affective and cognitive determinants on fish consumption behaviour in five European countries. Cross-sectional data were collected through the pan-European consumer survey (n=4,786). First, the cross-cultural validity and cross-cultural differences in health-related beliefs (a belief that eating fish is healthy, health involvement and interest in healthy eating) and (subjective and objective) knowledge about fish have been tested. Next, structural equation modelling (LISREL) was used in order to simultaneously estimate the strength and direction of hypothesised relationships between the belief that eating fish is healthy, health involvement, interest in healthy eating and knowledge about fish in relation to fish consumption and two socio-demographic variables: age and education. The belief that eating fish is healthy links up directly (and positively) with total fish consumption and interest in healthy eating. Increased interest in healthy eating positively influences fish consumption frequency. Increased subjective and objective knowledge had a positive effect on total fish consumption. Practical implications, limitations of this study and recommendations for future research will be provided.

This chapter is in preparation to be submitted to *Public Health Nutrition*

1 Introduction

In the last decade alarming data and research findings about European and North American consumers' health status have been published (see e.g. http://ec.europa.eu/health), mainly due to a lack of physical activities and poor diets. Although a general improvement of public health had been observed since 1990, the last years have been characterised by a slowdown, or even stagnation. Consequently, at the beginning of 2005 the EU Platform for Action "Diet, Physical Activity and Health" was launched aiming on communication about healthy dietary behaviour. Furthermore, recently a trend towards a healthier lifestyle may be observed.

Seafood has been shown to have positive effects on human health (Fernandez et al., 1999; Mozaffarian & Rimm, 2006; Schmidt et al., 2000). A diet including fish at least twice a week might be preventive against many chronic diseases, e.g. cancers, diabetes, cardiovascular diseases (Mozaffarian & Rimm, 2006; Sioen, 2007; Smith & Sahyoun, 2005). Public health authorities, the fish industry and seafood marketers have an interest in promoting fish consumption, either for public health or commercial reasons. Fish is a food product with a predominantly healthy image and attitudes toward eating fish have been shown to be strongly favourable among consumers (Olsen, 2003; Trondsen et al., 2004b). Nevertheless, fish consumption still remains below the recommended intake levels in the majority of European countries (Welch et al., 2002). Recently, several studies focused on psychological determinants of fish consumption such as attitudes, beliefs, interests, involvement, social norms and other constructs influencing food choice in general (Shepherd & Raats, 1996; Shepherd & Sparks, 1994; Verbeke & Pieniak, 2006) and fish consumption behaviour in particular (Juhl & Poulsen, 2000; Olsen, 2003; Scholderer & Grunert, 2001; Verbeke & Vackier, 2005). Relatively little attention has been paid to understand the complementary relationship between the consumption of seafood and other healthy food on one hand, and consumers' health and beliefs about healthy food on the other hand (Trondsen et al., 2004b).

In this paper, we will build further on the model developed in *Chapter V*, explicitly focusing on health-related beliefs influencing fish consumption. The issues relating to information, as covered within this particular study, are also within the scope of the thesis. Therefore, we have additionally extended the model presented in the previous

chapter, section 4.4, with two variables: subjective and objective knowledge. In this paper, objective (nutritional) knowledge will be an attribute-related knowledge (Wansink et al., 2005). The primary objective of this study is to test for cross-cultural differences and construct validity of subjective and objective knowledge about fish, as well as health involvement and interest in healthy eating, belief that eating fish is healthy and total fish consumption in five European countries: Belgium, Denmark, the Netherlands, Poland and Spain. Noteworthy, the construct *interest in healthy eating* used in this study (see also section 3.2 in this chapter) is considered as a proxy/alternative to (food/healthy eating) involvement. It covers aspects of importance attached to healthy eating, which have already been reported to influence seafood consumption (Olsen, 2001, 2003). The second objective is to assess the impact of affective (belief that eating fish is healthy, interest in healthy eating and health involvement) and cognitive (subjective and objective knowledge about fish) determinants on fish consumption behaviour in the considered countries. Based on the results of previous research, we assume that when consumers are (1) aware of and knowledgeable about fish and the fact that fish fits well with healthy eating behaviour (cognitive factor), and moreover, (2) convinced that fish is indeed healthy (affective belief factor), their fish consumption frequency will be on a higher level.

2 Conceptual framework

Olsen (2003) suggested that at least two different streams of research investigating variation in food consumption behaviour may be identified: the econometric tradition, based on socio-economic and demographic variables (Ritson & Hutchins, 1995); and a rather psychology-oriented tradition, concentration on the role of psychological variables, such as beliefs, attitudes, interest, involvement and knowledge (e.g. Shepherd & Raats, 1996; Shepherd & Sparks, 1994). In the conceptual framework for our study, we unite three dimensions of attitudes (Engel et al., 1968; Lavidge & Steiner, 1961), i.e. a cognitive (knowledge about eating fish), an affective (attitude towards fish healthiness, interest and involvement in health and healthy eating) and a conative dimension (fish consumption) with two external demographic variables (age and education). The

demographic variables will be incorporated as antecedents to potential internal mediators (cognitive and affective constructs influencing a particular outcome variable, i.e. fish consumption in this specific case) and total fish consumption (Olsen, 2003).

Attitude is the amount of affect or feeling for or against a stimulus (Mowen, 1993). More specifically, attitude may be defined as a negative or positive evaluation of the consequences of behaviour (such as consumption) that consumers hold. According to Fishbein's summative model of attitudes, attitudes are approached as a sum of the person's beliefs about the object (Fishbein, 1967). In the four decades since this publication, the relationship between attitude and behaviour has been subjected to extensive research in social psychology, marketing and consumer research. Consumers' attitudes toward food and nutrition have been found to be important factors influencing food consumption behaviour (Homer & Kahle, 1988; Raats & Shepherd, 1996), and particularly fish consumption behaviour (Foxall et al., 1998; Olsen, 2003; Trondsen et al., 2004b; Verbeke & Vackier, 2005). Hearty et al. (2007) confirmed that attitudes toward healthy eating behaviour are related to dietary and lifestyle behaviour. Nauman et al. (1995) reported that perception of seafood as a healthy and tasty food significantly influenced consumers' decision to purchase finfish products. Since fish is heavily promoted as a healthy food, we could expect a positive relationship between the belief that eating fish is healthy (as a part of consumers' more general attitude toward fish) and fish consumption behaviour.

Involvement refers to personal relevance and importance attached to specific issues based on inherent needs, values and interests (Zaichkowsky, 1985). Involvement may be seen as a trait, individual state (motivation/interest), process, mediator or moderator (O'Cass, 2000). In the consumer behaviour research literature, the concept of involvement has widely been used and shown to have robust effects on explaining consumers' purchase and eating decisions (Beharrell & Denison, 1995; Marshall & Bell, 2004; Verbeke & Vackier, 2004; Zaichkowsky, 1985), including fish consumption (Juhl & Poulsen, 2000; Olsen, 2001). Public health authorities recommend eating fish twice a week (World Health Organization, 2003) as a part of healthy diet. However, health involvement and interest in healthy eating are not always drivers for purchasing and consuming a particular food with a predominantly healthy image, such as fish. A healthy diet does not

necessarily have to include fish (Foxall et al., 1998), e.g. for the simple reason of disliking or being allergic to fish or seafood (Brunsø et al., 2007). Nevertheless, a positive relationship between (health) involvement (covering also aspects of a healthy diet, therefore also referred to as importance attached to healthy eating) and seafood consumption has been reported (Olsen, 2001; 2003). Furthermore, Verbeke and Vackier (2005) found that food involvement was a significant factor in explaining fish consumption frequency and intention to eat fish. Additionally, product involvement was found to positively influence the frequency of product usage in the case of fish (Foxall et al., 1998) and involvement in healthy eating positively influenced purchase of fish rich in PUFA (Juhl & Poulsen, 2000). Perceived importance and health awareness (relating to dietary quality) have also been found to be dominant factors influencing nutritional behaviour (Sapp & Jensen, 1998). Finally, our results presented in *Chapter V* indicated a direct relationship between interest in healthy eating and total fish consumption (Pieniak et al., 2007b). Since the aim of healthy eating is most likely to maintain health and prevent chronic diseases, such as cardiovascular diseases and cancers, we expect to find a positive relationship between health involvement and interest in healthy eating. Furthermore, we anticipate finding a direct relationship between interest in healthy eating and total fish consumption.

Consumer's product knowledge is an important factor in consumer decision-making (e.g. Alba & Hutchinson, 1987; Brucks, 1985). With respect to consumer knowledge, two constructs are distinguished: objective knowledge, i.e. the accurate information about the product stored in consumer's long-term memory and subjective knowledge, i.e. people's subjective perceptions of what or how much they know about (are familiar with) a product based on their interpretation of what one knows (Park et al., 1994; Selnes & Gronhaug, 1986). A positive relationship between knowledge and behaviour has been found in health-oriented research (Jayanti & Burns, 1998). Petrovici and Ritson (2006) reported that people with higher levels of knowledge about nutrition, among other factors (such as age and education), were more likely to perform dietary health preventive behaviour. Verbeke (2005) stated that consumers must have a sufficient level of knowledge based on reliable information, in order for information to have a favourable impact on consumer's food choice. Knowledge of seafood is suggested to be an important

factor in explaining the choice for seafood (Brunsø, 2003; Gempesaw et al., 1995). Therefore, the expectation is that both subjective as well as objective knowledge about fish are likely to be positively associated with total fish consumption.

Park et al. (1994) observed that the level of correspondence between objective and subjective knowledge is usually not high. An only weak to moderate correspondence between subjective and objective knowledge was found in previous studies (Brucks, 1985; Radecki & Jaccard, 1995). A recent review on consumer knowledge (Alba & Hutchinson, 2000) suggested that consumers were generally overconfident about themselves, thus their overall level of subjective knowledge is greater than the percent answers correct (factual knowledge). Based on past research, it seems likely that only a modest relationship between objective and subjective knowledge will be observed also with regard to knowledge about fish.

Within the attitudinal strength perspective, attitude importance or involvement is defined as an individual's subjective sense of the concern, care, and significance the person attaches to an attitude (Boninger et al., 1995b), whilst attitude relevant knowledge is associated with various subjective attitude strength-related beliefs, such as certainty and subjective knowledge (e.g. Krosnick et al., 1993). This can also be considered as consumers' confidence in the validity of their judgements (Gross et al., 1995). "Not all attitudes are equal" (Fazio, 1986) in terms of their impact on perceptions and behaviour. The likelihood of behavioural outcomes is moderated by a dimension of attitudinal strength, such as confidence, interest or knowledge (Petty & Krosnick, 1995). Hence, we expect that consumers' interest in healthy eating and health involvement will positively influence the belief that eating fish is healthy.

Perceptions and beliefs are shaped by knowledge (Engel et al., 1995; Mcintosh et al., 1994). The role of knowledge in relation to attitude change and dietary behaviour has been discussed in the literature (Biddle et al., 1994; Buttriss, 1997). Knowledge has also been found to be an important predictor of positive beliefs toward health related behaviour, for example breast-feeding (Swanson et al., 2006). Increasing knowledge by the provision of information is more likely to activate existing attitudes already held by consumers (rather than to change these attitudes) (Fazio, 1990). Increases in knowledge

have been associated with greater predictive power of attitudes on behaviour. Fabrigar et al. (2006) provided evidence of a causal impact knowledge has on attitude-behaviour consistency. Hence, we anticipate finding a direct relationship between both subjective knowledge and the belief that eating fish is healthy; as well as between objective knowledge, and the belief that eating fish is healthy.

Consumer demographics, such as age and education are often discussed as relevant determinants of food choice in general and fish consumption in particular. Though, such demographics are more likely to be correlates of actual determinants, such as interest in and knowledge about issues related to nutrition (thus also healthy eating and fish consumption) or health status (Grunert et al., 2007). Previous research has identified age as one important variable in explaining food-related cognition and attitude. Additionally, age has been identified as an important dimension in behaviour towards seafood consumption (Myrland et al., 2000; Olsen, 2003; Trondsen et al., 2004b; Verbeke & Vackier, 2005). Interest in health and nutrition has been shown to increase with age. Aging is arguably associated with higher awareness of health and diet-disease relationships (Senauer et al., 1991). Also, Verbeke et al. (2007b) identified four fish consumer segments, where Connoisseurs were the oldest and the most strongly involved with food in general and most convinced of the association between food and health. As such, it is hypothesised that older consumers will be more health involved; more interested in healthy eating and will consume more fish than younger consumers. Furthermore, more experience and knowledge influence the perception of the relationships between food, health and after-meal feeling (Trondsen et al., 2004b). Therefore, we also anticipate finding a direct relationship between age and both subjective and objective knowledge.

McKay et al. (2006) suggest that educational level, more than any other socioeconomic factor, can predict health-related behaviour patterns and diet quality. Previous studies found that respondents with higher education levels are more likely to use nutrition information from food labels (Drichoutis et al., 2005; Kim et al., 2001). Higher education is more likely to promote more healthful diets since higher educated people access and process better nutrition information (Popkin et al., 2003). Seafood consumption has also been associated directly with education (Myrland et al., 2000; Nauman et al., 1995).

Myrland et al. (2000) found that people with a university education had higher fish consumption rates. Trondsen et al. (2004b) suggested that education might be most important for dietary choice in the cases where emerging knowledge about food and health has to be considered, adopted and implemented into new consumption practice. Therefore, education is expected to be associated with people's objective and subjective knowledge about fish and their general involvement with health.

3 Materials and methods

3.1 Sample and procedure

Data for this study were collected from randomly selected consumers from five European countries through survey questionnaires during November-December 2004. The countries included were Belgium, Denmark, the Netherlands, Poland and Spain. A total sample of 4,786 participants (n=800-1,100 respondents per country) was obtained. Methodological aspects and sample description are provided in *Chapter I*, section 4.2.

3.2 Measures

The master questionnaire was developed in English and then translated (using the back-translation method) into the different languages by professional translation services. The questionnaires have been pre-tested in the national languages in pilot studies.

Belief that eating fish is healthy (as a part of consumers' attitude towards fish healthiness) has been measured by the item "Eating fish is healthy" to be answered on a 7-point Likert scale ranging from "totally disagree" to "totally agree". In this study, we were interested in a very concrete belief (namely that eating fish is healthy), which is only a part of one's overall attitude. Several authors propose the use of single-item measures, if the only purpose is to measure very concrete variables (Rossiter & Eagleson, 1994; Urban & Hauser, 1993), such as the concrete belief that eating fish is healthy.

Subjective knowledge about fish was measured by three items: (1) "My friends consider me as an expert on fish"; (2) "I have a lot of knowledge of how to prepare fish for

dinner"; and (3) "I have a lot of knowledge how to evaluate the quality of fish" to be answered on a 7-point Likert scale ranging from "totally disagree" to "totally agree"; consistent with measures used in previous studies (e.g. Brucks, 1985; Park et al., 1994).

Consumer's level of *objective knowledge* was measured by four statements that are either true or false. We assumed that these four statements are common nutritional knowledge among at least half of the population. Three of the statements were false: "Fish is a source of dietary fibre" (fish does not contain any dietary fibre, although many consumers believe so because of some fish's fibrous texture), and "Cod is a fatty fish" (cod is classified as a lean fish). The two other statements were true: "Fish is a source of omega-3 fatty acids"; and "Salmon is a fatty fish". For the four statements, a "true" / "false" scale was used (Park et al., 1994). We opted for not including a "don't know" answer, which forced respondents to think and make up their mind about the proposed statements.

Interest in healthy eating was measured by five items adapted from the Food Choice Questionnaire (Steptoe et al., 1995). Only the most appropriate, useful and relevant items related to fish were included based on the findings from exploratory focus group discussions (Brunsø et al., 2007; Pieniak et al., 2007c) (see also *Chapter V*, section 3.2).

Health involvement consisted of three items based on the involvement scale developed by Zaichkowsky (1985), which also corroborates the food involvement scale suggested by Bell and Marshall (2003) (see also *Chapter V*, section 3.2).

Total fish consumption was based on self-reported items, which were measured as the sum of fish consumed at home and fish consumed out of home. A 9-point frequency scale ranging from "never" to "daily or almost every day" was used. This response scale was recoded into frequencies per week (e.g. "never" became 0; "once a week" became 1; and "daily or almost daily" became 6.5 and so on) and aggregated in order to compute one behavioural variable, namely total fish consumption frequency (per week).

3.3 Data analysis

First, data were analysed using the statistical software SPSS version 12.0. Missing data were imputed by means of the EM (expectation-maximization) algorithm. Due to the

cross-cultural nature of the study and in line with the first objective of our study, the measurement invariance of the constructs had to be examined. Multi-group confirmatory factor analyses were conducted, using the robust maximum likelihood estimator in LISREL 8.72. Next, a maximum likelihood confirmatory factor analysis on the pooled sample (exploring discriminant and convergent validity), was performed also by using the robust maximum likelihood procedure in LISREL 8.72.

The mean scores of the resulting constructs were calculated and ANOVA F-tests with Duncan post hoc comparison of mean scores across the countries were used to detect differences in the belief that eating fish is healthy, interest in healthy eating, knowledge about fish and fish consumption frequency. The model parameters have been estimated and the general fit of the model has been assessed by means of LISREL 8.72. With the use of Structural Equation Modelling, the examination of all relationships between constructs and items is performed simultaneously, which is a substantial advantage compared with single equation modelling (Bollen, 1989).

4 Results

4.1 Measurement invariance

In order to establish whether direct comparison of means from multi-item scales (knowledge about fish and interest in healthy eating) across the five countries were meaningful, the measurement invariance of the observed variables was assessed (Steenkamp & Baumgartner, 1998) (see also *Chapter III*, section 2.2).

Separate multi-group confirmatory factor analysis models were estimated for the two latent constructs included in the conceptual framework, namely knowledge about fish (3 items, 1 factor) and interest in healthy eating (3 items, 1 factor). The model parameters were estimated by means of robust maximum likelihood (Satorra and Bentler, 1988) using LISREL 8.72. The goodness-of-fit statistics indicated that the scalar invariance assumption was acceptable for the interest in healthy eating items (Satorra-Bentler χ^2 = 107.50, df = 16, RMSEA = 0.077, GFI=0.98, CFI=0.99) and the health involvement items (Satorra-Bentler χ^2 = 79.34, df = 16, RMSEA = 0.064, GFI=0.99, CFI=0.99). Hence, common interval scales can be assumed to exist for these items, and direct

comparisons of means across countries are meaningful. Unfortunately, the goodness-of-fit statistics indicated that scalar invariance was unacceptable for knowledge about fish. However, metric invariance could be accepted for the subjective knowledge items (Satorra-Bentler χ^2 = 32.22, df = 8, RMSEA = 0.06) and the objective knowledge items (Satorra-Bentler χ^2 = 204.03, df = 41, RMSEA = 0.06). Taken together, it can be concluded that the responses vary in terms of the same scale units, but that the items measuring the subjective and objective knowledge were additively biased across countries (see Scholderer *et al*., 2005). The bias was eliminated by standardising the subjective and objective knowledge items within countries before further analysis.

4.2 Confirmatory factor analysis and construct validity

Confirmatory factor analysis has been performed to determine whether measures of a construct actually converge the intended latent variable or share a high proportion of variance in common (convergent validity) and whether the constructs are distinct from each other (discriminant validity).

As a general rule, Malthora (1996) recommends the use of multi-item scales, whenever feasible, since they provide a more accurate measurement than a single-item scale. Therefore, we account that both behavioural and attitudinal one-item measures used in the analysis, are not totally free of measurement error through introducing some error variance (20%) in both of these one-item measures during estimation. This approach is in line with previous research and advices reported by Jöreskog and Sörbom (1993; 1999).

In order to assess convergent validity the rules of thumb suggested by Hair et al. (2006) have been followed. Standardised factor loadings, reliability estimates and the variance extracted are presented in Table VI-1.

The individual item loadings on the constructs were all highly significant with values ranging from 0.72 to 0.93 and *t*-values from 40.77 to 342.17. No cross loadings worth mentioning were detected. Hence, all the items were considered in the interpretation of the factors. Additionally, Cronbach's alpha internal reliability coefficients were 0.87, 0.91 and 0.94, thus well above the threshold value of 0.7 for satisfactory scales. Finally, in our study, the variance extracted measures were equal to or exceeded the 0.5 threshold

(Table VI-1) (Fornell & Larcker, 1981). Our results satisfy the three criteria for convergent validity for the internal constructs (Bagozzi et al., 1991; Hair et al., 2006).

Table VI-1. Factor loadings, reliability estimates and variance extracted for construct measures

Constructs and items	Standardised factor loading	Composite reliability	Variance extracted
Belief that eating fish is healthy			0.50
Eating fish is healthy	1.00 (fixed)		
Subjective knowledge		0.87	0.68
My friends consider me as an expert on fish	0.88		
I have a lot of knowledge of how to prepare fish for dinner	0.88		
I have a lot of knowledge how to evaluate the quality of fish	0.72		
Objective knowledge			0.50
Sum score based on four nutritional questions	1.00 (fixed)		
Interest in healthy eating		0.91	0.78
It is important to me that the food I eat on a typical day is good for my physical and mental health	0.92		
It is important to me that the food I eat on a typical day keeps me healthy	0.88		
It is important to me that the food I eat on a typical day is nutritious	0.85		
Health involvement		0.94	0.83
Health means a lot to me	0.90		
I care a lot about health	0.91		
Health is very important to me	0.93		
Total fish consumption			0.50
How often do you eat fish at home and out of home	1.00 (fixed)		

All factor loadings are significant at $p < 0.001$. Fit-statistics for the pooled data: $\chi^2(54) = 197.81$, $p < 0.001$; RMSEA = 0.024; GFI = 0.993; CFI = 0.996.

Intercorrelations between the constructs are presented in Table VI-2. All correlations were significant but below 0.30. To further assess the discriminant validity of the subset of measures, we adopted the procedure recommended by Hair et al. (2006). All variance-extracted estimates displayed in Table VI-1 were greater than the corresponding interconstruct squared correlation estimates in Table VI-2. Therefore, this test does not suggest problems with discriminant validity. In sum, the measures of the proposed constructs are both reliable and valid, since sufficient convergent and discriminant validity was proven.

Table VI-2. Correlations of constructs used in the study/ Correlation matrix of independent variables

Construct	1	2	3	4	5	6	7	8
1. Belief that eating fish is healthy	1.00							
2. Subjective knowledge	0.16	1.00						
3. Objective knowledge	0.05	0.11	1.00					
4. Interest in healthy eating	0.29	0.25	0.03	1.00				
5. Health involvement	0.28	0.14	0.02	0.45	1.00			
6. Total fish consumption	0.11	0.30	0.05	0.18	0.08	1.00		
7. Age	0.01	0.03	0.02	0.01	0.04	0.01	1.00	
8. Education	0.03	0.03	0.13	0.02	0.01	0.05	0.06	1.00

4.3 Cross-cultural differences

ANOVA with post-hoc multiple comparisons (Tukey HSD tests) were conducted between the five countries with mean scores of the constructs as dependent variables. The results were already reported in previous chapters: belief that eating fish is healthy in *Chapter III*, section 3.2.2; subjective knowledge in *Chapter IV*, section 3.3.2; interest in healthy eating and health involvement in *Chapter V*, section 3.2.1 and total fish consumption in *Chapter IV*, section 3.2.1. With regard to consumers' objective knowledge about fish, in this paper we have focused particularly on objective (nutritional) knowledge. Significant differences in their factual knowledge have been found ($F=144.0$; $p<0.001$; partial eta-squared $=0.108$). Danes reported the highest (mean=3.11 on a 4-point scale), followed by Spaniards (mean=2.58) and Belgians

(mean=2.42). Polish and Dutch respondents displayed the lowest objective knowledge (mean=2.18 and 2.19, respectively).

4.4 Structural analysis (model validation)

The hypothesised structural model for associating health-related beliefs, knowledge, demographics (age and education) with fish consumption, was estimated by means of robust maximum likelihood. In general, the model performed well. The χ^2 for the model was 352.48 with 51 degrees of freedom ($p<0.001$). However, due to the large sample size the χ^2 is not an appropriate measure of goodness-of-fit (Browne & Cudeck, 1993). Therefore, three other indices are reported: the Root Mean Square Error of Approximation (RMSEA) value was 0.035, which is below the recommended level of 0.08 (Browne & Cudeck, 1993); the Goodness of Fit Index (GFI) was 0.99 and the Comparative Fit Index (CFI) was 0.99, which exceed the recommended level of 0.90 (Bollen, 1989). Also the other goodness-of-fit indices were satisfactory. Hence, it may be concluded that the hypothesised theoretical model fitted the data well. The path diagram, including the significant paths and the standardised estimates, is displayed in Figure VI-1.

The belief that eating fish is healthy had a significant but very weak direct effect on total fish consumption frequency. Hence, the analysis has confirmed our expectation although the strength of association is not up to the size one might have expected. This result is relevant as it suggests that a very positive belief (which holds true for the majority of fish consumers) that eating fish is healthy alone, is probably not sufficient to convince and encourage people to eat fish more frequently. Furthermore, the belief that eating fish is healthy is already very positive, thus leaving only limited room for further improvement.

Second, the results of the structural equation analysis supported that health involvement has a significant and relatively highly sized direct effect on interest in healthy eating. This is the strongest association that has been found within our model (r=0.45). Additionally, interest in healthy eating had a direct positive effect on total fish consumption. Since a direct relationship between health involvement and fish consumption has already been rejected in the analysis performed in *Chapter V*; interest in

healthy eating can be upheld as a full mediator between health involvement and total fish consumption.

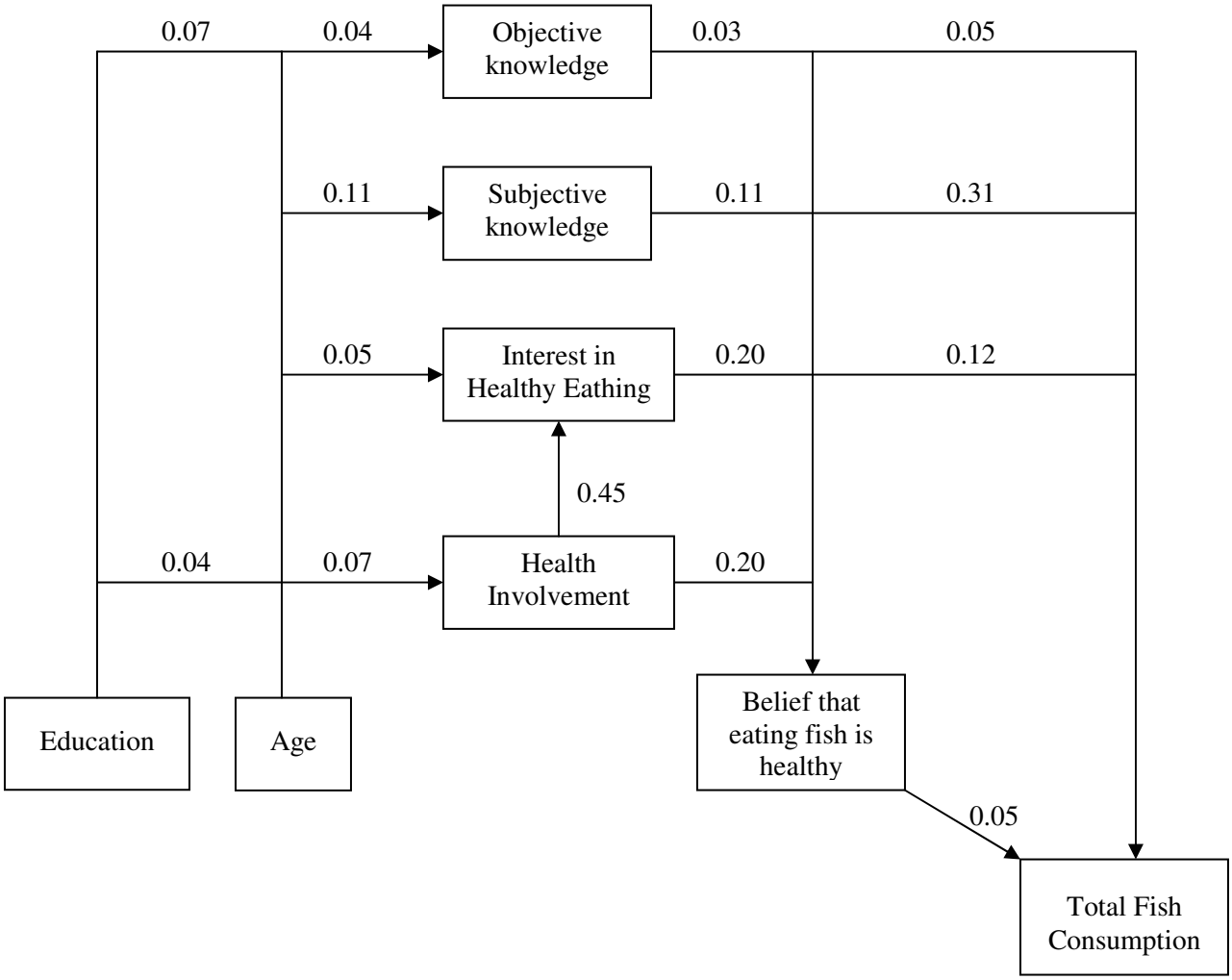


Figure VI-1. Structural model (standardised solution).

All paths are significant at $p<0.001$. Goodness-of-Fit statistics for the pooled data: $\chi^2(51) = 352.48$, $p< 0.001$; RMSEA = 0.035; GFI = 0.99; CFI = 0.99.

Third, subjective knowledge had a significant positive and moderate direct effect on total fish consumption, whilst objective knowledge had a positive but very weak association with fish consumption. Objective knowledge failed to have a significant effect on subjective knowledge, indicating that the accurate (nutritional) information about fish is not directly associated with the subjective (or self-) evaluation of one's knowledge about

fish. The findings herewith confirm previous findings that subjective knowledge is likely to be a better predictor of behaviour than objective knowledge.

Fourth, health involvement and interest in healthy eating had significant positive and moderate direct effects on the belief that eating fish is healthy. Hence, it is both interest in health in general, and the more concrete interest in healthy eating in particular, that provides people with a stronger belief that eating fish is healthy. Furthermore, the hypothesised effect of objective and subjective knowledge on the belief that eating fish is healthy was confirmed. People who evaluated themselves as having better knowledge about fish and those who actually were more knowledgeable about nutritional aspects of fish consumption held a stronger belief that eating fish is healthy. This indicates that the association of fish with health is a part of consumers' cognitive representations related to fish.

Confirming our expectations age was significantly associated with interest in health in general, and healthy eating in particular. Hence, elderly people were found to be more involved in health and more interested in healthy eating, as compared to younger people. Furthermore, a positive relationship between age and both constructs of knowledge was found, indicating that older respondents had a higher factual knowledge about fish and also perceived themselves as more knowledgeable about fish than younger respondents. However, the association between age and subjective knowledge is stronger than between age and objective knowledge. Interestingly, no direct path between age and total fish consumption was confirmed in the model. Hence, our study indicates that interest in healthy eating, subjective and objective knowledge act as mediators between age and fish consumption.

Finally, the results of the structural model analysis also confirmed an important role of education. Objective knowledge and health involvement were found to be positively affected by education level, meaning that higher educated people are more involved with health issues and more knowledgeable about fish. Although significant, these effects were rather weak. The relationship between education and subjective knowledge has been rejected, indicating that people with a higher level of education do not perceive themselves as more knowledgeable about fish, than people with lower education level.

5 Discussion and conclusions

The first objective of the present study was to investigate the cross-cultural differences in (1) the concrete belief that eating fish is healthy, (2) subjective and objective (nutritional) knowledge about eating fish, (3) health involvement and interest in healthy eating, and (4) total fish consumption in five European countries: Belgium, Denmark, the Netherlands, Poland and Spain. The results indicated that both constructs of knowledge about eating fish, health involvement and interest in healthy eating are cross-culturally valid constructs, meaning that they have a similar meaning and similar structural characteristics across the European cultures considered in this study. Furthermore, the proposed constructs showed a high reliability and a satisfactory convergent and discriminant validity.

Our findings indicate that significant differences exist in the belief that eating fish is healthy, subjective and objective knowledge about fish, health involvement and interest in healthy eating, and total fish consumption between the five EU countries. In general, respondents held a very positive attitude toward fish healthiness. This healthy image of fish is consistent with previous studies based on several other consumer samples (Leek et al., 2000; Olsen, 2003; Trondsen et al., 2004b; Verbeke et al., 2005). Spaniards evaluated themselves as most knowledgeable about fish, displayed a high interest in health and healthy eating, and consumed fish most frequently. Poles reported high subjective knowledge, health involvement and interest in healthy eating but very low factual nutritional knowledge and a moderate frequency of fish consumption. Dutchmen showed the lowest level of both subjective and objective knowledge, interest in healthy eating and low fish consumption frequency. Belgians reported a low level of both objective and subjective knowledge, moderate interest in healthy eating and rather low frequency of fish consumption. Finally, despite the highest factual knowledge, Danes displayed moderate subjective knowledge about fish, relatively low interest in healthy eating and a moderate frequency of fish consumption.

In order to explore whether and to what extent affective and cognitive determinants as well as socio-demographic variables have an impact on fish consumption behaviour, a conceptual model has been developed and tested. The proposed model contributes to a better understanding of factors influencing fish consumption behaviour. First, our results support a positive relationship between attitude and behaviour in the context of health-and-diet-related issues (Hearty et al., 2007; Petrovici & Ritson, 2006; Trondsen et al., 2004b). Earlier studies have shown a good agreement between attitude toward healthy eating and dietary (and lifestyle) behaviour (Hearty et al., 2007; Kearney et al., 2001). Furthermore, belief that diet can prevent disease had a positive influence on dietary health preventive behaviours (Petrovici & Ritson, 2006).

However, the association that we have found between the belief that eating fish is healthy and fish consumption is weaker than we might have expected. For example, Olsen (2001, 2003) reported much stronger relationships between attitude toward eating fish and fish consumption behaviour. However, in those studies, attitude was specified as a more general predisposition of people toward particular behaviour, while we concentrated specifically on only one particular component of attitude, namely the belief that eating fish is healthy. Our result is very important as it suggests that a very positive belief, which holds true for the majority of respondents, that eating fish is healthy, is actually not sufficient to convince/encourage people to eat fish. Improving this belief is superfluous, since it is already very strong and leaves little room to be further improved.

Nevertheless, this study highlights the importance of considering consumers' general interest in healthy eating as a target variable, e.g. in communication aiming at improving fish consumption and aligning it with public health recommendations. Consumers' interest in healthy eating is shown to positively influence fish consumption behaviour, which confirms previous studies (Gempesaw et al., 1995; Olsen, 2001, 2003; Verbeke & Vackier, 2005). Additionally, by being positively related to fish consumption frequency, interest in issues related to diet and health confirms the role of fish in the healthy eating pattern. Therefore, with our results, fish is proven to be considered or perceived as a part of the healthy eating diet.

Subjective knowledge is found to be more strongly associated with behaviour than actual (objective) knowledge, which supports previous studies investigating food consumption behaviour in general (Radecki & Jaccard, 1995; Raju et al., 1995) and fish consumption behaviour in particular (Rortveit & Olsen, 2007). The findings suggest that subjective knowledge is the most important predictor of total fish consumption; whilst the prediction ability (power) of the objective knowledge is rather weak. This weak correlation between objective knowledge and total fish consumption found in our study might be a result of measuring only food-specific attribute knowledge. Food-attributes knowledge, on which much of nutrition education has been focused, deals with only one part of the knowledge hierarchy (Wansink et al., 2005). In addition to food-attributes knowledge (nutrients' content in fish), we believe that fish consumption is more likely to occur when people link their knowledge of fish nutrients to the benefits of consuming it.

The present study indicates a rather complex pattern of age and education effects on fish consumption decision-making. The estimations provide empirical evidence that the relationship between socio-demographic characteristics such as age and/or education is mediated by attitudinal and motivational variables or attitudinal strength dimensions, as proposed by Ajzen and Fishbein (1980) and Olsen (2003). Although our findings do not support the direct relationship between age and fish consumption reported in previous studies (Myrland et al., 2000; Olsen, 2003; Trondsen et al., 2004b; Verbeke & Vackier, 2005), age is found to be significantly contributing to increased interest in health and healthy eating, indicating that elderly people are more involved in healthy eating which corroborate with previous studies (Kearney et al., 1998; Olsen, 2003; Roininen et al., 1999). Thus, fish consumption frequency seems not to increase "naturally" or "automatically" with biological ageing, though with changing health-related beliefs and interests that come along with ageing.

Furthermore, older respondents perceive themselves as more knowledgeable about fish and have higher factual nutritional knowledge about fish. Older and higher educated people have yet been reported to have a higher use of nutrition labels (Satia et al., 2005), which may explain increased objective knowledge as discovered in our study.

Our results indicate that the role of people's life course (and age) should be considered when modelling food choice in general (Furst et al., 1996) and fish choice in particular (Olsen, 2003). People change their attitudes (within the attitudinal strength perspective, knowledge, interest and involvement) during their life course, and consequently eating habits. Implications clearly extend beyond fish consumption alone. Notably, the associations between ageing and health-related beliefs suggest that increased demand for healthy food, including fish, can be expected owing to population ageing processes, at least in the short and medium term.

On the other hand, age differences in health involvement and knowledge might be a consequence of shared experiences, attitudes and preferences of the different cohorts of the age classes (Rentz & Reynolds, 1981). People's attitudes toward food may form according to the impact of their particular historical era, the cultural and social settings to which they are exposed throughout their lives, and the timing and trajectories of their individual experiences of past and current events (Devine & Olson, 1991; Furst et al., 1996). Characteristics of a given age cohort may affect their relationship to food (Rentz et al., 1983). If so called age-period-cohort interpretation is correct, younger consumers might not easily change their attitudes (thus also involvement and interest) over their life course. Hence, lower demand for healthy food, including fish, would be expected, as the younger generation will grow older, thus in the longer term. Future research analysing changing health-related attitudes and beliefs, as well as food (and fish) consumption patterns with cohort analysis is recommended.

Furthermore, a positive relationship between consumer's education level and health involvement was proved in the model. Previous studies (Drichoutis et al., 2005; Kim et al., 2001) found a positive relationship between education level and the use of nutrition information from food labels. Additionally, higher education was more likely to promote more healthful diets since higher educated people might have access to better nutrition information (Popkin et al., 2003). Our results suggest an indirect effect of education on fish consumption through the objective knowledge, which is line with Trondsen's (2004b) observation that more experience and knowledge about seafood influence the perception of the relationships between food and health.

The results of our study advocate that communicating to people that eating fish is healthy most likely will be insufficient. One implication is that health information that strengthens the beliefs that fish consumption is important for health (because of the nutrient content and prevention against chronic diseases, such as cancers, diabetes, cardiovascular diseases), although probably rather difficult to understand for the majority of consumers, still might lead to an increase in fish consumption frequency. Improving people's subjective knowledge is more likely to cause an increase in fish consumption as compared to the strategies aiming at increasing consumers' objective knowledge (Pieniak et al., 2006). Producers, but also health authorities are recommended to inform people about the beneficial aspects of eating fish for human health; this information should be more detailed than just stressing once more that eating fish is healthy. Instead, such an information message could also try to explain why fish is healthy and what fish can contribute in terms of benefits to consumers' health. Additionally, it should aim at improving consumers' self-confidence in evaluating fish quality because it appears to be important what people believe to know rather than what they actually know.

One limitation of our study is that it explicitly focuses on the attribute-related objective knowledge (Wansink et al., 2005). Nevertheless, knowledge about the benefits of fish consumption may also explain some variance. Further research to explore the impact of consumers' actual knowledge on total fish consumption level is recommended. Furthermore, our study focused on the single item measure for belief, as a part of the attitude. This approach has been chosen because of our specific interest in a very concrete belief, namely the perceived healthiness of fish consumption. However, a common practice for measuring beliefs and attitudes is through using multi-item measures. Aditionally, our selection of countries imposes some limitations and further cross-cultural validation of our findings is recommended. Finally, future research could manipulate one some of the antecendents variables to verify the causal relationship between the constructs. A longitudinal design, including all variables, could test for the age-period-cohort problem, and could improve the internal validity of our results.

Chapter VII

Consumer use and trust in information sources as basis for fish market segmentation

Abstract

This chapter focuses on identifying segments of consumers based on their use of and trust in information sources about fish. Cross-sectional data were collected through the SEAFOODplus pan-European consumer survey (n=4,786) with samples representative for age and region in Belgium, the Netherlands, Denmark, Spain and Poland. Three distinct clusters, based on use of and trust in fish information sources, were identified: Sceptic (24.0%), Enthusiast (41.4%) and Confident (34.6%). Those consumer segments differed significantly with respect to use of and interest in information cues on fish labels, knowledge, behaviour and beliefs toward fish consumption, and socio-demographic profile. Recommendations for the use of multiple sources targeted to a particular audience's interest and behavioural profile were formulated.

This chapter is compiled and adapted from:

Pieniak, Z., Verbeke, W., Scholderer, J., Brunsø, K. & Olsen, S.O. (2007). "European consumers' use of and trust in information sources about fish", *Food Quality and Preference,* 18, 1050-1063.

Verbeke, W., Pieniak, Z., Brunsø, K. & Olsen, S.O. (2008). Evaluating consumer information needs in the purchase of seafood products. In: Børresen, T. (Ed.). Improving seafood products for the consumer.

1 Introduction

In the previous chapters, empirical findings allowing us to better understand several determinants of European consumers' fish consumption have been presented and discussed. In this chapter, identification of possible groups of consumers (market segments) based on their use and trust in information sources will be performed.

The rationale for performing a market segmentation analysis is that efficient and effective communication begins with a clear target audience in mind (Kotler & Armstrong, 2001). Insight into the characteristics of the target audience permits providing more specific and targeted information to be delivered through the appropriate information media and sources, resulting hopefully in higher effectiveness, higher impact, better coverage and higher penetration (Sacharin, 2001). Information is likely to be effective only when it addresses specific information needs, is accessible, and can be processed and used by its target audience (Verbeke, 2005).

Therefore, to develop an effective communication strategy, it is crucial to understand how consumers are searching for available information when they have a question related to the quality or safety of their food (Kornelis et al., 2007; Verbeke, 2005) or when they are confused due to contradictory information they obtain with respect to fish consumption. Previous research has shown that potential sources of information about food and nutrition include mass media, family and friends, doctors, government, scientists, industry (Bocker & Hanf, 2000; Burger & Waishwell, 2001; Kornelis et al., 2007; Rosati & Saba, 2004; Siegrist & Cvetkovich, 2001; Verbeke & Vackier, 2004). Nevertheless, the availability of many information sources does not imply that every consumer uses the same sources to the same extent. Furthermore, trust plays a fundamental role in the utilisation of provided information. Trust emerges as a requirement of the effectiveness of information with regard to access (Thiede, 2005) (see *Chapter III* section1.1 for more details).

The focus of this chapter/study is on consumers' claimed use of and trust in information sources about fish. By applying clustering techniques, we will investigate whether it is possible to identify groups of consumers based on their use and trust in information sources. Cluster analysis can be described as the process of sorting respondents into groups, where on some suitable criterion/criteria, similarity between group members is

high and similarity between members of different groups is low (Moutinho et al., 1998). Consumer segmentation has been widely applied in consumer behaviour research. Brunsø et al. (2002) already stressed that grouping consumers into segments with similar characteristics can provide a better understanding of consumption patterns. Additionally, segmentation followed by targeted information provision has been suggested to be a valuable route for reducing uncertainty at the consumer level, and effectively changing consumer behaviour (Kornelis et al., 2007; Verbeke, 2005). Several studies have recently applied fish consumer segmentation based. Different segmentation variables have been used, for example segmentation based on consumers' evaluation of fish quality (Verbeke et al., 2007b), importance of the symbolic value and of the product utility for a consumer's involvement in fish products (Juhl & Poulsen, 2000), consumers' attitude toward wild and farmed fish (Arvanitoyannis et al., 2004), consumers' motives and barriers (Hanson et al., 1994). In this particular study, we opted for using as segmentation variable consumers' use of and trust in information sources about fish.

1.1 Purpose of this study

The primary objective of this study is to identify market segments based on consumer's use of and trust in information sources about fish, i.e. external information sources available in the living environment of the consumer. Such an identification of homogenous consumer groups on the basis of their utilisation of and trust in information sources may help to improve the potential effectiveness of information provision. The second objective is to investigate whether the resulting segments differ with respect to the use of packaging or labels as sources of information about fish, i.e. information sources that are part of the product or sources that become available only when the consumer actively searches for or picks up the product. The third objective is to assess whether this interest and use profile of information associates with consumers' objective and subjective knowledge. Finally, the aim is to test whether use of and trust in information sources associate with attitudinal, behavioural and demographic characteristics.

Based on an exploratory study on this subject (Pieniak et al., 2007c) (see also *Chapter II*) it is expected that heavy fish users (i.e. consumers who eat fish more frequently) are more

willing to actively search for information about fish (will use more frequently labels). The following section details materials and methods used in this study. In order to achieve a, descriptive statistics will be presented first. Second, cluster analysis will be performed to detect fish information sources-based market segments. Third, segments will be profiled in terms of their use of potential and existing information cues, knowledge, behaviour and socio-demographics. Finally, conclusions and recommendations will be provided.

2 Methodology

Cross-sectional data were collected through the SEAFOODplus pan-European consumer survey (n=4,786) with samples representative for age and region in Belgium, the Netherlands, Denmark, Spain and Poland. Sampling procedure, data collection and characteristics of the overall sample were previously presented in *Chapter I*, section 4.2. Measures used in this chapter for cluster analysis, as well as for further profiling of the identified consumer groups in terms of use of potential and existing information cues, subjective and objective knowledge, health beliefs and risk perception, behaviour toward eating fish and finally socio-demographics have been already described in the previous parts of the thesis (see *Chapter III*, sections 2.1.1-2.1.4 and *Chapter V*, section 3.2).

2.1 Data analysis

Data were analysed using the statistical software SPSS version 12.0. First, missing data were imputed by means of the EM (expectation-maximization) algorithm and the standardising procedure was conducted for all validation criteria. Then, two-step clustering (Wedel & Kamakura, 2000) based on likelihood measures was applied to obtain segments based on information source use and trust. The clustering solution was cross-checked by means of latent class analysis. Cluster profiles were determined using cross-tabulation and univariate ANOVAs with post-hoc Tukey HSD comparison of mean scores. The segments were compared based on their behaviour, knowledge levels, use of existing and potential information cues, and demographics. Each of the resulting segments will be described in turn below.

3 Empirical findings

3.1 Identification of consumer segments based on use of and trust in information sources about fish

Respondents' mean use of and trust in information sources' scores have subsequently been used for cluster analysis, with the aim to obtain use of and trust in information-based segments of fish consumers. A three-cluster solution emerged as the optimal solution from the cluster analysis. Effect sizes, as an estimate of the proportion of variance in the dependent variable (i.e. use or trust in this case) explained by an independent variable (i.e. cluster membership), are expressed as partial eta-squared. The partial-eta measure has been included in the analysis, as our sample-size is large and therefore even trivial effects can have impressive looking p-values. The effect size value indicates how strongly two or more variables are related, or how large the differences between groups are (Levine & Hullett, 2002). The partial eta-squared values show that differences between the three clusters are significant with greater importance/effects for use of radio ($F=1669.66$, $p<0.001$, partial eta-squared=0.438), TV ($F=1384.15$, $p<0.001$, partial eta-squared=0.392), public health recommendations ($F=1356.99$, $p<0.001$, partial eta-squared=0.388), newspapers ($F=1329.42$, $p<0.001$, partial eta-squared=0.383), advertising ($F=1276.56$, $p<0.001$, partial eta-squared=0.373), scientists ($F=1221.32$, $p<0.001$, partial eta-squared=0.363), government ($F=1213.32$, $p<0.001$, partial eta-squared=0.361) and consumer organisations ($F=1113.37$, $p<0.001$, partial eta-squared=0.342); and for trust in radio ($F=2193.64$, $p<0.001$, partial eta-squared=0.462), TV ($F=1887.72$, $p<0.001$, partial eta-squared=0.419), newspapers ($F=1801.36$, $p<0.001$, partial eta-squared=0.418), government ($F=2520.74$, $p<0.001$, partial eta-squared=0.407), advertising ($F=1656.92$, $p<0.001$, partial eta-squared=0.342), scientists ($F=2110.98$, $p<0.001$, partial eta-squared=0.338) and supermarkets ($F=1654.70$, $p<0.001$, partial eta-squared=0.335). It should be noted that the most used and trusted information sources, namely family and friends and fish monger, had relatively low partial etas-squared what indicates that these sources are the least differentiated (as highly used and trusted) among the three consumer groups.

Table VII-1. Mean ratings of clusters on the classification variables

	Consumer segments			F	Partial Eta Squared
	Cluster 1	Cluster 2	Cluster 3		
Size (% of the sample)	24.0	41.4	34.6		
Use of information sources					
Radio	1.44 [a]	3.44 [c]	1.34 [a]	1669.66	.438
TV	2.18 [a]	4.32 [c]	2.13 [a]	1384.15	.392
Public health recommendations	2.45 [b]	4.43 [c]	1.82 [a]	1356.99	.388
Newspapers	1.91 [b]	3.78 [c]	1.64 [a]	1329.42	.383
Advertising	1.90 [a]	4.06 [b]	2.01 [a]	1276.56	.373
Scientists	1.47 [a]	3.13 [c]	1.20 [a]	1221.32	.363
Government	1.20 [a]	2.77 [b]	1.16 [a]	1213.09	.361
Consumer organisation	1.78 [b]	3.39 [c]	1.42 [a]	1113.37	.342
Fish/food industry	2.36 [b]	3.76 [c]	1.74 [a]	917.53	.300
Supermarkets	2.31 [a]	4.33 [c]	2.60 [b]	826.52	.278
Dietician	2.03 [b]	3.59 [c]	1.46 [a]	774.90	.266
Doctor	2.35 [b]	3.85 [c]	1.65 [a]	765.80	.263
Fishermen	2.26 [b]	3.55 [c]	1.63 [a]	650.28	.233
Fish monger	3.49 [a]	4.82 [b]	3.35 [a]	334.29	.135
Family and friends	3.57 [b]	4.45 [c]	3.13 [a]	273.26	.113
Trust in information sources					
Radio	1.71 [a]	4.14 [c]	4.00 [b]	2193.64	.462
TV	2.05 [a]	4.33 [c]	4.13 [b]	1887.72	.419
Newspapers	2.13 [a]	4.35 [c]	4.17 [b]	1801.36	.418
Government	1.62 [a]	4.01 [b]	4.30 [c]	2520.74	.407
Advertising	1.76 [a]	3.91 [c]	3.68 [b]	1656.92	.342
Scientists	2.46 [a]	4.77 [b]	4.79 [b]	2110.98	.338
Supermarkets	2.27 [a]	4.33 [b]	4.32 [b]	1654.70	.335
Consumer organisation	2.87 [a]	4.89 [b]	4.88 [b]	1585.50	.287
Public health recommendations	3.26 [a]	5.28 [c]	4.93 [b]	1405.87	.250
Dietician	3.11 [a]	5.17 [b]	5.08 [b]	1597.81	.244
Doctor	3.65 [a]	5.45 [c]	5.24 [b]	1166.07	.197
Fish/food industry	2.97 [a]	4.55 [b]	4.48 [b]	941.94	.195
Fishermen	3.18 [a]	4.89 [b]	4.76 [b]	1071.34	.192
Fish monger	3.81 [a]	5.25 [b]	5.30 [b]	839.79	.168
Family and friends	4.69 [a]	5.38 [b]	5.37 [b]	182.62	.040
Key characteristic	Low use & low trust	High use & high trust	Low use & high trust		

The a, b, c indicate significantly different means. Univariate General Linear Model with Tukey HSD Post Hoc on a 7-point scale (1= never; 7= very often for use of information; and 1= completely distrust; 7= completely trust for the trust in information sources) has been applied to assess significant differences and their importance between segments; 95% C.I.

The profile of each cluster in terms of mean scores, size, socio-demographic and behavioural profile is presented in eight subsequent tables (Table VII-1 – Table VII-8).

Cluster 1 is the smallest consumer segment accounting for 24.0% of the sample. Respondents from this segment displayed low use of mass media and independent information sources and moderate to rather low use of health related information sources, such as doctor, dietician and public health recommendations. However, their trust level was the lowest among the three groups. They seemed to be very distrustful, insecure about information sources in general. Individuals belonging to this group did not trust and did not use any particular information source more in comparison with the other two clusters. Therefore, they might be called as "Sceptics".

Cluster 2 is the biggest (41.4%) and the least differentiated in terms of use of and trust in information sources. Individuals belonging to this group scored the highest on the use of all information sources about fish. Simply, they were very involved in information search related to fish consumption. Additionally, they displayed the highest trust in almost all information sources (except in government); they might be called as "Enthusiasts".

Cluster 3 accounts for 34.6% of the sample. Individuals belonging to this segment did not actively search information about fish (themselves). They were rather "passive" in information search about fish (the lowest scores on use of almost all information sources). However, they held trust in independent information sources, such as government, scientists and consumer organisations (score on the use of government is the highest among the three clusters). Therefore, individuals belonging to this consumer group might be called as "Confidents", or those who "rely on the system".

In the next sections characterisation of the consumer segments in terms of use of information cues, knowledge, attitudes toward fish healthiness and safety, health beliefs; risk perception; behaviour toward eating fish and finally socio-demographic characteristics will be provided.

3.2 Use of existing and potential information cues by segments

Comparison of the use of information cues between segments revealed significant differences (Table VII-2). Enthusiasts (cluster 2) reported the highest usage of all information cues. Sceptics (cluster 1) showed the lowest usage of "basic" on-pack or on-label information cues such as price, expiry date, fish species, weight and brand name, and at the same time a moderate usage of nutritional composition, capture area and date of capture. However, those scores were still below the average score for the total sample. Finally, Confidents (cluster 3) displayed the lowest usage of all given information cues.

Table VII-2. Standardised scores of the use of information cues between clusters

Use of information cues	Consumer segments			F-value	Partial Eta Squared
	Sceptics	Enthusiasts	Confidents		
Nutritional composition	3.88 [b]	4.77 [c]	3.49 [a]	199.95	.086
Capture area	2.94 [b]	3.90 [c]	2.68 [a]	186.46	.082
Brand name	3.83 [b]	4.49 [c]	3.44 [a]	130.85	.058
Date of capture	3.82 [a]	4.72 [b]	3.80 [a]	94.11	.042
Weight	5.50 [b]	5.71 [c]	5.15 [a]	45.92	.022
Fish species/name	5.63 [a]	5.95 [b]	5.51 [a]	31.85	.015
Price	5.92 [b]	5.96 [b]	5.58 [a]	27.51	.013
Expiry date	6.29 [b]	6.38 [b]	6.03 [a]	23.84	.011

The a, b, c indicate significantly different standardised means using Tukey HSD Post Hoc

In general respondents from all three clusters were the most interested in obtaining information about safety guarantee, quality mark and recipes related to fish consumption (Table VII-3). With regard to interest in potential information cues, Enthusiasts (cluster 2) scored the highest (above the average) on all potential information cues. They were simply interested in obtaining any information about fish. On the other hand, significant differences between respondents belonging to the Sceptic and Confident consumer segments were found for potential information cues such as method of preparation,

recipes, safety guarantee, and quality mark. Respondents who rely on the system (cluster 3) scored higher on those items compared to the Sceptic respondents (cluster 1). Nevertheless, both clusters scored significantly lower than Enthusiasts.

Table VII-3. Standardised scores of the interest in potential information cues between clusters

Interest in potential info cues	Consumer segments			F-value	Partial Eta Squared
	Sceptic	Enthusiast	Confident		
Health benefits	4.89 [a]	5.58 [b]	4.82 [a]	109.85	.052
Wild/farmed	4.36 [a]	5.14 [b]	4.42 [a]	101.45	.048
Feed used during farming	3.90 [a]	4.69 [b]	3.90 [a]	89.27	.042
Country of origin	4.32 [a]	5.04 [b]	4.32 [a]	81.18	.039
Method of preparation	4.67 [a]	5.43 [c]	4.94 [b]	77.32	.037
Fish welfare	4.16 [a]	4.94 [c]	4.45 [b]	67.80	.033
Environmental friendly	4.51 [a]	5.15 [b]	4.61 [a]	61.42	.030
Recipes	4.91 [a]	5.56 [c]	5.16 [b]	60.67	.029
Colorants used	4.68 [a]	5.31 [b]	4.62 [a]	59.96	027
Fed with genetically modified feed	4.43 [a]	5.08 [b]	4.44 [a]	55.91	.027
Quality mark	5.10 [a]	5.69 [c]	5.25 [b]	52.14	.025
Batch number	3.61 [a]	4.31 [c]	3.87 [b]	48.72	.024
Safety guarantee	5.28 [a]	5.74 [b]	5.32 [a]	42.10	.020

a, b, c indicate significantly different standardised means using Tukey HSD Post Hoc.

3.3 Differences in consumers' knowledge about fish between segments

Sceptics reported the lowest objective knowledge about fish followed by respondents belonging to the Enthusiast consumer segment. Confidents indicated the lowest factual knowledge about fish (Table VII-4). Consumers particularly involved in information search about fish (Enthusiasts), followed by the Sceptic fish consumers showed the highest subjective knowledge. On the contrary, respondents who particularly rely on the system (Confidents) estimated their knowledge about fish as the lowest. Confident fish

consumers scored the highest on the need for cognition, which indicates that these consumers were more likely to process information more carefully and systematically considering the content of the message and evaluating the merits of the arguments, than those low in NFC. With their highest objective knowledge about fish, they indicated to have a broader or more accessible knowledge base, which had the potential to facilitate performance on cognitive tasks. Sceptics scored the lowest on the NFC construct.

Table VII-4. Standardised scores on knowledge variables

	Consumer segments			F-value	Partial Eta Squared
	Sceptic	Enthusiast	Confident		
Objective knowledge	2.71 [a]	3.02 [b]	3.13 [C]	38.77	.018
Subjective knowledge	3.47 [b]	3.79 [c]	3.07 [a]	96.83	.044
Need For Cognition	4.32 [a]	4.62 [b]	4.80 [c]	44.84	.021

The a, b, c indicate significantly different standardised means using Tukey HSD Post Hoc; **p<0.001

3.4 Differences in health beliefs about fish between segments

Beliefs that eating fish is healthy and nutritious as well as health involvement construct have not been found significantly different between the three cluster groups (Table VII-5). As already presented in *Chapter V*, people held very strong believe that eating fish is healthy and nutritious (mean scores above 6.0 on a 7-point Likert scale). Furthermore, all fish consumers were found very much involved with their health (mean scores about 6.20).

However, significant differences between the consumer segments were found with respect to two constructs: satisfaction with life and interest in healthy eating. Enthusiasts (cluster 2) together with Confidents (cluster 3) were more satisfied with their lives, whereas Sceptics scored the lowest on this construct, meaning that they were the least satisfied with their life. Finally, Sceptical and Enthusiastic respondents were the most interested in healthy eating, whilst Confidents were the least interested in healthy eating.

To sum up, Enthusiasts were both the most satisfied with their life and interested in healthy eating.

Table VII-5 Mean scores of consumers' attitudes toward fish healthiness and health constructs between segments (n=4,786)

	Consumer segments			F-value	p-value
	Sceptics	Enthusiasts	Confidents		
Eating fish is healthy	6.21	6.24	6.27	0.90	0.405
Eating fish is nutritious	6.00	6.04	6.01	0.31	0.735
Satisfaction with life	4.46 [a]	4.90 [b]	4.98 [b]	58.21	<0.001
Interest in healthy eating	6.04 [a, b]	6.07 [b]	5.96 [a]	4.19	0.015
Health involvement	6.20	6.21	6.17	0.39	0.675

The a, b, c indicate significantly different means using Tukey HSD Post Hoc on a 7-point scale

3.5 Differences in consumers' risk perception between segments

Next, consumers' attitudes toward fish safety and the risk perception with respect to potential food poisoning from eating fish were compared between the segments and the results are presented in Table VII-6. In general, consumers considered fish mainly as a safe product (mean scores above 5 on a 7-point Likert scale). Enthusiasts (cluster 2), together with Sceptics (cluster 1) reported the highest scores on attitudes towards fish safety, meaning that they perceived fish in general as the safest from the three consumer groups. Confidents indicated the lowest belief in fish safety in general, although their mean score on the safety perception items is still substantially above the neutral point of the scale.

Table VII-6. Mean scores of consumers' attitudes toward fish safety, perceived risk items and construct between segments (n=4,786)

	Consumer segments			F-value	Partial Eta Squared
	Sceptics	Enthusiasts	Confidents		
Eating fish is safe	5.29 [b]	5.33 [b]	5.13 [a]	8.61	.004
I do not want to eat fish too often because I am afraid of food poisoning from chemical contamination	2.47 [a]	2.76 [b]	2.33 [a]	28.74	.013
I do not want to eat fish too often because I am afraid of food poisoning from bacterial contamination	2.33 [b]	2.53 [c]	2.14 [a]	26.67	.012
I am very concerned about the possibility of getting ill from eating fish	2.27 [b]	2.52 [c]	2.11 [a]	28.47	.013
Fish is more risky to eat with respect to food poisoning from chemical contamination than other kinds of food	2.41 [a]	2.79 [b]	2.37 [a]	31.34	.015
Fish is more risky to eat with respect to food poisoning from bacterial contamination than other kinds of food	2.44 [a]	2.72 [b]	2.33 [a]	24.74	.012
Risk perception	2.38 [b]	2.66 [c]	2.26 [a]	36.60	.017

The a, b, c indicate significantly different means using Tukey HSD Post Hoc on a 7-point scale; all differences significant at $p < 0.001$

Enthusiast respondents scored the highest on all five risk perception items. Sceptic respondents scored moderate on two items: *"I do not want to eat fish too often because I am afraid of food poisoning from bacterial contamination"* and *"I am very concerned about the possibility of getting ill from eating fish"* and together with the Enthusiasts the highest on the item *"Fish is more risky to eat with respect to food poisoning from chemical contamination than other kinds of food"*. Finally, Confident consumers scored the lowest on all of the items. With regard to the overall risk perception construct, Enthusiasts perceived fish consumption as the most risky; whereas Sceptics and Confidents reported the lowest risk perception related to fish consumption. However, fish was perceived as a safe product to consume by respondents from the three consumer

segments. On average, two thirds of the respondents were not afraid of food poisoning from eating fish.

Additionally, it is worth noticing that specifying a particular origin of food poisoning from eating fish (i.e. through microbiological versus chemical contamination), have not actually influenced consumers' fish safety or risk perceptions. Respondents have not differentiated between chemical and bacterial contamination. Nevertheless, the mean scores for fear of food poisoning from chemical contamination were to some extent higher than for poisoning from bacterial contamination.

3.6 Differences in fish consumption between segments

For the three measures of behaviour (total fish consumption, fish consumption at home and out of home) and also for the intention to eat fish (see *Chapter IV*, Section 2.2.1) the same pattern was observed: Enthusiasts (cluster 2) reported the highest fish consumption (1.79 times a week in total, with 1.43 times a week at home and 0.36 times a week out of home) and the strongest intention to eat fish in the future. Sceptics and Confidents displayed the lowest fish consumption and intention to eat fish (1.25 and 1.31 times a week in total, with 1.02 and 1.06 times a week at home and 0.23 and 0.25 times a week out of home, respectively) (Table VII-7).

Table VII-7. Mean ratings on behavioural variables

Behaviour	Consumer segments			F-value	Partial Eta Squared
	Sceptic	Enthusiast	Confident		
Total fish consumption	1.25 [a]	1.79 [b]	1.31 [a]	60.86	.028
Fish consumption at home	1.02 [a]	1.43 [b]	1.06 [a]	54.82	.025
Fish consumption out of home	0.23 [a]	0.36 [b]	0.25 [a]	17.22	.008
Intention to consume fish	-.090 [a]	.194 [b]	-.185 [a]	62.68	.030

The a, b, c indicate significantly different means using Tukey HSD Post Hoc for total fish consumption, fish consumption at home and out of home, and intention on a frequency scale (times per week).

3.7 Socio demographic differences between segments

Socio-demographic characteristics comprise age, gender, education, income and nationality. According to the results of the Pearson χ^2 tests (at 95% confidence level, p=0.05) and ANOVA comparison of mean (for age), age, gender, income and nationality differ significantly between the three consumer segments.

As compared to the distribution in the total sample, there were relatively more women to men in cluster 2 (Enthusiasts) and more men to women in cluster 1 (Sceptics) (Table VII-8). Gender distribution of the Confident fish consumer segment was very similar to the one of the total sample. The Confident consumer segment was the youngest segment (41.3 years of age) with relatively more of the middle aged respondents and less of the older ones. The Sceptic consumer segment was the oldest consumer group (43.4 years of age) with relatively less of the middle-aged respondents and more of the older ones.

Education levels differed only marginally between the clusters (p=0.116), with a tendency that respondents with a higher education belonged more to the Enthusiasts, whereas skilled respondents belonged rather to the Sceptics and Confidents.

Significantly more respondents with lower income and fewer respondents with middle income belonged to the segment of Sceptic fish consumers, whereas less of the respondents with lower income level and more of those with middle income level belonged to the segment of Enthusiasts.

With regard to country distribution between the segments, relatively more Polish respondents and less Belgian, Danish, Dutch and Spanish ones belonged to the Sceptic consumer segment. The Enthusiasts segment consisted of relatively more Spanish consumers and of less Dutch, Danish and Polish ones. Finally, Confident fish consumers were rather living in Belgium, Denmark and the Netherlands, and less in Poland and Spain as compared to the total profile of the sample.

Table VII-8. Socio-demographic profile of the clusters

Socio-demographic profile	Consumer segments			Total sample	p-value	F-value*/ Pearson χ^2
	Sceptic	Enthusiast	Confident			
Age (mean)*	43.4	42.7	41.3	42.7	< 0.001	9.04
Age (classes)					0.005	14.95
< 25 years	11.4	10.3	10.6	10.2		
25-55 years	67.7	71.1	74.0	70.9		
> 55 years	21.0	18.6	15.4	18.9		
Gender					< 0.001	17.57
- Male	28.1	21.1	24.0	23.7		
- Female	71.9	78.9	76.0	76.3		
Education					0.116	7.41
- Unskilled	45.5	45.1	45.8	44.4		
- Skilled	41.8	39.2	41.2	41.6		
- Higher education	12.6	15.7	13.0	14.0		
Income					0.029	10.80
- Lower	28.4	23.8	25.1	25.7		
- Middle	44.5	50.4	48.1	47.8		
- Upper	27.1	25.8	26.8	26.5		
Nationality					< 0.001	826.76
- Belgian	12.6	15.8	17.7	17.8		
- Danish	11.4	18.5	29.8	23.2		
- Dutch	11.8	16.2	26.9	16.9		
- Polish	50.2	20.1	5.5	21.2		
- Spanish	14.0	29.3	20.2	20.9		

* F-value for the "mean age", Chi-square for all other tests

4 Discussion and conclusions

4.1 Summary of the segments

Three distinct consumer groups were identified on the basis of use of and trust in information sources with regard to fish. The main characteristics of individuals in these groups are summarised below.

4.1.1 Sceptical fish consumers (24.0%)

These individuals reported the lowest use of most of the information sources (except for health-related, such as dietician, doctor, and public health recommendation) and the lowest trust in all information sources; indicated low intention to eat fish, and low total fish intake both at home and out of home. When compared to the other two segments, this group displayed moderate subjective knowledge (but still below the average scores for the total sample) and the lowest objective knowledge. Furthermore, they indicated the lowest use of basic, mandatory information cues and low interest in potential information cues with regard to fish compared with the other groups. Consumers from this cluster were the least satisfied with their lives; and consisted of relatively older, more men, more skilled workers and less higher educated ones. There were significantly more Polish and less Belgian, Danish, Dutch and Spanish respondents in this segment.

4.1.2 Enthusiastic fish consumers (41.4%)

These individuals reported the highest use of all information sources and the highest trust in almost all information sources about fish (except government). Although they perceived the highest risk related to fish, Enthusiasts reported the highest intention and consumption of fish, indicated the highest subjective knowledge and objective knowledge about fish. Additionally, they were the most interested in all potential information cues and showed the highest usage of all information cues. Enthusiastic fish consumers were the most interested in healthy eating and, together with Confidents, most satisfied with their lives. This segment included relatively more women than men, more higher educated and with middle income level, more Spanish consumers and less Belgian, Dutch, Danish and Polish ones.

4.1.3 Confident fish consumers (34.6%)

These individuals claimed to have the lowest use of almost all information sources (except supermarket), the highest trust in government and relatively high trust in other independent information sources, such as scientists and consumer organisations. Together

with Sceptics, they indicated low intention to eat fish and low total fish consumption. With their highest objective knowledge about fish, they have a broader or more accessible knowledge base, which had the potential to facilitate performance on cognitive tasks (high on NFC). However, their subjective knowledge about fish was on the lowest level among the three groups. Individuals from this group reported the lowest usage of all information cues. Additionally, they showed moderate interest in information about the quality mark of fish, safety guarantee, recipes and method of preparation. On average, members of this group were younger than individuals in other groups and most satisfied with their lives (together with Enthusiasts). This consumer segment consisted of more skilled respondents and less of those with higher education; more Belgian, Danish and Dutch and less Polish and Spanish ones.

4.2 Validating assumptions from the exploratory study

These findings confirm the first assumption made based on the results from the focus group discussions (see *Chapter II*), namely that consumers with higher experience, thus higher fish consumption, and higher knowledge are likely to use more frequently information sources and cues about fish. This description corresponds to the profile of the Enthusiastic fish consumers, who displayed the highest fish consumption level and the highest knowledge about fish, while reporting higher use of the majority of information sources and cues. However, no considerable differences between the consumer segments in the positive attitudes toward fish consumption were reported; noteworthy, they were all very positive.

Additionally, results of this segmentation support the second assumption made based on the findings from the exploratory study. The profile of the Confident fish consumers complies with the conjecture that light users might be more interested in both information directly related to fish quality; information that facilitates their fish quality evaluation, and information about the preparation and cooking of fish. Those consumers reported much higher interest in information about the quality mark of fish, safety guarantee, recipes and method of preparation compared with the Sceptical fish consumers.

Finally, the third assumption that resulted from the qualitative study may be partially supported. Consumers, who perceived the highest risk related to fish (Enthusiasts), indeed displayed the highest use of personal information sources. Noteworthy, even the highest risk perception of food poisoning from eating fish is still very low (below the neutral point of the scale). However, Enthusiasts perceived the highest risk of food poisoning from eating fish and at the same time reported the highest fish consumption level. Furthermore, this consumer segment consisted of relatively more Spanish consumers (thus a country with a high tradition of fish consumption) and of less Dutch, Danish and Polish ones. Therefore, the second part of this assumption, namely that risk perception related to fish will be higher for countries with a low tradition of fish consumption, is rejected.

Chapter VIII

Fish consumption and its motives in households with versus without self-reported medical history of CVD

Abstract

The purpose of this study was to explore the cross-cultural differences in fish consumption and motives for fish consumption among people from households with versus without medical history of cardiovascular diseases, based on data obtained from five European countries. A cross-sectional consumer survey was carried out in with representative household samples from Belgium, the Netherlands, Denmark, Poland and Spain. A total sample of 4,786 persons, responsible for food purchasing and cooking in the household, aged 18-84, was obtained. Individuals from households in the CVD+ group consumed fish more frequently in Belgium and in Denmark as compared to those in the CVD- group. The consumption of fatty fish, which is the main sources of omega-3 PUFA associated with prevention of cardiovascular diseases, was on the same level for the two CVD groups in the majority of the countries, except in Belgium. Although a number of differences between CVD- and CVD+ subjects with respect to their frequency of fish intake are uncovered, the findings suggest that fish consumption traditions and habits – rather than a medical history of CVD – account for large differences between the countries, particularly in fatty fish consumption. This study exemplifies the need for nutrition education and more effective communication about fish to the broader public. European consumers are convinced that eating fish is healthy, but particular emphasis should be made on communicating benefits from fatty fish consumption in particular.

This chapter is based on:

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1 Introduction

Fish and seafood products are recommended to take a prominent position in the human diet due to their beneficial role in the prevention of chronic degenerative diseases. The consumption of fish may be protective against certain cancers (Caygill et al., 1996; Fernandez et al., 1999; Geelen et al., 2007; Norat et al., 2005) and cardiovascular diseases (Nestel, 2000; Schmidt et al., 2000). Consumption of fish or fish oils lowers the risk of coronary heart disease, death or sudden death (Folsom & Demissie, 2004; Mozaffarian et al., 2005; Mozaffarian & Rimm, 2006; Nakamura et al., 2005). This (health) beneficial role of fish intake is particularly due to its omega-3 polyunsaturated fatty acids (PUFA) content, which have been associated with the prevention of cardiovascular diseases (Mozaffarian & Rimm, 2006). Eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) that are formed from alpha-linolic acid have been identified as the two long-chain omega-3 PUFA's to be the likely active constituents of fatty fish. EPA has protective health effects such as the lowering rates of heart diseases (Yancy et al., 2003), the reduction of arrhythmias and thrombosis (Kinsella et al., 1990), the lowering plasma triglyceride levels (Harris, 1990), and the reduction of blood clotting tendency (Agren et al., 1997; Mori et al., 1997).

Previous studies carried out on general population samples found that attitudes towards fish consumption (Olsen, 2003; Verbeke & Vackier, 2005), motivational aspects such as health involvement or the importance attached to healthy eating (Gempesaw et al., 1995; Olsen, 2001), were significant factors in explaining fish consumption. Also people's health motivation and knowledge about nutrition were, among others, positive predictors of dietary health preventive behaviour (Petrovici & Ritson, 2006). Furthermore, fish availability, perceived difficulty or easiness in the preparation and cooking of fish, perception that fish is expensive compared to the other food types, physical properties such as bones and smell, and taste preference were found to be important factors shaping fish consumption (Leek et al., 2000; Myrland et al., 2000; Nielsen et al., 1997; Olsen et al., 2007; Scholderer & Grunert, 2001). Despite the predominantly healthy image fish has among nutritionists, food scientists, government and consumers (Brunsø, 2003; Gross, 2003; Pieniak et al., 2004), the recommendations of eating fish at least twice a week are

not met by large groups of the population in many countries (Verbeke et al., 2005; Welch et al., 2002).

2 Scope and objectives

Our specific interest for performing this study stems from the role of fish consumption in the prevention of cardiovascular disease (CVD). The aim of this paper is to investigate the differences in the frequency of fish consumption and motivational aspects such as health beliefs, use of and trust in information sources and knowledge levels, between individuals from households with (CVD+) versus without (CVD-) medical history of CVD in Belgium, Denmark, The Netherlands, Poland and Spain.

The risk of CVD can be lowered by adhering to dietary and lifestyle recommendations (Stampfer et al., 2000), particularly the weekly consumption of two portions of fish, one of which should be fatty fish. Therefore, at least if dietary recommendations were consciously adhered to, one would expect that individuals from CVD+ households will report a higher frequency of fish consumption in general and fatty fish consumption in particular, as compared to those who have not been confronted with CVD in their direct social environment. As it is known, people are influenced by others, also in their food purchase and consumption behaviour. Consumers having the feeling that other people who are important to them, such as family members, stimulate their consumption are also reporting a higher intention to buy fish (Olsen, 2001; Verbeke & Vackier, 2005). Additionally, the moral obligation or personal norms of individuals may lead to performing a particular behaviour for reasons other than own liking, like serving the family a healthy meal (Leek et al., 2000; Olsen, 2001). Therefore, we believe that questioning people responsible for the shopping in their household is relevant and meaningful.

Whether dietary recommendations are adhered to is likely to depend also on multiple other personal factors, including cultural background, as well as attitudinal and information-related variables. In this study, we will concentrate both on countries with a weak (Poland), a moderate (Belgium, the Netherlands and Denmark) and a strong tradition (Spain) of eating fish. Based on the Food Balance Sheets data provided by FAO

(2006), Spain reported one of the highest fish intakes in Europe and in the world, whereas Denmark, Belgium and the Netherlands reported moderate fish consumption levels, close to European's average. Poland was among the countries with the lowest consumption of fish within Europe (see also *Chapter I*, section 1). Determinants of fish consumption might be different depending on the country and fish consumption level. What is important in one country may not be significant in the other. Therefore, some cross-cultural differences related to motivational aspect of fish consumption are expected.

The use of information sources as a part of information search (Brucks, 1985; Pieniak et al., 2007c) in the decision making process (Engel et al., 1995), associates with behaviour and/or food choice (Alba & Marmorstein, 1987). Therefore, information addressed to consumers must be reliable and trustworthy (Salaün & Flores, 2001), since trust plays a crucial role in the utilisation of provided information (Thiede, 2005) and is an important antecedent to information effectiveness. Furthermore, consumer knowledge has been proven to be a relevant and significant construct that influences how consumers gather and organise information, and ultimately, what products they buy and how they use them (Alba & Hutchinson, 1987). In this study, two knowledge constructs will be distinguished: subjective knowledge and objective knowledge (Bearden et al., 2001; Brucks, 1985; Park & Lessig, 1981; Park et al., 1994). Subjective knowledge relates to people's perceptions of what or how much they know about a product class and are based on consumer's interpretation of what s/he knows, while objective knowledge refers to the accurate information about the product class stored in long-term memory (Park et al., 1994; Selnes & Gronhaug, 1986).

3 Methods

3.1 Study design

The overall research design for this study has been described in detail elsewhere (Pieniak et al., 2007a) and will only be summarized here. Cross-sectional survey data were collected through questionnaires in five European countries: Belgium, Denmark, the

Netherlands, Poland and Spain during November-December 2004. Sample selection and contact procedures differed between countries, depending on cost efficiency, time effectiveness and best practice of the market research agencies that performed the fieldwork. Households were selected at random, either from panels (Belgium and the Netherlands), phone books (Denmark), census data (Poland) or through random walk procedures (Spain), taking predetermined quota with respect to age and regional distribution into account within each country. In Denmark and Belgium, the field work consisted of mail surveying with a response rate of 79% (Denmark) and 53% (Belgium), respectively. In Poland and in Spain, the participants were contacted face-to-face at their homes. Upon their agreement to participate, they were asked to self-administer and return the questionnaire. In the Netherlands, data were collected electronically by means of a web-based survey. Most importantly, all questionnaires were self-administered by the participants without interference from the researchers, the agency or interviewers (see also *Chapter I*, section 4.2).

3.2 Measures

A questionnaire was developed in English and further translated into Dutch and French (Belgium), Danish (Denmark), Dutch (the Netherlands), Polish (Poland) and Spanish (Spain) by professional translation service in each country. The back-translation method was used to construct the local language versions of the questionnaire. The questionnaires, measuring a wide variety of constructs including behaviour, attitudes and beliefs, knowledge, and use of information sources, have been pre-tested in the national languages through pilot studies.

In order to obtain a measure for whether an individual has been confronted with CVD in her/his direct social environment, respondents were asked if there was anybody in their households[6] suffering or having suffered from cardiovascular diseases (nominal yes/no scale). No concrete definition of cardiovascular diseases has been given to the

[6] In this study household refers to all individuals who live in the same dwelling. It has been translated to “gezin” (Flemish/Dutch), “foyer” (French), “gospodarstwo domowe” (Polish), “husstanden” (Danish), and “hogar” (Spanish).

respondents. We assumed that cardiovascular diseases refer to the class of diseases that involve the heart and/or blood vessels (arteries and veins). Nevertheless, we used the term that is the most familiar in common layman language in the respective countries. From a medical perspective these terms do not necessarily cover all potential diseases involving heart and/or blood vessels. From our perspective, it is the subjective feeling, or even reality of facing or having faced any disease related to cardiovascular diseases that matters. Our measure is a self-reported, single item measure that indicates if there are persons in the households with medical history of cardiovascular diseases. It is important to note that no medical examinations have been carried out in this study. In order to avoid post-rationalisation and social desirability response behaviour, this question about CVD was asked at the end of the questionnaire.

Fish consumption behaviour was a self-reported measure and was scaled as the frequency of total fish consumption per week. The respondents were asked through two questions how often they eat fish both at home and out of home; then the responses were summated in order to create one final variable, namely, total fish consumption. Additionally, the consumption of fatty fish was assessed by measuring the consumption frequency of four fatty fish species (fat concentration > 10% on fresh weight basis): salmon, mackerel, eel and herring. A 9-point frequency scale ranging from “never” (1) to “daily or almost every day” (9) was used for both total and fatty fish consumption. Assuming that fish consumption behaviour might be driven through dietary recommendations related to the prevention against cardiovascular diseases, these variables were recoded into binary (yes/no) fish consumption variables; either meeting or not meeting dietary recommendations with respect to fish. In the case of total fish consumption, the benchmark (dietary recommendation) is eating fish at least twice a week; whereas for fatty fish it is fatty fish intake at least once a week.

Perception of fish as being a healthy food was measured by two items: “Eating fish is healthy”, and “Eating fish is nutritious”. Both statements were scored on a 7-point Likert scale, ranging from “totally disagree” (1) to “totally agree” (7).

Satisfaction with life was measured using the scale developed by Diener (1985) and consisted of four items. Five items regarding subjective health were included. The items were mainly based on the general health perception scale from the short-form health survey SF-36 (Ware et al., 1993). Interest in healthy eating was measured by five items adapted from the Food Choice Questionnaire (Steptoe et al., 1995). Only the most appropriate, useful and relevant items related to fish were included based on findings from exploratory focus group discussions (Brunsø et al., 2007; Pieniak et al., 2007c). Health involvement consisted of three items based on the involvement scale developed by Zaichkowsky (1985), which also corroborates the food involvement scale suggested by Bell and Marshall (2003). Those four constructs have been cross-culturally validated across the consumer samples taken from Belgium, The Netherlands, Spain, Denmark and Poland (Pieniak et al., 2007b) (see also *Chapter V*, section 3.2).

Next, respondents were asked about their use of different information sources in order to obtain information about fish. Only information sources communicating about public health issues were selected for the current analysis, such as doctor, dietician, public health recommendations, government and scientists. A 7-point Likert scale ranging from "never" (1) to "very often" (7) was used. Next, consumers' trust in those sources was assessed (Rosati & Saba, 2004). Respondents were asked to rate each of the above mentioned information sources to the question "To what extent do you trust information about fish from the following sources?" on 7-point Likert scales ranging from "completely distrust" (1) to "completely trust" (7).

Subjective knowledge about fish was measured by three items: (1) "My friends consider me as an expert on fish"; (2) "I have a lot of knowledge of how to prepare fish for dinner"; and (3) "I have a lot of knowledge how to evaluate the quality of fish" to be answered on a 7-point Likert scale ranging from "totally disagree" to "totally agree"; consistent with measures used in previous studies (e.g. Brucks, 1985; Park et al., 1994).

Next, consumer's level of objective knowledge about fish and cardiovascular diseases was measured with three statements that are either true or false. It was assumed that those

statements should be common knowledge among at least half of the population. One of the statements was false: "Cod is a fatty fish" (cod is classified as a lean fish) and two statements were true: "Fish is a source of omega-3 fatty acids"; and "Salmon is a fatty fish". For the three statements, a binary scale "true" / "false" was used (Park et al., 1994). We opted for not including a "don't know" response category, which forced respondents to think and make up their mind about the proposed statements. Through providing the opportunity to indicate a certainty level (measured by 5-point Likert scales ranging from "very uncertain" (1) to "very certain" (5) for each knowledge item), respondents could reflect how sure/unsure they felt about their answer. Before analyses, a new variable objective knowledge was computed as the sum of three binary items (0 for a wrong answer; 1 for a correct answer) multiplied with the corresponding score for each item on the certainty scale (1-5). Hence, the computed objective knowledge ranged from 0 to 15.

3.3 Participants

A total sample of 4,786 consumers (n=800-1,100 respondents per country) was obtained. The sample was composed of 3,652 women (76.3%) and 1,134 men (23.7%). This gender distribution reflects the criterion that all respondents were the main responsible people for food purchasing within their household. The age of the respondents ranged from 18 to 84 years, with a mean of 42.7 (SD=12.6). The main socio-demographic characteristics of the participants from each of the five European countries are presented in Table VIII-1.

Table VIII-1. Sample characteristics

	Belgium (n=852)	Denmark (n=1110)	Netherlands (n=809)	Poland (n=1015)	Spain (n=1000)	Total (n=4786)
Gender						
Male	24.8	25.6	28.4	30.0	10.6	23.7
Female	75.2	74.4	71.6	70.0	89.4	76.3
Age						
<25 years	3.2	3.6	14.5	11.0	19.5	10.2
25-55 years	73.0	70.7	71.3	70.7	69.0	70.9
>55 years	23.8	25.7	14.2	18.3	11.5	18.9

3.4 Statistical analyses

Data were analysed using SPSS version 12. First, in order to validate the health related scales an exploratory factor analysis with the seventeen items related to health was performed. Confirming our expectations, the analysis showed that a four factor solution is best suited for the data. The factors explained almost 65% of the variance in the original data. Table VIII-2 presents the factor loadings, percentage of variance explained, the internal consistency reliability of the four resulting health constructs, as well as their mean and standard deviation for the total sample. The reliability coefficients alpha indicate that the different items with a high loading on a specific factor can be summated into a composite construct score. The four constructs are further referred to as 'Interest in healthy eating', 'Satisfaction with life', 'Health involvement' and 'Subjective health'.

Bivariate analyses through chi-square association tests, comparison of mean scores through independent samples t-tests and analysis of covariance, Pearson's correlation, as well as multiple linear regressions were used to detect differences in demographic characteristics, consumer beliefs, perception and intake of fish between respondents who have been confronted with cardiovascular diseases in their family and those who have not. Results are presented in table format expressed as percentages, mean scores and standard deviations, including test statistic p-values. A p-value less than 0.05 was considered as statistically significant.

Table VIII-2. Validity of the health constructs

Health constructs and indicators	Factor 1	Factor 2	Factor 3	Factor 4
Interest in healthy eating				
It is important to me that the food I eat on a typical day is good for my psychical and mental health	0.943			
It is important to me that the food I eat on a typical day keeps me healthy	0.863			
It is important to me that the food I eat on a typical day is nutritious	0.839			
It is important to me that the food I eat on a typical day is a natural product	0.633			
It is important to me that the food I eat on a typical day has been produced without preservatives or additives	0.616			
Satisfaction with life				
I am satisfied with my life		0.868		
The general conditions of my life are excellent		0.848		
In most ways my life is close to my ideal		0.752		
If I could live my life over, I would change almost nothing		0.669		
Health involvement				
Health is very important to me			0.930	
I care a lot about health			0.922	
Health means a lot to me			0.918	
Subjective health				
Compared with people at my age, my health is excellent				0.971
Compared with people at my age, my current physical health is excellent				0.885
I am as healthy as anyone I know at my age				0.650
Compared with people at my age, my current mental health is excellent		0.219		0.412
I consider myself as very health conscious	0.228			0.201
Explained variance (%)	28.794	19.484	9.611	6.236
Cronbach's alpha	0.880	0.854	0.937	0.822
Mean (standard deviation)	5.81 (1.06)	4.85 (1.26)	6.18 (1.15)	4.94 (1.24)

4 Results

4.1 CVD based consumer groups

Respondents were divided into two groups: one group consisting of people who reported to face or have faced cardiovascular disease in their household (n=351; 7.3%), further referred to as "CVD+" respondents and the other group of people from households who claimed no medical history of cardiovascular diseases (n=4,435; 92.7%), called "CVD-" respondents.

Table VIII-3 shows the socio-demographic characteristics of respondents from households with versus without medical history of cardiovascular diseases among the countries. The self-reported (subjective) prevalence of CVD ranges from around 4% in Denmark and Spain to more than 10% in Belgium and the Netherlands. These results, of which the external validity will be discussed later on, are subject to potential impact from the varying number of relatives and the corresponding age ranges in the households of the respondents, on which no specific data were collected. Despite the relatively low shares of CVD+ subjects within the samples, the number of participants is substantial enough for performing statistical analyses.

With regard to age, in Belgium, Denmark, the Netherlands and Poland CVD+ consumers were significantly ($p<0.001$ in all countries) older than the other group of respondents. No significant differences with respect to gender and income were found between the two groups. In Poland, the group of CVD+ consisted of significantly more individuals with lower education level (unskilled) and less higher educated and skilled individuals compared with the CVD- group. A similar tendency was observed for the Dutch respondents ($p=0.106$) although this association was not statistically significant.

4.2 Fish consumption level

Table 4 presents a comparison of the frequency of fish intake among CVD+ and CVD- households within and between the countries. In general, Spanish CVD+ and CVD- respondents reported the highest total fish consumption frequency, followed by Danes and Poles. Belgians and Dutchmen scored significantly lower than consumers from any

other country. Polish and Danish respondents from both groups of CVD displayed the highest, whilst Belgians the lowest fatty fish consumption frequencies.

In Belgium, CVD+ respondents reported a significantly higher frequency of fish intake in general, and a higher frequency of fatty fish intake in particular. Almost 70% of CVD+ respondents claimed to eat fish at least once a week versus only half of CVD- respondents. One third of the CVD+ respondents versus one fifth of CVD- respondents reported fish intake in accordance with dietary recommendations, i.e. at least twice per week. With regard to fatty fish consumption, almost one quarter of the CVD+ respondents claimed to eat salmon, herring, mackerel and/or eel at least once a week, versus only 13% of CVD- respondents.

In Denmark, significant differences in the frequency of total fish consumption were found between the two CVD groups. About 80% of respondents from households with medical history of CVD indicated to consume fish at least once a week versus less than half of the CVD- respondents. Furthermore, almost half of the CVD+ respondents met the dietary recommendations of eating fish twice a week versus only one quarter of the CVD- respondents. No significant difference between CVD+ and CVD- with respect to fatty fish consumption was observed.

In the Netherlands, significantly more consumers from CVD+ households reported fish consumption at least twice a week in comparison with CVD- respondents. However, no significant differences in meeting the weekly fish consumption level were found between the two CVD groups. Comparing with the other countries, the smallest proportion of compliers with dietary recommendations was found in the Netherlands.

In Poland, no significant differences in the frequencies of fish consumption were found between CVD+ and CVD- respondents.

Table VIII-3. Sample characteristics for CVD+ and CVD- households in five European countries; % of respondents within each CVD group

	Belgium			Denmark			The Netherlands			Poland			Spain		
	CVD+ (n=90) 10.5%	CVD- (n=762) 89.5%	p	CVD+ (n=45) 4.0%	CVD- (n=1065) 96.0%	p	CVD+ (n=88) 10.9%	CVD- (n=721) 89.1%	p	CVD+ (n=87) 8.6%	CVD- (n=928) 91.4%	p	CVD+ (n=41) 4.1%	CVD- (n=959) 95.9%	p
Age *	52.1	45.1	<.001	56.3	45.4	<.001	46.8	39.4	<.001	50.8	42.0	<.001	40.1	38.2	.347
Gender			.172			.381			.319			.989			.735
Male	18.9	25.5		20.0	25.8		33.0	27.9		29.9	30.0		12.2	10.5	
Female	81.1	74.5		80.0	74.2		67.0	72.1		70.1	70.0		87.8	89.5	
Education			.405			.494			.106			.037			.258
Unskilled	25.5	19.6		42.9	47.0		55.2	44.1		56.3	42.5		56.1	62.9	
Skilled	66.7	71.7		35.7	38.3		42.5	50.8		35.6	44.2		19.5	11.2	
Higher	7.8	8.7		21.4	14.8		2.3	5.2		8.0	13.3		24.4	24.9	
Income			.521			.527			.248			.183			.694
Lower	30.0	25.2		15.6	22.1		34.1	29.7		31.0	29.8		26.8	21.7	
Middle	44.4	50.3		48.9	47.9		40.9	50.2		50.6	43.0		43.9	49.5	
Upper	25.6	24.5		35.5	30.0		25.0	20.1		18.4	27.2		29.3	28.8	

* Mean (years)

Table VIII-4. Table 4. Frequency of fish intake among CVD+ and CVD- households; comparison within and between the countries (n=4,786)

	Belgium			Denmark			The Netherlands			Poland			Spain		
	CVD+ (n=90) 10.5%	CVD- (n=762) 89.5%	p	CVD+ (n=45) 4.0%	CVD- (n=1065) 96.0%	p	CVD+ (n=88) 10.9%	CVD- (n=721) 89.1%	p	CVD+ (n=87) 8.6%	CVD- (n=928) 91.4%	p	CVD+ (n=41) 4.1%	CVD- (n=959) 95.9%	p
Total fish (≥ 1/week)	67.8	50.1	.002	80.0	47.6	<.001	37.5	37.7	.967	54.0	54.8	.882	92.7	88.6	.421
Total fish (≥ 2/week)	33.3	20.7	.006	46.7	24.0	.001	26.1	16.8	.030	24.1	22.7	.766	82.9	71.1	.101
Fatty fish (≥ 1/week)	23.3	13.0	.008	42.2	32.6	.178	22.7	20.9	.699	47.1	41.9	.347	24.4	27.0	.711

The numbers indicate the percentage of respondents within each CVD group who eat fish in total at least once a week; at least twice a week; and fatty fish at least once a week. Mean values of fish intake were significantly different between countries for both CVD+ and CVD- (P<0.001).

Finally, in Spain, no significant differences in the frequencies of fish consumption between the two groups were found. However, opposite to the Polish respondents, Spanish consumers reported a very high total fish consumption level, with about 90% of the respondents claiming to eat fish at least once a week. Furthermore, 82.7% of the CVD+ versus 71.1% of the CVD- consumers stated to consume fish minimum twice a week, thus meeting the dietary recommendations with respect to fish consumption.

4.3 Potential factors influencing fish consumption

Table VIII-5 presents the results of the analysis of covariance (ANCOVA) performed for potential factors influencing the frequency of fish intake between CVD+ and CVD- respondents within each of the five countries and across the countries. Analysis of covariance was used to compare potential factors influencing the frequency of fish consumption by state controlling for age (in all countries) and education (in the case of Poland). Hence, this analysis yields the effects after removing the variance for which the covariates age and education account.

Both groups of respondents scored very high on the health beliefs related to fish consumption, meaning that all respondents perceive fish as a very healthy and nutritious food product. In general, no significant differences in the belief that eating fish is healthy and nutritious between the two consumers groups was found for the majority of the countries. Comparison of the beliefs across the countries shows that in both groups of CVD respondents, Polish, Danish and Spanish respondents were most positive, whereas Belgian and Dutch respondents were least persuaded of the healthy and nutritious properties of fish.

Table VIII-5. Mean values of potential factors influencing frequency of fish intake between CVD+ and CVD- households; comparison within and between the countries (n=4,786)

	Belgium #				Denmark †				The Netherlands ‡			
	CVD+ (n=90)		CVD-(n=762)		CVD+ (n=45)		CVD- (n=1065)		CVD+ (n=88)		CVD- (n=721)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Eating fish is healthy	6.25	1.21	6.09	1.21	6.61	0.65	6.37	1.00	5.98	1.57	5.99	1.33
Eating fish is nutritious	5.70	1.54	5.74	1.34	6.44	0.84	6.29	1.04	5.78	1.42	5.60	1.31
Life satisfaction	4.47	1.50	4.78	1.29	5.05	1.13	5.36	1.17	4.91	1.24	4.82	1.19
Subjective health	4.32	1.34	4.69	1.15	5.13	1.41	5.28	1.26	4.59	1.52	4.76	1.29
Interest in healthy eating	6.12	0.90	5.78	0.99	6.18	0.81	5.54	1.09	5.67	1.13	5.26	1.10
Health involvement	6.50	0.94	6.35	1.14	6.29	0.96	5.88	1.12	6.03	1.64	6.10	1.29
Information sources												
Use of medical	2.99	1.64	2.48	1.43	2.77	1.44	2.07	1.18	3.07	1.65	2.08	1.28
Use of non-medical	2.21	1.37	1.99	1.27	1.93	1.31	1.79	1.19	2.16	1.45	1.91	1.21
Trust in medical	5.00	1.22	4.84	1.41	5.14	1.44	5.00	1.24	4.62	1.31	4.68	1.25
Trust in non-medical	4.19	1.44	4.26	1.43	4.29	1.48	4.61	1.27	4.10	1.24	4.30	1.27
Objective knowledge	2.47	1.12	2.42	1.14	3.40	0.78	3.09	1.01	2.27	1.01	2.18	0.99
Subjective knowledge	3.72	1.66	3.13	1.48	4.04	1.77	3.38	1.64	2.94	1.52	2.91	1.55

Table 5. *Continued*

	Poland§				Spain ¶			
	CVD+ (n=87)		CVD- (n=928)		CVD+ (n=41)		CVD-(n=959)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Eating fish is healthy	6.42	1.18	6.45	0.99	6.51	1.12	6.24	1.07
Eating fish is nutritious	6.33	1.06	6.16	1.15	6.10	1.50	6.22	1.03
Life satisfaction	4.49	1.26	4.38	1.25	4.31	1.25	4.89	1.15
Subjective health	4.60	1.41	4.77	1.26	5.06	1.18	5.16	1.04
Interest in healthy eating	6.35	0.87	6.14	0.95	6.21	0.68	6.12	0.91
Health involvement	6.33	1.20	6.28	1.15	6.43	0.89	6.29	0.99
Information sources								
Use of medical	3.62	1.72	3.04	1.77	4.00	1.67	3.58	1.64
Use of non-medical	1.70	1.03	1.73	1.11	2.34	1.50	2.23	1.44
Trust in medical	4.52	1.76	4.05	1.84	5.46	1.15	5.17	1.24
Trust in non-medical	2.38	1.37	2.48	1.38	4.30	1.43	4.03	1.40
Objective knowledge	2.21	1.08	2.17	1.03	2.71	0.95	2.57	0.94
Subjective knowledge	3.83	1.45	3.71	1.48	3.98	1.29	3.83	1.37

Mean values of all constructs were significantly different between countries for CVD+ (P<0.001) (ANCOVA). Mean values were significantly different between countries for CVD- for all constructs (P<0.001), except for subjective health, health involvement and use of independent information sources (ANCOVA).
Significant differences between CVD groups in Belgium for life satisfaction (P=0.018), subjective health (P<0.001), use of medical info sources (P<0.05) and subjective knowledge (P=0.021) (ANOVA).
† Significant differences between CVD groups in Denmark for subjective health (P=0.014) and use of medical info sources (P=0.002) (ANOVA).
‡ Significant differences between CVD groups in the Netherlands for healthy eating (P=0.037) and use of medical info sources (P<0.001) (ANOVA).
§ Significant differences between CVD groups in Poland for use of medical info sources (P=0.014) and trust in medical info sources (P=0.039) (ANOVA).
¶ Significant differences between CVD groups in Spain for life satisfaction (P=0.001) (ANOVA).

Three personal self-reported health constructs were included in the analysis, namely satisfaction with life, subjective health and health involvement. In Belgium and Spain, CVD- respondents were significantly more satisfied with their life compared to the CVD+ respondents. In Denmark the difference in life satisfaction between the two groups was marginally significant (P=0.056), with CVD+ respondents scoring higher. Spanish CVD+ respondents were the least satisfied with their life, whereas Danish and Dutch CVD+ consumers were the most satisfied with life. With regard to people who did not report to face or have faced cardiovascular disease in their household, Danish and Spanish respondents scored highest, whilst Belgians and Polish lowest on life satisfaction.

In Belgium and Denmark, CVD- respondents scored significantly higher on subjective health than CVD+ respondents, meaning that the first perceive themselves as much healthier. Subjective health perception was not significantly different in the Netherlands, Poland and Spain between the two groups. In both CVD groups Danish and Spanish consumers considered themselves healthier as compared to people from Belgium, the Netherlands and Poland. Further analyses were undertaken to investigate whether the health constructs were correlated with each other. The present study found strong correlations ($p<0.001$) between satisfaction with life and subjective health ($r=0.511$ in Belgium; $r=0.515$ in Denmark; $r=0.581$ in the Netherlands; $r=0.500$ in Poland; and $r=0.439$ in Spain).

Interest in healthy eating was significantly different between the two groups the Netherlands and marginally significant in Denmark (P=0.056). In those countries, consumers facing the CVD in their direct social environment were substantially more interested in healthy eating. Although in general, the respondents from all countries were interested in healthy eating, some differences were noticed. CVD+ and CVD- consumers from Poland and Spain attached most interest to healthy eating, whereas consumers from the Netherlands displayed the lowest interest in healthy eating.

Finally, no significant difference between the two groups of respondents on health involvement was detected. Remarkably, all respondents scored very high on the health involvement construct, meaning that their personal health is evaluated as very important

to them. Consumers from both CVD groups from Belgium, Spain and Poland were the most involved with health, whereas Danish and Dutch consumers showed the lowest involvement with health.

In Belgium, Denmark, the Netherlands and Poland, CVD+ respondents indicated to use significantly more medical information sources about fish, such as doctor, dietician, and public health recommendations than CVD- respondents. Spanish and Polish respondents from both groups of CVD households reported the highest use of medical information sources, whereas Danish the lowest. The use of non-medical information sources, such as government and scientists, was not significantly different between CVD+ and CVD- in any of the countries but significantly different across the countries. Spaniards and Belgians used non-medical information sources the most frequent, while Poles and Danes least often. Remarkably, the scores on the use of medical information sources were much higher than the scores on the use of non-medical information sources. Doctor, dietician and public health recommendations were more frequently used as sources of information than government and scientists. With respect to trust in information sources, a significant difference between the two CVD groups was found only in Poland. CVD+ respondents reported significantly higher trust in medical information sources than individuals without medical history of cardiovascular diseases. However in general, Polish respondents held the lowest trust in all information sources compared with the other countries.

A marginally significant (P=0.085) difference in the objective, thus factual knowledge related to fish (with relevance to its nutritional nature) was found in Denmark between the two consumer groups. CVD+ respondents reported substantially higher objective knowledge about these fish aspects compared to CVD- subjects. Generally, Danish respondents (both CVD+ and CVD-) reported the highest, whereas Polish and Dutch respondents displayed the lowest objective knowledge. Only in Belgium, CVD+ respondents perceived themselves as more knowledgeable about fish than CVD- respondents. Danish CVD+ respondents and Spanish CVD- respondents evaluated themselves as with highest subjective knowledge about fish. Dutchmen and Belgians from both CVD groups perceived themselves as least knowledgeable.

Summing up, Belgian respondents from CVD+ households consumed fish significantly more frequently in general and fatty fish in particular. They reported more frequent use of medical sources of information. Additionally, they were more confident about their knowledge about fish, felt less healthy and less satisfied with their lives than CVD- respondents.

In Denmark, CVD+ respondents consumed fish significantly more frequently in general as compared to CVD- subjects. They were more interested in healthy eating and used more frequently doctor, dietician or/and public health recommendations as information sources about fish. Furthermore, they reported higher objective knowledge about fish, but they felt less healthy and less satisfied with their lives in comparison with the CVD- respondents.

In the Netherlands, both groups of respondents denoted very low fish consumption frequency levels. CVD+ consumers were more interested in healthy eating and reported higher use of medical information sources about fish than the other group of consumers.

Similarly to the Netherlands, Polish respondents reported a very low frequency of fish intake in general, but the highest frequency of fatty fish intake at least once a week. Individuals from households with a medical history of CVD in their households reported higher use of and trust in medical information sources.

Finally, Spanish respondents reported a very high fish consumption frequency. The only significant difference was found for the satisfaction with life construct. People from CVD- households reported to be more satisfied with their life in comparison with the CVD+ group.

5 Discussion

5.1 Fish consumption frequency

The purpose of this study was to explore the cross-cultural differences in the frequency of fish intake and motivation for fish consumption among people from households with versus without medical history of cardiovascular diseases, based on data from five

European countries. The results confirm our expectation that more of the consumers from households with a medical history of cardiovascular diseases followed dietary recommendations related to the frequency of total fish intake, i.e. ate fish at least twice a week, in comparison with consumers without medical history of CVD. Nevertheless, only in Belgium and in Denmark the differences in the total fish intake between the two groups were significant. This study emphasizes an enormous discrepancy in the frequency of fish consumption between Northern and Southern European countries. In Spain, almost three quarters of sample reported eating fish at least twice a week, whilst in the other countries only about one quarter did (Belgium 22.1%; Denmark 25.0%; the Netherlands 17.1%; and Poland 22.9%). With regard to frequency of the fatty fish consumption, in most of the countries (except in Spain) more people with a medical history of CVD ate fatty fish at least once a week in comparison with people without medical history of CVD. Nevertheless, only in Belgium the difference was significant. Interestingly, the Polish sample includes the highest number of respondents who reported consuming fatty fish at least once a week compared to the respondents from the other countries. The explanation is that herring, which is a fatty fish, is a traditional fish consumed in Poland (mostly marinated), and its high consumption among both CVD+ and CVD- respondents resulted in a relatively high frequency of fatty fish consumption (more than 40% ate fatty fish at least once a week). Nevertheless, this higher fatty fish consumption level as compared to other countries does not translate into higher total fish intake. Although Spaniards display the highest fish consumption frequency, only about one quarter of Spanish respondents declared to eat fatty fish at least once a week. This implies that differences in the fatty fish consumption levels might not be the result of adherence to dietary recommendations, but rather reflecting a tradition of eating (predominantly lean) fish as a part of the Mediterranean diet in Spain (de Lorgeril & Salen, 2006) and high herring consumption level in Poland (Pieńkowska, 2004). Although strong scientific evidence exists that lower risk of death due to coronary heart diseases is more strongly related to the intake of fatty fish rather than lean fish (He et al., 2004; Iso et al., 2006; Mozaffarian et al., 2003; Oomen et al., 2000), consumers may not be aware of it. Only in Belgium significantly more CVD+ respondents consumed fatty fish at least once a week compared with CVD- respondents. These findings may indicate

that for most of the respondents, fatty fish is not perceived as having particular health beneficial effects as compared to lean fish. Instead, the findings suggest that 'fatty fish' and 'fatty acids' might be rather associated with "fatty", thus high in fat, and therefore also less healthy or unhealthy. In a series of studies convincing evidence has been found (Carels et al., 2006; Oakes & Slotterback, 2001a, b, c) that foods acquire reputations of being good or bad; these reputations as well as "foods healthfulness" are greatly influenced by real or perceived fat content (food high in fat is believed to be unhealthy). Furthermore, a previous fish consumer study based on a Belgian consumer sample found that Belgian consumers held strong beliefs that regular fish consumption reduces risks for coronary heart disease, which is one of the cardiovascular diseases (Verbeke et al., 2005). This could explain the difference observed in the frequency of fatty fish intake between both CVD groups in our Belgian sample.

5.2 Motivational aspects for fish consumption among CVD+ versus CVD- subjects

In general, the results display significant differences between the countries in most of the investigated motivational aspects for fish consumption (except for the belief that eating fish is healthy). No significant differences in the beliefs about fish health and nutrition were found between the two groups in the majority of the countries. Both CVD+ and CVD- respondents perceive fish as a very healthy and nutritious food. This confirms previous reports demonstrating that fish has a healthy image among consumers (Brunsø, 2003; Brunsø et al., 2007; Gross, 2003; Pieniak et al., 2007c; Verbeke et al., 2005). Only in Denmark, consumers from CVD+ households perceived fish even healthier and more nutritious than the CVD- subjects.

In general, respondents from households with a medical history of cardiovascular disease, feel personally less healthy than the respondents not confronted with CVD in their household, as demonstrated by the CVD+ subjects' lower score on the subjective health construct. Nevertheless, only in Belgium this difference was significant. Our results confirm previous findings where subjective health was found to be routinely better among people with fewer illnesses (Ferraro et al., 1997; Idler & Kasl, 1995; Wannamethee & Shaper, 1991). Furthermore, Belgian ($p=0.068$) and Danish ($p=0.086$)

and Spanish (p=0.002) CVD+ respondents (tend to) feel less satisfied with their life than CVD- respondents. These findings are in agreement with previous reports where self-rated general health was found to associate with future health and people's satisfaction with life (Benyamini et al., 2004).

Recommendations about healthy eating have been shown to influence consumers' food-related beliefs and consumption patterns (Harel et al., 2001; Nayga, 2000). Perceptions and beliefs are shaped by knowledge, which in turn is a product of exposure to information sources and personal effort in obtaining information (Mcintosh et al., 1994). In this study, respondents from households with a medical history of CVD in almost all countries (except in Spain) reported substantially higher use of medical information sources. In Denmark, CVD+ respondents not only reported higher frequency of total and fatty fish consumption but also held stronger beliefs about fish health. Additionally, they displayed higher subjective and objective knowledge about fish in the context of cardiovascular diseases. However, this was the case only for Danish consumers. In the other countries, despite CVD+ subjects' higher claimed use of medical information sources about fish, their objective knowledge was on a low level, similar as for respondents from households without medical history of cardiovascular diseases. Research carried out on the general population in Poland found that men with coronary heart diseases and women with a family history of CVD death reported significantly higher levels of knowledge related to CVD prevention methods (Piwonska et al., 2006). In our study, both groups of Polish respondents reported a very low level of objective knowledge about fish. With regard to Belgian consumers with medical history of CVD, despite a significantly higher subjective knowledge level, their objective, i.e. factual knowledge is on the same level as for CVD- respondents.

Previous research indicated that consumers face difficulties in understanding concrete information about dietary fat and that the majority of consumers is not particularly interested in knowing more on the subject (Federation of American Societies for Experimental Biology, ; The American Dietetic Association, 1995). This may explain, first, the low level of objective knowledge about fish in the context of cardiovascular diseases in the majority of the countries, and second, the fact that fatty fish and fatty acids

are not consistently understood as beneficial for health. The latter may also result from awareness of the potential presence of, and toxicological risks posed by particular fat-soluble environmental contaminants such as PCBs and dioxins in fatty fish species. However, empirical findings indicate that consumers are either hardly aware of these risks, or they are not particularly concerned about contaminants in fish (Pieniak et al., 2007b).

Some limitations of this study should be acknowledged. The most important limitation relates to the fact that we used a rather blunt measure for CVD prevalence. Respondents were grouped into those with versus without a medical history of cardiovascular diseases based on a single item measure. As a result, the data obtained on CVD prevalence could potentially suffer from some weakness in the external validity. The single question probing for CVD prevalence could have been interpreted in different ways in different countries and – within countries – also variations in the understanding and the conceptualisation of this category of diseases could have been occurred. A similar effect modification could have been introduced because of differences in the understanding and interpretation of these terms and concepts between social classes. These limitations might partially explain why the gradients in CVD prevalence do not perfectly match the picture known from longitudinal epidemiological studies that have measured CVD prevalence in a standardised way, like the WHO MONICA study (Evans et al., 2001; Truelsen et al., 2003). From these studies, it is known that CVD prevalence in general increases from Southern Europe to the North and from Western Europe to the East. Nevertheless, the absence of any significant differences between sexes in the reported CVD prevalence suggests a similar understanding of the construct of the question on CVD; in the opposite case, a much higher prevalence would be expected in males. Overall, it can be concluded that the characterisation of individuals as a function of a medical history for CVD has not reached the highest accuracy level for this study, but at the same time there is an indication for sufficient discriminatory value in order to allow some carefully formulated conclusions in terms of knowledge, behaviour and attitudes related to fish consumption. Furthermore, this study focused only on health-related factors that are only one kind of driver of food choice, dietary habits and eating behaviour, such as fish consumption, and mostly not even the main one. Other factors, like taste, availability, convenience and

price perceptions may account for substantial differences in fish consumption behaviour, and therefore, future research investigating the impact of such perceptions together with those investigated in the study is highly recommended.

Furthermore, the present study may face some limitations induced by the use of different sample selection, recruitment and contact procedures that were used across the countries. The choice of procedures was informed by best practice within each country. Although the difference in procedures may have introduced some bias, most important is that all questionnaires were self-administered by the participants, and that the procedures yielded samples that are representative for age and region within each country. Although some differences in the composition of the sample exist, more specifically with respect to the age distribution, the applied statistical analyses (ANCOVA) have allowed accounting for the variance induced by such covariates. Moreover, it should be noted that the data were collected within a broader consumer survey, focusing mainly on motives, barriers and attitudes with respect to eating fish in Europe, and not on measuring actual fish intake. Inference was often drawn based on claimed and self-reported behaviour. These answers may be subjected to social desirability, post-rationalisation, and cognitive dissonance or consonance and hence may deviate from actual behaviour. Therefore, it is recommended to take the issues relating to attitudes and knowledge as covered in our study on board in future epidemiological studies. Finally, testing for various degrees of invariance or equality in the model between the countries, using multiple group comparisons analysis, is recommended. For example, the role of explanatory variables in fish consumption behaviour could be compared between the CVD+ and CVD- consumers in the five countries.

6 Conclusions

In Belgium and in Denmark, people from households with a medical history of cardiovascular diseases consumed fish more frequently as compared to people who were not confronted with CVD. Surprisingly, the consumption of fatty fish, which is the main source of omega-3 PUFA associated with the prevention of cardiovascular diseases (Mozaffarian & Rimm, 2006), was on the same level for the two groups in the majority of

the countries (except in Belgium). Despite higher use of medical information sources about fish and higher interest in healthy eating in most of the countries among CVD+ respondents, their objective or factual knowledge about fish was on the same level as the respondents of CVD- households. This might be the most likely reason why fatty fish consumption was not more elevated in this group as compared to the consumers from households without medical history of CVD. Clearly, fish consumption traditions and habits – rather than a medical history of CVD – account for large differences between the countries, particularly in fatty fish consumption, which is very obvious in the cases of Spain (rather lean fish consumption) and Poland (rather fatty fish consumption).

Only in Belgium, the CVD+ consumers reported a significantly higher frequency of total and fatty fish intake which could be mainly due to their highest health involvement, their higher subjective knowledge and more frequent use of medical sources of information. With regard to Danish CVD+ respondents, their higher frequency of total fish consumption might be due to their highest level of subjective and objective knowledge and their higher health involvement. In Poland, higher use of medical information sources about fish and higher interest in healthy eating did not result in a higher frequency of fish consumption. In Spain, the fish consumption frequency is on a very high level, independently of their motivational aspects. Clearly, eating (mainly lean) fish is strongly habitual and a part of the traditional Mediterranean diet in Spain.

This study exemplifies the need for nutrition education and more effective communication about fish, not only to the people facing chronic diseases, but also to the broader public. Consumers are convinced that eating fish is healthy, but on one hand, particular emphasis should be on communicating benefits from fatty fish consumption, as the results suggest that people might perceive "fatty" in general as negative. On the other hand, by communicating benefits from fatty fish consumption respondents may perceive this as receiving contradictory information (in the case of meat, "fatty" is associated with unhealthy), which has been shown to have a negative influence. Communicating effectively requires that the target population is identified and their specificities are well understood and taken into account so as to make information meaningful, useful and efficient. Therefore, further research to explore consumers' knowledge about fish is

recommended. More specifically, research on subjects with a medical history of cardiovascular diseases with regard to their health perception of fish, relation between knowledge about content and role of omega-3 fatty acids in fish and prevention of cardiovascular diseases is needed in order to issue appropriate dietary recommendations and public health information for both CVD+ and CVD- subjects. Even so, further research is needed dealing with the impact of information on consumer decision-making in the specific case of fish consumption.

Chapter IX

Discussion and conclusions

1 Recapitulation

The overall objective of this study was to improve the understanding of determinants of seafood consumption among European consumers'. Emphasis has been placed on the impact of information and health-related beliefs on fish consumption behaviour. Analyses were made based on the conceptual framework developed in *Chapter I* derived from the literature review. Qualitative exploratory research and quantitative conclusive research have been carried out and data served as input for statistical analyses.

In the first three chapters European consumers' interest in and need for information related to fish, their knowledge about fish, and also beliefs, attitudes and behaviour toward fish consumption were assessed. In *Chapter II* the information search stage of consumer making decision process was explored through literature review and focus group discussions in Belgium and Spain. Based on insights from literature, a conceptual framework dealing with the role of information in consumer decision-making towards food was presented. Secondary data from literature were combined with primary qualitative data and constituted the basis for questionnaire development and further quantitative research. In *Chapter III* further investigation of the information search stage of the consumer decision process was provided using the primary data obtained from the consumer survey carried out in five European countries (n=4,876). Consumers' use of and trust in information sources, interest in information cues, as well as knowledge about fish, were assessed. Constructs related to information were cross-culturally validated. *Chapter IV* bridged to the next stage of the consumer decision process, namely the

evaluation of alternatives, and described consumers' beliefs, attitudes and behaviour toward fish consumption based on the exploratory study and the consumer survey.

In the next two chapters, the impact of affective and cognitive determinants of fish consumption through the conceptualisation and validation of two models by means of structural equation modelling (LISREL) was assessed. More specifically, *Chapter V* investigated associations between consumers' health beliefs, health involvement and risk perception and fish consumption, whereas *Chapter VI* investigated the impact of affective (the belief that eating fish is healthy and interest in healthy eating) and cognitive (knowledge about fish) determinants on fish consumption behaviour. Additionally, constructs related to health beliefs and risk perception, were cross-culturally validated.

In *Chapter VII,* three consumer groups on the basis of their utilisation of and trust in information sources were identified, namely Sceptics, Enthusiasts and Confidents. These three clusters differed in their knowledge level, behaviour towards fish consumption, use of potential and existing information cues, health beliefs and risk perception, and finally also with respect to their socio-demographic profile. Opportunities for targeted information provision efforts have been presented.

Finally, in *Chapter VIII*, a specific case study dealing with fish consumption among people from households with versus without a medical history of cardiovascular diseases was provided. Cross-country differences in fish consumption (and compliance with dietary recommendations) as well as potential motives for fish consumption were presented and discussed.

2 General discussion

In the implemented research (see *Chapter I*, section 3), ten hypotheses were developed and will be verified and discussed in subsequent paragraphs. Furthermore, general discussion of the results in light of the proposed conceptual framework will be provided.

2.1 Constructs cross-culturally validated

The present data were collected in five different EU member states, which implies some concerns related to the cross-cultural validity of the collected information. In order to deal with the cross-cultural issue of our data, we have followed the procedure presented by Steenkamp and Baumgartner (1998). Confirmatory factor analyses for constructs related to information and knowledge (*Chapter III*) and to health-related beliefs, health involvement and risk perception (*Chapter V*) were performed. The scalar invariance assumption was acceptable for the use of information sources items and the trust in information sources items, the health involvement items, the interest in healthy eating items and the risk perception items. The metric invariance assumption was acceptable for the use of information cues items, the objective knowledge items, the subjective knowledge items, the need for cognition items, the intention items, the subjective health items, the satisfaction with life items, and tentatively acceptable for the interest in information cues items. The results indicate that the considered constructs have a similar meaning and structural characteristics across the considered cultures within Europe. Therefore, those constructs are proven to be cross-culturally valid **(H2 and H6 confirmed)**. This means that observed differences are real differences, in the sense that they do no stem from cross-cultural differences in the interpretation of the concepts and items presented in the questionnaire.

2.2 Attitudes, health-related beliefs and fish consumption behaviour

In general, fish was strongly perceived as a healthy and nutritious food by consumers, particularly as compared with meat as its main substitute protein source, which confirms previous findings (Olsen, 2003; Verbeke et al., 2005). Furthermore, people do not

perceive a high risk of food poisoning from eating fish and fish is considered as a safe product to consume. Next, European consumers were found to be very interested in health and healthy eating. However, despite the positive attitudes and high involvement with health and healthy eating, the self-reported fish consumption data were rather on a low level, especially as compared to the current dietary recommendations with respect to fish. The total sample average fish consumption was 1.49 times per week (±1.50), mainly due to the very high fish consumption level in Spain. This study emphasises an enormous discrepancy in the fish consumption level between Northern and Southern European countries. In Spain, almost three quarters of sample (71.6%) complied with dietary recommendations regarding fish, i.e. reported to eat fish at least twice a week, whilst in the other countries only about one quarter did so (Belgium 22.1%; Denmark 25.0%; the Netherlands 17.1%; and Poland 22.9%). Consumers' fish consumption levels were strongly influenced by socio-demographic factors. Fish consumption frequency (for the total sample) was found to be higher among women **(H5a confirmed)**, and unexpectedly decreased with age **(H5b rejected)**. Cross-country analyses showed that in Belgium, Denmark and the Netherland ageing was found to considerably increase fish consumption frequency, whilst in Poland and Spain the opposite tendency was reported. Higher education was associated with higher fish consumption. Middle and higher income tended to increase the fish consumption level as well **(H5c confirmed)**. Presence of children did not emerge to significantly influence fish consumption levels among the total sample.

2.3 Cross-country differences

Considerable differences between consumers from the five European countries exist with regard to their attitudes **(H2a confirmed)**, health-related beliefs **(H2b confirmed)**, information use **(H2c confirmed)** and claimed fish consumption **(H2d confirmed)**. The main characteristics of consumers from each country are summarised below.

Consumers from **Belgium** reported low fish consumption. Fish intake was much higher among older consumers and those living without children. When compared to the other countries, Belgians perceived eating fish as somewhat less healthy, nutritious and safe

(however, they held still very positive attitudes), and more risky to consume. They held the strongest negative beliefs about fish, particularly related to unpleasant fish bones and the high price of fish. Additionally, they felt the least confident regarding the evaluation of fresh fish quality. On the other hand, Belgian consumers were the most involved with health; reported moderate usage of health-related information sources; moderate to rather low usage of the standard information cues; and relatively high trust in more independents information sources about fish, such as consumer organisation, newspapers, government and scientists; and the highest interest in a quality mark for fish.

Danes reported the second highest fish consumption in this study. Particularly, older consumers, higher educated and living in a family without children were found to consume fish more frequently. Consumers from Denmark held very strong attitudes toward fish healthiness and nutritional value and were the most confident regarding the evaluation of fresh fish quality. They perceived fish bones as the least unpleasant and had weaker beliefs that eating fish is safe. When compared to the other countries, Danes considered themselves healthier; and the most satisfied with life. However, they indicated the lowest involvement with health and relatively low usage of health-related information sources. Danes reported the highest trust in more independent information sources about fish and the highest usage of expiry date, date of capture, and nutritional composition. Those consumers not only had the highest factual (objective) knowledge about fish but also were the most interested in information cues related to the origin of fish, sustainability issues, but also method of preparation, safety guarantee and quality mark.

Consumers from **the Netherlands** scored the lowest on all potential motives for fish consumption and the highest on potential barriers for fish consumption (except for price). They also reported the lowest fish consumption at home. Fish consumption frequency in the Netherlands was higher among women, consumers aged over 55 years, higher educated and families living without children. Dutch consumers displayed the lowest interest in healthy eating and the lowest interest in all considered potential information cues. They reported a relatively low usage of health-related information sources and estimated their knowledge about fish as the lowest one compared to the other countries.

They seem not to be interested in healthy eating in general, and fish consumption in particular.

Despite displaying the most positive attitudes towards fish health, nutrition and safety, **Polish** consumers reported relatively low total fish consumption and the lowest fish consumption out of home. Potential barriers corresponded to unpleasant fish smell and bones, high price, and Poles' feeling as the least confident regarding the evaluation of fresh fish quality. Consumers from Poland were the least satisfied with their life. They attached most interest to healthy eating and were the most involved with health. They reported a relatively high usage of health-related information sources, but also family and friends and fish or food industry. Polish respondents were the most suspicious; they held the lowest trust in almost all information sources (except trust in family and friends). They reported the highest usage of price, weight, fish species name, brand name and nutritional composition as information cues on fish labels; and displayed the highest interest in health benefits and the lowest in fish welfare. Although Polish consumers had the lowest factual (objective) knowledge, their subjective self-evaluation of fish knowledge was the highest as compared to consumers from other countries.

Spanish respondents reported the highest consumption of fish. They were the most confident regarding the evaluation of fresh fish quality and held strong attitudes towards fish safety. Nevertheless, Spaniards perceived fish bones and smell as very unpleasant. Consumers from Spain attached most interest in healthy eating, were the most involved with health and considered themselves as healthier in comparison to the other countries. They reported the highest trust in supermarkets, fish monger, family and friends, doctor and advertising the highest usage of capture area and the lowest use of expiry date, the latter corresponding with their greatest experience and familiarity with evaluating freshness and quality of fish. Additionally, they were most interested in health benefits, wild/farmed and feed used during farming. Spanish consumers reported both high objective as well as subjective knowledge.

2.4 Sources of fish information used and trusted

Key insights with regard to the information search stage in the consumer decision making process were first obtained from qualitative focus group discussions and literature review (*Chapter II*) and second, quantitatively validated through the consumer survey research (*Chapter III*). The results showed a rather wide diversity in consumer's use of and trust in different sources of information related to fish. Personal sources were the most frequently actively used and trusted information sources by consumers. Additionally, European consumers displayed a high level of trust in health-related information sources about fish. Furthermore, people with the strongest interest in the health-related sources paid also more attention to health and nutrition-related information sources and cues. This finding emphasises the need to ensure that health professionals communicate simultaneously information related to health and food with a special focus on the role of fish on a diet. Doctors and dieticians are well placed to be involved in the dissemination of information on food, nutrition (e.g. nutritional composition of fish, sources of omega-3 acids, etc.) and heath (e.g. health benefits from eating fish).

Consumers' use of and trust in information sources and cues about fish were found to be affected by socio-demographic factors **(H3 confirmed)**. In general women, older and higher educated consumers displayed higher use, trust and interest in information sources and cues. Therefore, confirming previous findings, depending on the message one wants to communicate the consumers, different media and sources of information should be used (Gutteling & Wiegman, 1996; Jungermann et al., 1996; Richardson et al., 1994). Furthermore, the results of this research suggest that it is crucial, when evaluating the potential usefulness and effectiveness of information sources, to consider both people's use of information sources with their trust in them (Thiede, 2005). It is important to understand people's choices of certain information sources when in fact they do not really trust these (e.g. commercial or economic operators) and/or although other information sources (e.g. health professionals) are highly trusted, they are not really utilised. Such an insight would help those involved in the communication and promotion of fish to be more aware of the real obstacles and reasons why most of people do not consume fish in line with dietary recommendations.

2.5 Use of label's information

In this study, special attention has been also paid to the use of information cues on fish labels, packages or shelves. In general, labels were found to be good, market effective, sources of information. Consumers were most familiar with information cues like expiry date, price, species name and weight and they felt able to derive clear quality expectations from the information these cues convey. The strongest interest in potential information cues was displayed for a safety guarantee and a quality mark for seafood. Potential opportunities for the fish industry related to use and interest in information cues will be described further in this chapter in section 4.

2.6 Three consumer segments identified

As indicated in the previous paragraph, it is essential to combine people's use of information sources with their trust in them. Therefore, identification of possible groups of consumers (market segments) based on both their use of and trust in information sources was performed. Three consumer groups, for which the within-group differences were significantly smaller than between-group differences, were identified and profiled in *Chapter VII*. Hence, the hypothesis **H9 is supported**. These three clusters differed in their knowledge level, behaviour towards fish consumption, use of potential and existing information cues and finally socio-demographic composition, which yields opportunities for targeted information provision efforts. Interestingly, this study revealed that there is no group of consumers who report very low trust levels, but at the same time high use levels of information sources related to fish. This finding indicates a minimum level of trust might be required before information sources are critically examined and (reported as) used. In the extreme situation of very low trust, consumers are unlikely to examine information sources in any way; that is neither critically nor uncritically. Sceptical distrusting but involved consumers do not seem to exist, at least not with respect to fish information sources. Whether this conclusion holds similarly to other food categories deserves further attention in future studies, for example with respect to meat where consumer perceptions were shaped largely by safety issues that have been the cornerstone of public information policies.

The first segment, who were called Sceptics, included consumers who were very passive towards trusting and using any information with regard to fish. This segment included more older and male consumers who displayed the lowest fish consumption level; therefore they could be a very relevant communication target, especially from a public health point of view. However, this is also the most difficult group to reach by communicators and marketers because of what may be called a genuine disinterest in any information about fish. Additional analysis showed that people from this group hardly used information sources but also did not use any particular information cues.

Enthusiasts constituted the biggest consumer group who used and trusted in all information sources about fish. In general, they were the most interested in information about fish and they used different information cues on the labels to obtain this information. Importantly, this segment consists of relatively more women than men. We could speculate that they are the most fish-information involved group of consumers who are still open to receiving and using more information related to fish.

The last segment "Confident fish consumers" was the smallest consumer group, consisting of relatively more younger people who did not really use any information sources but had high trust in authorities, such as government, scientists and consumer organisations. They simply "trust on the system". This consumer group, together with the Sceptics, reported a low fish consumption level. However, this is the easiest group to reach by communicators and marketers because of their high trust.

Finally, this study revealed the lack of the fourth group of consumers, who particularly do not trust, but at the same time highly use of information sources about fish.

2.7 Knowledge about fish consumption

Knowledge is known as an important construct in consumer's decision making process. Investigation of the impact of consumer knowledge (subjective and objective) about fish on fish consumption behaviour revealed that what people believe to know about fish matches poorly with their actual objective knowledge (*Chapter III*). Subjective knowledge was found to be more strongly correlated with behaviour than objective

knowledge, in this particular case, fish consumption frequency **(H4 confirmed)**, in line with results obtained by Radecki and Jaccard (1995). This suggests that subjective knowledge is likely to be a better determinant/better predictor of total fish consumption than objective knowledge. Therefore, future communications are recommended to concentrate on consumers' self-assessed knowledge, e.g. improving consumers' self-confidence in evaluating fish quality; because it appears important what people believe to know rather than what they actually know.

2.8 Influence of health-related beliefs on fish consumption

The potential impact of subjective and objective knowledge on fish consumption frequency was further investigated in *Chapter VI* through incorporating subjective and objective knowledge, together with interest in healthy eating, health involvement and belief that eating fish is healthy in a structural equation modelling analysis. Consumers' belief that eating fish is healthy, interest in healthy eating, objective and subjective knowledge about fish were found to have a positive impact on fish consumption **(H8 confirmed).** However, the association between the belief that eating fish is healthy and fish consumption is weaker than we might have been expected. This result is very important as it suggests that a very positive belief, which holds true for the majority of respondents, that eating fish is healthy, is actually not sufficient to convince/encourage people to eat fish. Improving this simple belief that eating fish is healthy is superfluous, since it is already very strong and leaves little room to be further improved. On the other hand, results from another structural equation modelling analysis (*Chapter V*) suggested that reinforcing or confirming existing health-related beliefs might be important in the development of effective strategies for stimulating fish consumption. Health involvement is found to be an indirect driver of both subjective health and fish consumption, whilst interest in healthy eating emerges as a direct driver of fish consumption behaviour. Furthermore, although people do not perceive a high risk of food poisoning from eating fish, risk perception was significantly and negatively influencing fish consumption **(H7 confirmed)**.

2.9 Important role of healthy eating

This doctoral study highlights the importance of considering consumers' general interest in healthy eating as a target variable for improving fish consumption. The effect of belief that fish is healthy is found to be partially mediated by people's interest in healthy eating. Furthermore, consumers' interest in healthy eating is shown to positively influence fish consumption behaviour, which confirms previous studies (Gempesaw *et al.*, 1995; Olsen, 2001; Olsen, 2003). Additionally, by being positively related to fish consumption frequency, interest in issues related to diet and health confirms that consumers believe in the role of fish in a healthy eating pattern. Therefore, fish is proven to be considered as a part of a healthy diet. The need for more effective communication about healthy eating and fish consumption as a part of a healthy eating pattern to the broader public will be discussed in the next section.

2.10 Need for nutrition education

This study exemplifies the need for nutrition education and more effective communication about healthy eating and fish consumption as a part of a healthy eating pattern, to the broader public and to the people facing chronic diseases (themselves or in their direct social environment), such as cardiovascular diseases. Consumers are convinced that eating fish is healthy, but particular emphasis on the one hand should be on communicating benefits from fatty fish consumption, as the results showed that people might perceive "fatty" in general as rather negative. On the other hand, by communicating benefits from fatty fish consumption, respondents may perceive this as receiving contradictory information (in the case of meat, "fatty" is associated with unhealthy), which has been shown to have a negative influence on food choice. Nevertheless, in general, informing people that eating fish is healthy, not only will increase consumers' knowledge about fish, but also raise their attention to how important it is to eat healthily and is likely to raise the overall interest in healthy eating. The management of information from agriculture and the food industry requires that the target population is identified and their specificities are well understood and taken into account so as to make information meaningful, useful and efficient.

2.11 Special focus on household with a medical history of cardiovascular diseases

More consumers from households with a medical history of cardiovascular diseases followed the dietary recommendations related to the total fish intake, i.e. ate fish at least twice a week in comparison with consumers without medical history of CVD (**H10 confirmed**). Nevertheless, only in Belgium and in Denmark those differences were significant. Surprisingly, the consumption of fatty fish, which is the main source of n-3 PUFA associated with prevention of cardiovascular diseases (Mozaffarian & Rimm, 2006), was on the same level for the two groups in the majority of the countries (except in Denmark). With regard to the fatty fish consumption level, in most of the countries (except in Spain) more people with a medical history of CVD ate fatty fish at least once a week in comparison with people without a medical history of CVD. Nevertheless, only in Belgium the difference was significant. Despite a higher use of medical information sources about fish and a higher interest in healthy eating (social responsibility measure?) in most of the countries among CVD+ respondents, their objective or factual knowledge about fish was on the same level as for the respondents without medical history of CVD. Likely, this is the reason why fatty fish consumption was not more elevated in this group as compared to the consumers from households without medical history of CVD.

3 Major implications

Implications from this doctoral research extend to four different levels: fish industry, retailers, public health authorities and future scientific research. Issues deal with communication and marketing. Practices in the fish industry and retailers as well as communication to consumers from different information sources are considered.

First, at fish industry level, marketers could take advantages of the healthy and safe image of fish among a large majority of the consumers. Trends relating to healthy-eating, safety, freshness, convenience and high quality food product at the consumer level urge for product and process innovations, as well as for the adoption of new technologies and extensive quality control. Consumers' high usage of information cues placed on fish labels, and high interest in a safety guarantee and quality mark as potential information cues, provide opportunities for effective and efficient communication through seafood

labels. Furthermore, by introducing such a safety guarantee or quality mark as information cues, consumers trust (which now is on moderate level) in information provided by the fish industry could possibly raise, at least if this introduction can be backed up by trustworthy controls and guarantees provided by watertight traceability. Finally, in order to be efficient and effective, marketers (and health practitioners?) are recommended to deliver tailored marketing and communication strategies, including the provision of specific fish information to each of the identified consumer segments (*Chapter VII*).

Second, retailers could realise the responsible role they fulfil in the communication with consumers. Since consumers undoubtedly indicated the highest use of and trust in personal information sources (such as fish monger), retailers are recommended to invest time, effort and irrecoverable resources to create and communicate marketing offerings that satisfy consumers' needs and inform consumers e.g. about the benefits of eating fish on human health. Additionally, they should develop and implement efficient relationship marketing tactics as a foundation for strong relationship commitment with consumer.

Third, public health authorities should educate not only end consumers, but also retailers and health professions about importance of fish consumption in a healthy diet since they were identified as the most used and trusted information sources. Need for more effective communication about healthy eating in general, as well as advantages of fish consumption to the broader public has already been described in section 2.8 of this chapter.

Finally, future research recommendations that emerge from this doctoral thesis deal with methodological and marketing, communication issues. Communication related to healthy eating became one of the major findings from this study. Also, testing of such a communication strategy could be an interesting path for future research. Future scientific research could investigate what particularly consumers understand as a healthy diet in general, and more specifically, in relation to fish consumption. Specifically, fish species, origin of fish, form of preservation and preparation should be explored. Further future research recommendations are described together with limitations of this doctoral research in the section underneath.

4 Limitations and future research

The results of the present study are undoubtedly meaningful for better understanding whether and to what extent factors such as information and health-related beliefs are influencing European consumers' fish consumption. Nonetheless, the choice for a specific research design, with its corresponding materials and methods also imposed some limitations on this doctoral research.

First, the cross-sectional data were obtained from representative sample of respondents from five European countries Belgium, Denmark, the Netherlands, Poland and Spain. Those countries are rather Nordic oriented (except Spain), which could have its drawbacks with respect to the validity of a generalisation of our findings for other European markets, marketers and public health authorities. On the one hand, the world market is strongly globalising, with large multinational companies controlling global food markets in the European Union. Also, seafood is the most globally trade food commodity. On the other hand, an increasing regionalisation of food markets is observed. Markets become saturated with the global food products and consumers start to attach additional value to national or even regional products. Future research focusing on whether fish is perceived either as a national/regional or rather as a global food product is recommended. Furthermore, our study focused on fish as a product category, without differentiating between different fish species or fish from different origins (e.g. geographic, wild versus farmed), neither did we look especially to shellfish, where consumer beliefs, opinions and reactions might be slightly different e.g. because of higher risks for microbial contamination or allergenenicity. Future research using similar survey questionnaires could focus on a more specific product level. Additionally, as already mentioned, our selection of countries has been limited and further cross-cultural validation of our findings would be relevant and interesting.

Second, apart from the initial qualitative research, all of the findings relate to a single consumer survey. Despite the advantage of having a large number of variables assessed across a very large sample (n=4,786), there are some drawbacks to this research (thesis) methodology. Gathering the data through a cross-sectional survey does not allow for the development of ideas across the chapters as a series of studies would have allowed.

Additionally, presenting the analyses as a series of papers leads to a geat deal of repetition. Next, the consumer survey data were collected only from fish consumers. As a result, this study only reports an attitudinal perspective as provided by people who eat fish. No information about actual reasons for not eating fish is known. Perceived barriers related to reasons for not eating more fish, rather than to not at all eating fish. Therefore, future studies focusing on consumers attitudes toward not eating fish are recommended.

Third, it is important to note that some of the findings from this study did not result from direct questioning, e.g. we did not directly probe about reasons for refusing or eating fish. This approach has the advantage that it avoids socially desirable answering to a large extend, but also brings along the disadvantage not to prove any causality, though only association. To resolve issues related to causality in future research, the adoption of conclusive experimental and casual designs is recommended.

Fourth, inference was often drawn based on claimed and self-reported behaviour. These answers may be subjected to social desirability, post-rationalisation, and cognitive dissonance or consonance and hence may deviate from actual behaviour. This limitation is particularly important with respect to intention to eat fish and fish consumption behaviour.

Finally, the focus of this study was on information and health-related beliefs. Within the conceptual framework, affective and cognitive bases of fish attitudes were identified and a choice was made to concentrate on a set of specific attitudes in the analyses. However, further consumer research on fish as a food product, but also more general food selection/preference should incorporate and explore additional factors influencing consumers' decision making process, such as environmental (including sustainability and animal welfare issues) and person-related factors as well as properties of the food.

5 Main conclusions

- This study provides cross-culturally validated measures of information, knowledge, behaviour, health beliefs, health involvement and risk perception in relation to fish across consumer samples taken from Belgium, the Netherlands, Spain, Denmark and Poland.
- Fish was strongly perceived as a healthy and nutritious food by consumers, particularly as compared with meat as its main substitute protein source. Furthermore, fish was considered as a safe product to consume and people did not perceive high risk of food poisoning from eating fish. Nevertheless, higher risk perception related to fish was found to weakly but significantly negatively influence fish consumption.
- Wide diversity in consumer's use of and trust in different sources of information related to fish was found. Personal sources were the most frequently actively used and, together with health-related, the most trusted information sources by consumers. Women and higher educated consumers used most of the information sources more often.
- High use of on-label information cues was reported; hence, labels were found as good, market effective, sources of information. Consumers were most familiar with these cues and they felt able to derive clear quality expectations from the information these cues convey. The strongest interest in safety guarantee and a quality mark for seafood was displayed.
- Affective and cognitive beliefs (components of attitudes) have been recognised as determinants to fish consumption behaviour through development of two unique models by means of structural equation modelling. First model related health beliefs (subjective health and satisfaction with life), health involvement (and interest in healthy eating) and risk perception to fish consumption, whereas the second focused on associating belief that eating fish is healthy, interest in healthy eating and subjective knowledge with fish consumption. Health involvement, interest in healthy eating and subjective knowledge positively influenced fish consumption frequency.

- Consumers' health-related beliefs were found to be important factors influencing fish consumption. This result provides additional potential and opportunity for public health authorities in creating more effective communication with respect to fish consumption.
- Importance of subjective knowledge as determinant of fish consumption was emphasised. Improving consumers' subjective knowledge is more likely to cause an increase in the fish consumption as compared to the strategies aiming at increasing consumers' objective knowledge.
- Three distinct clusters, based on use of and trust in fish information sources, were identified: Sceptic (24.0%), Enthusiast (41.4%) and Confident (34.6%). Those consumer segments differed significantly with respect to use of and interest in information cues on fish labels, knowledge, behaviour and beliefs toward fish consumption, and socio-demographic profile.
- Future research is recommended, particularly focusing on (1) other countries(not only European); (2) specific fish species; (3) the comparison of shellfish with finfish; (4) the actual measure of fish consumption behaviour, (5) the testing the impact of communication strategies; and (6) the use of experimental design in order to test for causality.

SUMMARY

Owing to its evident benefits on human health on one hand, and also because of some potential harmful effect on the other hand, fish has been widely communicated to the consumers. The public is faced with seemingly conflicting news/messages over the benefits and risks from eating fish, resulting potentially in controversy and confusion over the role of fish consumption in a healthy diet, at least in consumers' perception. This doctoral research has been performed within the frame of the European Integrated Project SEAFOODplus. The overall objective of the research was to improve the understanding of information and health-related beliefs as determinants of European consumers' fish consumption. Important levels of analysis were cross-cultural variations in Europe, consumers' needs for fish information, attitudes and preferences in relation to fish, and the link of these aspects to perceived health, well-being and involvement with health from a consumer point of view. This PhD thesis is structured using a conceptual framework based on three stages of the classical consumer decision-making process: information search, evaluation of alternatives and behaviour itself. Both qualitative exploratory (focus group discussions) and quantitative conclusive (pan-European consumer survey) studies were conducted, with secondary and primary data input.

From the applied research, the following major conclusions are drawn:

- This study provides cross-culturally validated measures of use of and trust in information sources, use of and interest in information cues, knowledge, behaviour, health beliefs, health involvement and risk perception in relation to fish across consumer samples taken from Belgium, the Netherlands, Spain, Denmark and Poland.
- Fish was strongly perceived as a healthy and nutritious food by consumers, particularly as compared with meat as its main substitute protein source. Furthermore, fish was considered as a safe product to consume and people did not perceive high risk of food poisoning from eating fish. Nevertheless, higher risk perception related to fish was found to weakly but significantly negatively influence fish consumption.
- Wide diversity in consumer's use of and trust in different sources of information related to fish was found. Personal sources were the most frequently actively used and, together with health-related sources, the most trusted information sources by

consumers. Women and higher educated consumers used most of the information sources more frequently as compared to men and lower educated consumers.

- High use of on-label information cues was reported. Hence, labels were found to have considerable potential as market effective sources of information. Consumers were most familiar with basic, mandatory information cues, such as expiry date, price, species name and weight; and they felt able to derive clear quality expectations from the information these cues convey. The strongest interest in safety guarantee and a quality mark for seafood was displayed.
- Affective and cognitive beliefs (as components of attitudes) have been recognised as determinants of fish consumption behaviour through the specification and estimation of two unique models by means of structural equation modelling. The first model related health beliefs (subjective health and satisfaction with life), health involvement (and interest in healthy eating) and risk perception to fish consumption, whereas the second focused on associating the belief that eating fish is healthy, interest in healthy eating and subjective knowledge with fish consumption. Health involvement, interest in healthy eating and subjective knowledge positively influenced fish consumption frequency.
- Consumers' health-related beliefs were found to be important factors influencing fish consumption. This result entails opportunity for public health authorities in creating more effective communication – with specific reference to the potential health benefits from consuming fish – with respect to fish consumption.
- The importance of subjective knowledge as determinant of fish consumption was emphasised. Improving consumers' subjective knowledge is more likely to cause an increase in their fish consumption as compared to strategies aiming at increasing consumers' objective or factual knowledge about fish.
- Three distinct clusters based on use of and trust in fish information sources were identified: Sceptic (24.0%), Enthusiast (41.4%) and Confident (34.6%). Those consumer segments differed significantly with respect to use of and interest in information cues on fish labels, knowledge, behaviour and beliefs toward fish consumption, as well as in terms of their socio-demographic profile.
- Future research is recommended, particularly focusing on (1) other countries (not only European); (2) specific fish species rather than fish as an overall food group; (3) the comparison of shellfish with finfish; (4) measuring and explaining actual (marketplace) fish consumption behaviour, (5) testing the impact of communication strategies; and (6) the use of experimental designs in order to test for causality in the observed associations.

SAMENVATTING

Het gegeven dat visconsumptie enerzijds geassocieerd wordt met uitgesproken voordelen voor de menselijke gezondheid, maar anderzijds ook gelinkt wordt aan mogelijke schadelijke effecten, maakt dat vis onderhevig is aan heel wat communicatie naar de consument toe. Deze conflictsituatie resulteert in controverse en verwarring over de precieze rol van visconsumptie in een gezond dieet op consument niveau. Dit doctoraal onderzoek werd uitgevoerd binnen het kader van het geïntegreerd Europees project SEAFOODplus. Het overkoepelende objectief van dit onderzoek was een beter inzicht te krijgen in de rol van informatie en gezondheidsgerelateerde opvattingen als verklarende factoren voor de visconsumptie van de Europese consument. Belangrijke aandachtspunten binnen de analyses waren cross-culturele variaties binnen Europa, de informatiebehoefte van de consument met betrekking tot vis, hun houding en voorkeuren in relatie tot vis, en de relatie van deze aspecten met gezondheid, persoonlijk welzijn en betrokkenheid met gezondheid vanuit consumentenperspectief. Deze doctoraatsthesis is gestructureerd volgens een conceptueel raamwerk dat gebaseerd is op drie niveaus binnen het klassieke beslissingsproces van de consument: de zoektocht naar informatie; de evaluatie van alternatieven; en het gedrag zelf. Zowel kwalitatief exploratief (focusgroep discussies) als kwantitatief conclusief (pan-Europese consumentenenquête) onderzoek is uitgevoerd, met zowel primaire en secundaire gegevens als input.

Uit het gevoerde onderzoek komen volgende besluiten naar voor:

- In deze studie zijn meetschalen voor het gebruik van informatie, kennis, gedrag, overtuigingen met betrekking tot gezondheid, betrokkenheid met gezondheid en risicoperceptie in relatie tot vis over de landen heen gevalideerd op basis van steekproeven uit België, Nederland, Spanje, Denemarken en Polen.
- Vis werd door consumenten in sterke mate beschouwd als een gezond en voedzaam voedingsmiddel, vooral in vergelijking met vlees als het belangrijkste substituut voor de eiwitcomponent van een maaltijd. Verder werd visconsumptie als veilig beschouwd en niet gelinkt aan een hoog risico op voedselvergiftiging. Toch werd een – weliswaar zwakke – significant negatieve impact gevonden van een groter gepercipieerd risico gerelateerd aan het eten van vis op de visconsumptie.
- Een grote verscheidenheid met betrekking tot het gebruik van en het vertrouwen in verschillende informatiebronnen met betrekking tot vis werd waargenomen. Persoonlijke bronnen werden het vaakst en het meest actief gebruikt en, samen met gezondheidsgerelateerde bronnen, aanzien als de betrouwbaarste bronnen door de consument. Het hoogste gebruik van informatiebronnen werd vastgesteld voor vrouwen en hoger opgeleiden.
- Informatie vermeld op het etiket werd in hoge mate gebruikt, met als gevolg dat labels kunnen beschouwd worden als een bron van informatie die duidelijke

marketingperspectieven biedt. De consumenten waren het best vertrouwd met de verplicht basis gegevens op het etiket, zoals vervaldatum, prijs, vissoort, en gewicht en voelden zich in staat om op basis van deze gegevens de kwaliteit van het product in te schatten. De meeste interesse ging uit naar een veiligheidsgarantie en een kwaliteitslabel.

- Affectieve en cognitieve overtuigingen (als componenten van houding) zijn herkend als verklarende factoren voor het gedrag (meer bepaald de consumptie van vis) met behulp van twee 'structural equation' modellen die specifiek voor dit onderzoek ontwikkeld werden. In het eerste model werden gezondheidsovertuigingen (subjectieve gezondheid en voldoening in het leven), betrokkenheid met gezondheid (en interesse in gezond eten), en risicoperceptie in verband gebracht met visconsumptie, terwijl het tweede model focuste op de link tussen enerzijds de overtuiging dat vis eten gezond is, de interesse in gezond eten en subjectieve kennis, en visconsumptie als gedragsparameter anderzijds. Betrokkenheid bij gezondheid, interesse in gezond eten en subjectieve kennis beïnvloedden de visconsumptie positief.
- De gezondheidsgerelateerde opvattingen van consumenten waren belangrijke determinanten van visconsumptie. Deze bevinding houdt belangrijke kansen in voor publieke autoriteiten op het vlak van volksgezondheid, meer bepaald door middel van het ontwikkelen van meer effectieve communicatie, bij voorbeeld met betrekking tot de mogelijke gezondheidsvoordelen van visconsumptie.
- Het belang van subjectieve kennis als bepalende factor van visconsumptie werd in kaart gebracht. Het verbeteren van de subjectieve kennis van de consument lijkt de visconsumptie meer te verhogen in vergelijking met strategieën die als doel hebben de objectieve feitelijke kennis van consumenten te verhogen.
- Drie verschillende clusters werden geïdentificeerd gebaseerd op het gebruik van en het vertrouwen in informatiebronnen over vis: de Sceptische (24.0%), Enthousiaste (41.4%) en de Zelfzekere (34.6%). Deze consumentensegmenten waren significant van elkaar verschillend op het vlak van gebruik van en interesse in informatie op vislabels, kennis, gedrag en overtuigingen ten aanzien van visconsumptie, en vertoonden bovendien een verschillend socio-demografisch profiel.
- Verder onderzoek is aanbevolen, in het bijzonder met een focus op (1) andere landen (niet enkel Europese); (2) specifieke vissoorten; (3) de vergelijking tussen schaaldieren en vis; (4) het meten en verklaren van het werkelijke gedrag in termen van visconsumptie in plaats van het door de consument zelf aangegeven of beweerde gedrag; (5) het testen van de impact van communicatiestrategieën; en (6) het gebruik van experimentele onderzoeksopzet om de causaliteit van geobserveerde associaties na te gaan.

STRESZCZENIE

Ryby, w związku ze swym możliwym szkodliwym wpływem na ludzkie zdrowie z jednej strony, oraz oczywistym korzyściom dla ludzkiego zdrowia z drugiej strony, były szeroko komunikowane społeczeństwu; a informacje na jej temat były szeroko przekazywane konsumentom. Społeczeństwo zapoznając się z różnymi kontrowersyjnymi wiadomościami na temat ryzyka oraz korzyści wynikającymi ze spożycia ryb, jest zakłopotane i niepewne co do roli, jaką wnosi konsumpcja ryb dla zdrowej diety. Przedstawiona praca doktorska pt. „Informacja i przekonania skorelowane ze zdrowiem, czynnikami determinującymi konsumpcię ryb" została wykonana w ramach Projektu Unii Europejskiej SEAFOODplus. Głównym celem badań była poprawa zrozumienia roli jaką pełni informacja i przekonaia dotyczące zdrowia jako czynników wpływających na spożycie ryb przez europejskich konsumentów. Prowadzona analiza obejmowała różnice kulturowe istniejące w Europie, potrzeby konsumentów dotyczące informacji o rybach, ich postawy i preferencje wobec ryb, a także związku tych aspektów z postrzeganiem i zaangażowaniem w zdrowie oraz wpływem na jego pomyślność z punktu widzenia konsumenta. Niniejsza praca doktorska opiera się koncepcyjnej strukturze, bazującej na trzech szczeblach procesu decydowania konsumenta: poszukiwanie informacji, ocena alternatyw i w końcu wybór. Zarówno badanie rozpoznawcze (zogniskowany wywiad grupowy) jak i rozstrzygające (europejski badania ankietowe konsumentów) zostały przeprowadzone z wprowadzaniem wtórnych i pierwotnych danych.

Z wykonanych badań wynikają następujące główne wnioski:

- Badanie to dostarcza potwierdzonych między-kulturowo miar i skal dotyczących informacji, wiedzy, zachowania, wiary w zdrowie, wpływu na zdrowie oraz postrzegania ryzyka związanych ze spożyciem ryb przez konsumentów, których wytypowano w Belgii, Holandii, Hiszpanii, Danii i Polsce.
- Ryba była postrzegana przez konsumentów jako zdrowe, odżywcze i pożywne jedzenie, szczególnie w porównaniu z mięsem, jako jego główny substytut białka. Ponadto, ryba była widziana jako bezpieczny produkt do konsumpcji, a i ludzie nie dostrzegli wysokiego ryzyka związanego z możliwym zatruciem pokarmowym po zjedzeniu ryb. Niemniej jednak, wyższe postrzeganie ryzyka ze spożycia ryb wpływa słabo, ale znacząco ujemnie na konsumpcję ryb.
- Przedstawiono różnorodne, budzące zaufanie i dostępne dla konsumenta źródła informacji o rybach. Źródła osobowe (np. rodzina czy sprzedawca) były bardzo często wykorzystywane i, razem z tymi związanymi ze zdrowiem, stanowiły dla

konsumentów najbardziej zaufane źródła informacji. Kobiety i konsumenci z wyższym wykształceniem korzystali częściej ze źródeł informacji.

- To badanie zaobserwowało szerokie korzystanie z informacji umieszczonych na etykietach; w związku z tym, etykiety zostały uznane za dobre, rynkowo efektywne, źródło informacji. Konsumenci najlepiej znali te wskazówki i czuli, że to one są zdolne do przekazania jasnych, jakościowych informacji. Konsumenci wyrazili największe zainteresowanie informacjami podającymi gwarancją bezpieczeństwa i oraz znak jakości owoców morza.
- Przekonania poznawcze i afektywne (komponenty postawy) zostały rozpoznane jako wyznaczniki zachowania konsumentów dotyczącego spożycia ryb poprzez stworzenie dwóch unikalnych modeli przy pomocy strukturalnego równania modelującego. Pierwszy model powiązał przekonania dotyczące zdrowia (subiektywne zdrowie i zadowolenie z życia), z zaangażowaniem na temat zdrowia (i zainteresowaniem zdrowym jedzeniem) oraz postrzeganiem ryzyka, podczas gdy drugi skupił się na łączeniu przekonania, że jedzenie ryb jest zdrowe, zainteresowania zdrowym jedzeniem i subiektywnej wiedzy o konsumpcji ryb. Zaangażowanie w zdrowie, zainteresowanie zdrowym jedzeniem i subiektywna wiedza pozytywnie wpływały na częstość konsumpcji ryb.
- Przekonania konsumentów na temat zdrowia stały się ważnymi czynnikami wpływającymi na spożycie ryb. Ten wniosek dostarcza dodatkowych argumentów władzom odpowiedzialnym za zdrowie publiczne do tworzenia efektywniejszej propagandy konsumpcji ryb.
- Znaczenie subiektywnej wiedzy jako wyznacznika spożycia ryb, zostało szczególnie podkreślone. Poprawa subiektywnej wiedzy konsumentów być może przyczyni się do wzrostu konsumpcji ryb, w porównaniu do strategii nakierowanych na powiększenie obiektywnej wiedzy konsumentów.
- Trzy odmienne grupy konsumentów, (uzyskane) w oparciu o ich użycie oraz ufność do źródeł informacji o rybach, zostały sklasyfikowane: Sceptycy (24.0 %), Entuzjaści (41.4 %) i Przekonani (Pewni siebie) (34.6 %). Te segmenty różniły się znacząco w odniesieniu do ich wykorzystania oraz zainteresowania informacjami zawartymi na etykietach produktów rybnych; wiedzy, zachowania i przekonań dotyczących konsumpcji ryb, a także socjalno demograficznego profilu.
- Przyszłe badanie proponuje się prowadzić, skupiając się w szczególności na: (1) innych krajach (nie tylko Europejskich); (2) określonych gatunkach ryb; (3) porównaniu skorupiaków z rybami; (4) faktycznej mierze konsumpcji ryb, (5) testowaniu działania strategii komunikacji; i (6) użyciu doświadczalnego projektowania skupionego na testowaniu przyczynowości.

REFERENCES

Adams, S. M., & Standridge, J. B. (2006). What should we eat? Evidence from observational studies. *Southern Medical Journal,* 99 (7), 744-748.

Agren, J. J., Vaisanen, S., Hanninen, O., Muller, A. D., & Hornstra, G. (1997). Hemostatic factors and platelet aggregation after a fish-enriched diet or fish oil or docosahexaenoic acid supplementation. *Prostaglandins Leukotrienes and Essential Fatty Acids,* 57 (4-5), 419-421.

Ahluwalia, R., Burnkrant, R. E., & Unnava, H. R. (2000). Consumer response to negative publicity: The moderating role of commitment. *Journal of Marketing Research,* 37 (2), 203-214.

Aikman, S. N., & Crites, S. L. (2007). Structure of food attitudes: Replication of Aikman, Crites, and Fabrigar (2006). *Appetite,* 49 (2), 516-520.

Ajzen, I., & Fishbein, M. (1980). Understanding attitudes and predicting social behaviour. Englewoods Cliffs, NJ: Prentice-Hall.

Alba, J. W., & Hutchinson, J. W. (1987). Dimensions of consumer expertise. *Journal of Consumer Research,* 13 (4), 411-454.

Alba, J. W., & Hutchinson, J. W. (2000). Knowledge calibration: What consumers know and what they think they know. *Journal of Consumer Research,* 27 (2), 123-156.

Alba, J. W., & Marmorstein, H. (1987). The effects of frequency knowledge on consumer decision-making. *Journal of Consumer Research,* 14 (1), 14-25.

Alhakami, A. S., & Slovic, P. (1994). A psychological-study of the inverse relationship between perceived risk and perceived benefit. *Risk Analysis,* 14 (6), 1085-1096.

Alloport, G. (1935). Attitudes. In C. Murchison (Ed.), Handbook of Social Psychology pp. 798-884. Worcester, Mass: Clark Univerity Press.

Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice - a review and recommended 2-step approach. *Psychological Bulletin,* 103 (3), 411-423.

Anderson, R. D., Engledow, J. L., & Becker, H. (1979). Evaluating the relationships among attitude toward business, product satisfaction, experience, and search effort. *Journal of Marketing Research,* 16 (3), 394-400.

Andrews, F. M., & Withey, S. B. (1976). Social indicators of well-being: America's perception of life quality. New York: Plenum Press.

Arrindell, W. A., Meeuwesen, L., & Huyse, F. J. (1991). The Satisfaction with life scale (Swls) - Psychometric properties in a nonpsychiatric medical outpatients sample. *Personality and Individual Differences,* 12 (2), 117-123.

Arvanitoyannis, I. S., Krystallis, A., Panagiotaki, P., & Theodorou, A. J. (2004). A marketing survey on Greek consumers' attitudes towards fish. *Aquaculture International,* 12 (3), 259-279.

Auger, P., Burke, P., Devinney, T. M., & Louviere, J. J. (2003). What will consumers pay for social product features? *Journal of Business Ethics,* 42 (3), 281-304.

Aurier, P., & Ngobo, P. (1999). Assessment of consumer knowledge and its consequences: a multi-component approach. *Advances in Consumer Research,* 26, 569-575.

Bagozzi, R. P., Li, Y. J., & Phillips, L. W. (1991). Assessing construct-validity in organizational research. *Administrative Science Quarterly,* 36 (3), 421-458.

Barnekow-Bergkvist, M., Hedberg, G. E., Janlert, U., & Jansson, E. (1998). Health status and health behaviour in men and women at the age of 34 years. *European Journal of Public Health,* 8 (2), 179-182.

Baron-Epel, O., & Kaplan, G. (2001). General subjective health status or age-related subjective health status: does it make a difference? *Social Science & Medicine,* 53 (10), 1373-1381.

Bearden, W. O., Hardesty, D. M., & Rose, R. L. (2001). Consumer self-confidence: Refinements in conceptualization and measurement. *Journal of Consumer Research,* 28 (1), 121-134.

Bearden, W. O., Netemeyer, R. G., & Mobley, M. F. (1993). Handbook of Marketing Scales: Multi-Item Measures for Marketing and Consumer Research. Newbury Park, California: SAGE Publications, Inc.

Beardsworth, A., Bryman, A., Keil, T., Goode, J., Haslam, C., & Lancashire, E. (2002). Women, men and food: the significance of gender for nutritional attitudes and choices *British Food Journal,* 104 (7), 470 - 491

Beatty, S., & Kahle., L. R. (1988). Alternative hierarchies of attitude-behaviour relationship: The impact of brand commitment and habit. *Journal of the Academy of Marketing Science,* 16 (Summer), 1-10.

Beharrell, B., & Denison, T. J. (1995). Involvement in a routine food shopping context *British Food Journal,* 97 (4), 24-29.

Belgian Health Council. (2004). Vis en gezondheid bij volwassenen (Fish and health of adults). D/2004/7795/2003 - http://www.health.fgov.be/CSH_HGR.).

Bell, R., & Marshall, D. W. (2003). The construct of food involvement in behavioral research: scale development and validation. *Appetite,* 40 (3), 235-244.

Bender, M. M., & Derby, B. M. (1992). Prevalence of reading nutrition and ingredient information on food labels among adult Americans - 1982-1988. *Journal of Nutrition Education,* 24 (6), 292-297.

Benyamini, Y., Leventhal, H., & Leventhal, E. A. (2004). Self-rated oral health as an independent predictor of self-rated general health, self-esteem and life satisfaction. *Social Science & Medicine,* 59 (5), 1109-1116.

Bernues, A., Olaizola, A., & Corcoran, K. (2003). Labelling information demanded by European consumers and relationships with purchasing motives, quality and safety of meat. *Meat Science,* 65 (3), 1095-1106.

Bessler, D. (2003). On world poverty: Casual graphs from the 1990s.

Bessler, D., & Lopper, N. (2001). Economic development: Evidence from directed graphs. *Manchester School,* 69 (4), 457-476.

Bettman, J. (1979). An information processing theory of consumer choice. Reading: Addison-Wesley.

Bettman, J. R., Johnson, E. J., & Payne, J. W. (1991). Consumer decision making. In T. S. Robertson & E. Kassardjian (Eds.), Handbook of consumer behaviour pp. 50-84. Englewood Cliffs: Prentice-Hall.

Bettman, J. R., & Park, C. W. (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 (3), 234-248.

Biddle, S., Goudas, M., & Page, A. (1994). Social-Psychological Predictors of Self-Reported Actual and Intended Physical-Activity in a University Workforce Sample. *British Journal of Sports Medicine,* 28 (3), 160-163.

Bilau, M., Matthys, C., Baeyens, W., Bruckers, L., De Backer, G., Den Hond, E., et al. (2007). Dietary exposure to dioxin-like compounds in three age groups: Results from the Flemish environment and health study. *Chemosphere,* doi:10.1016/j.chemosphere.2007.07.008.

Blair, M. E., & Innis, D. E. (1996). The effects of product knowledge on the evaluation of warranted brands. *Psychology & Marketing,* 13 (5), 445-456.

Blaxter, M. (1990). Lifestyle and health. London: Tavistock / Routhledge.

Bocker, A., & Hanf, C. H. (2000). Confidence lost and - partially - regained: consumer response to food scares. *Journal of Economic Behaviour & Organization,* 43 (4), 471-485.

Bollen, K. A. (1989). Structural equations with latent variables New York: Wiley.

Boninger, D., Krosnick, J. A., & Berent, M. (1995a). Origins of attitude importance: Self-interest, social identification, and value relevance. *Journal of Personality and Social Psychology,* 68, 61-80.

Boninger, D. S., Berent, M. K., & Krosnick, J. A. (1995b). Origins of attitude importance - self-interest, social identification, and value relevance. *Journal of Personality and Social Psychology,* 68 (1), 61-80.

Børresen, T., Frederiksen, M., & Larsen, E. (2003). Traceability from catch to consumer in Denmark. In J. Luten, J. Oehlenschläger & G. Ólafsdóttir (Eds.), Quality of Fish from Catch to Consumer: Labelling, Monitoring and Traceability pp. 93-100. Wageningen:Wageningen Academic Publishers.

Breckler, S. J. (1984). Empirical validation of affect, behavior, and cognition as distinct components of attitude. *Journal of Personality and Social Psychology,* 47 (6), 1191-1205.

Breckler, S. J., & Wiggins, E. C. (1989). Affect versus evaluation in the structure of attitudes. *Journal of Experimental Social Psychology,* 25 (3), 253-271.

Bredahl, L., & Grunert, K. (1997). Determinants of the consumption of fish and shellfish in Denmark: an application of the theory of planned behaviour. In J. Luten, T. Børresen & J. Oehlenschager (Eds.), Seafood from producer to consumer, integrated approach to quality pp. 21-30. Amsterdam: Elsevier.

Brief, A. P., Butcher, A. H., George, J. M., & Link, K. E. (1993). Integrating bottom-up and top-down theories of subjective well-being - the case of health. *Journal of Personality and Social Psychology,* 64 (4), 646-653.

Brislin, R. W. (1970). Back-translation for cross-cultural research. *Journal of Cross-Cultural Psychology,* 1, 185-216.

Brislin, R. W., Lonner, W. J., & Throdike, R. M. (1973). Cross-cultural research methods. New York: John Wiley & Sons.

Browne, M., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. Bollen & J. Long (Eds.), Testing structural equation models, pp. 136-162. Newbury Park: CA: Sage.

Browne, M. W., & Cudeck, R. (1992). Alternative ways of assessing model fit. *Sociological Methods & Research,* 21 (2), 230-258.

Brucks, M. (1985). The effects of product class knowledge on information search behaviour. *Journal of Consumer Research,* 12 (1), 1-16.

Brug, J., de Vet, E., de Nooijer, J., & Verplanken, B. (2006). Predicting fruit consumption: Cognition, motivation, and habits. *Journal of Nutrition and Behaviour,* 38, 73-81.

Brunsø, K. (2003). Consumer research on fish in Europe. In J. Luten, J. Oehlenschlager & G. Olafsdottir (Eds.), Quality of fish from catch to consumer: labelling, monitoring and traceability. pp. 335-344. Wageningen: Wageningen Academic Publishers.

Brunsø, K., Fjord, T. A., & Grunert, K. (2002). Consumers' food choice and quality perception. MAPP Working paper No.77. Aarhus: The Aarhus School of Business.

Brunsø, K., Verbeke, W., Olsen, S. O., & Fruensgaard Jeppesen, L. (2007). Motives, barriers and quality evaluation in fish consumption situations: A comparison between heavy and light users in Spain and Belgium. *British Food Journal,* submitted.

Budtz-Jorgensen, E., Grandjean, P., & Weihe, P. (2007). Separation of risks and benefits of seafood intake. *Environmental Health Perspectives,* 115 (3), 323-327.

Burger, J., & Waishwell, L. (2001). Are we reaching the target audience? Evaluation of a fish fact sheet. *Science of the Total Environment,* 277 (1-3), 77-86.

Buttriss, J. L. (1997). Food and nutrition: attitudes, beliefs, and knowledge in the United Kingdom. *American Journal of Clinical Nutrition,* 65, S1985-S1995.

Cacioppo, J. T., & Petty, R. E. (1982). The need for cognition. *Journal of Personality and Social Psychology,* 42 (1), 116-131.

Cacioppo, J. T., Petty, R. E., Feinstein, J. A., Blair, W., & Jarvis, G. (1996). Dispositional differences in cognitive motivation: The life and times of individuals varying in need for cognition. *Psychological Bulletin,* 119 (2), 197-253.

Cacioppo, J. T., Petty, R. E., & Kao, C. F. (1984). The efficient assessment of need for cognition. *Journal of Personality Assessment,* 48 (3), 306-307.

Calder, P. C. (2006). n-3 polyunsaturated fatty acids, inflammation, and inflammatory diseases. *American Journal of Clinical Nutrition,* 83 (6), 1505S-1519S.

Cantril, H. (1946). The intensity of an attitude. *Journal of Abnormal and Social Psychology,* 41, 1-12.

Caporale, G., & Monteleone, E. (2004). Influence of information about manufacturing process on beer acceptability. *Food Quality and Preference,* 15 (3), 271-278.

Capps, O. (1992). Consumer response to changes in food labelling: Discussion. *American Journal of Agricultural Economics*, 1215-1216.

Carels, R. A., Harper, J., & Konrad, K. (2006). Qualitative perceptions and caloric estimations of healthy and unhealthy foods by behavioural weight loss participants. *Appetite,* 46 (2), 199-206.

Caswell, J. A., & Padberg, D. I. (1992). Toward a more comprehensive theory of food labels. *American Journal of Agricultural Economics,* 74 (2), 460-468.

Caygill, C. P. J., Charlett, A., & Hill, M. J. (1996). Fat, fish, fish oil and cancer. *British Journal of Cancer,* 74 (1), 159-164.

Chaiken, S. (1980). Heuristic versus systematic information-processing and the use of source versus message cues in persuasion. *Journal of Personality and Social Psychology,* 39 (5), 752-766.

Chaiken, S. (1987). The heuristic model of persuasion. In M. P. Zanna, J. M. Olson & C. P. Herman (Eds.), Social influence: the Ontario symposium, pp. 3-39. Hillsdale: Erlbaum.

Chaiken, S., Liberman, A., & Eagly, A. (1989). Heuristic and systematic processing within and beyond the persuasion context. In J. Uleman & J. A. Bargh (Eds.), Unintended thought pp. 212-252. New York: Guildford.

Chen, S., & Chaiken, S. (1999). The heuristic-systematic model in its broader context. In S. Chaiken & Y. Trope (Eds.), Dual Process Theories in Social Psychology pp. 73-96. New York: Guilford Press.

Cohen, J. T., Bellinger, D. C., Connor, W. E., Kris-Etherton, P. M., Lawrence, R. S., Savitz, D. A., et al. (2005). A quantitative risk-benefit analysis of changes in population fish consumption. *American Journal of Preventive Medicine,* 29 (4), 325-334.

Condra, M. (1992). The link between need for cognition and political interest, involvement and media usage. *Psychology,* 29, 13-17.

Cordell, V. V. (1997). Consumer knowledge measures as predictors in product evaluation. *Psychology & Marketing,* 14 (3), 241-260.

Coulson, N. (2000). An application of the stages of change model to consumer use of food labels. *British Food Journal,* 102 (9), 661-668.

Courneya, K. S. (1994). Predicting repeated behaviour from intention - the issue of scale correspondence. *Journal of Applied Social Psychology,* 24 (7), 580-594.

Crites, S. L., Fabrigar, L. R., & Petty, R. E. (1994). Measuring the affective and cognitive properties of attitudes - conceptual and methodological issues. *Personality and Social Psychology Bulletin,* 20 (6), 619-634.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika,* 31, 93-96.

Cummins, R. A. (2000). Personal income and subjective wellbeing: A review. *Journal of Happiness Studies,* 1, 133-158.

Daniels, J. L., Longnecker, M. P., Rowland, A. S., Golding, J., & ALSPAC Study Team (2004). Fish intake during pregnancy and early cognitive development of offspring. *Epidemiology,* 15 (4), 394-402.

Davidson, A. R. (1995). From attitudes to actions to attitude change: The effects of amount and accuracy of information. In R. E. Petty & J. A. Krosnick (Eds.), Attitude strength: Antecedents and consequences pp. 315-336. Mahwah: Erlbaum.

de Almeida, M. D. V., Graca, P., Lappalainen, R., Giachetti, I., Kafatos, A., deWinter, A. M. R., et al. (1997). Sources used and trusted by nationally-representative adults in the European Union for information on healthy eating. *European Journal of Clinical Nutrition,* 51, S16-S22.

de Garidel-Thoron, T. (2005). Welfare-improving asymmetric information in dynamic insurance markets. *Journal of Political Economy,* 113 (1), 121-150.

de Lorgeril, M., & Salen, P. (2006). The Mediterranean-style diet for the prevention of cardiovascular diseases. *Public Health Nutrition,* 9 (1A), 118-123.

deAlmeida, M. D. V., Graca, P., Lappalainen, R., Giachetti, I., Kafatos, A., deWinter, A. M. R., et al. (1997). Sources used and trusted by nationally-representative adults in the European Union for information on healthy eating. *European Journal of Clinical Nutrition,* 51, S16-S22.

Dean, D. H. (2004). Consumer reaction to negative publicity. *Journal of Business Communication,* 41, 192-211.

Devine, C. M., & Olson, C. M. (1991). Women's dietary prevention motives - life stage influences. *Journal of Nutrition Education,* 23 (6), 269-274.

Diehr, P., & Beresford, S. A. A. (2003). The relation of dietary patterns to future survival, health, and cardiovascular events in older adults. *Journal of Clinical Epidemiology,* 56 (12), 1224-1235.

Diener, E., Colvin, C. R., Pavot, W. G., & Allman, A. (1991). The psychic costs of intense positive affect. *Journal of Personality and Social Psychology,* 61 (3), 492-503.

Diener, E., Emmons, R., Larsen, J., & Griffin, S. (1985). The satisfaction with life scale. *Journal of Personality Assessment,* 49 (1), 71-75.

Dranove, D., Kessler, D., McClellan, M., & Satterthwaite, M. (2003). Is more information better? The effects of "Report cards" on health care providers. *Journal of Political Economy,* 111 (3), 555-588.

Drichoutis, A. C., Lazaridis, P., & Nayga, R. M. (2005). Nutrition knowledge and consumer use of nutritional food labels. *European Review of Agricultural Economics,* 32 (1), 93-118.

Dutta-Bergman, M. J. (2004). Primary sources of health information: Comparisons in the domain of health attitudes, health cognitions, and health behaviours. *Health Communication,* 16 (3), 273-288.

Eagly, A. H., Mladinic, A., & Otto, S. (1994). Cognitive and affective bases of attitudes toward social-groups and social policies. *Journal of Experimental Social Psychology,* 30 (2), 113-137.

Earle, T. C., & Cvetkovich, G. (1995). Social trust: toward a cosmopolitan society. London: Praeger.

Engel, J., Blackwell, R., & Miniard, P. (1968). Consumer Behaviour. Fort Worth: Dryden Press.

Engel, J., Blackwell, R., & Miniard, P. (1995). Consumer Behaviour. Fort Worth: Dryden Press.

Eshghi, A., Haughton, D., & Topi, H. (2007). Determinants of customer loyalty in the wireless telecommunications industry. *Telecommunications Policy,* 31 (2), 93-106.

Eurobarometer, S. (2006). Risk issues: executive summary on food safety. . Special Eurobarometer 238 / Wave 64.1 – TNS Opinion & Social.

Eurobarometer, S. (2007). European Social Reality. Special Eurobarometer 273 / Wave 66.3 - TNS Opinion & Social. Available on http://ec.europa.eu/public_opinion/archives/ebs/ebs_273_en.pdf.

Evans, A., Tolonen, H., Hense, H. W., Ferrario, M., Sans, S., Kuulasmaa, K., et al. (2001). Trends in coronary risk factors in the WHO MONICA Project. *International Journal of Epidemiology,* 30, S35-S40.

Fabrigar, L. R., Petty, R. E., Smith, S. M., & Crites, S. L. (2006). Understanding knowledge effects on attitude-behaviour consistency: the role of relevance, complexity, and amount of knowledge. *Journal of Personality and Social Psychology,* 90 (4), 556-577.

FAO. (2006). Food Balance Sheets. Rome www.fao.org.

Fazio, R. H. (1986). How do attitudes guide behaviour? In R. M. Sorrentino & E. T. Higgins (Eds.), Handbook of motivation and cognition. Foundations of social behaviour pp. 204-223. New York: Guilford.

Fazio, R. H. (1990). Multiple processes by which attitudes guide behaviour. In M. P. Zanna (Ed.), Advances in Experimental Social Psychology pp. 75-109. San Diego: Academic Press.

Federation of American Societies for Experimental Biology. Third report on nutrition monitoring in the United States: executive summary. Prepared for the Interagency Board for Nutrition Monitoring and Related Research. Washington, DC: US Government Printing Office.

Feldeisen, S. E., & Tucker, K. L. (2007). Nutritional strategies in the prevention and treatment of metabolic syndrome. *Applied Physiology Nutrition and Metabolism-Physiologie Appliquée Nutrition Et Métabolisme,* 32 (1), 46-60.

Fernandez, E., Chatenoud, L., La Vecchia, C., Negri, E., & Franceschi, S. (1999). Fish consumption and cancer risk. *American Journal of Clinical Nutrition,* 70 (1), 85-90.

Ferraro, K. F., Farmer, M. M., & Wybraniec, J. A. (1997). Health trajectories: Long-term dynamics among Black and White adults. *Journal of Health and Social Behavior,* 38 (1), 38-54.

FifeSchaw, C., & Rowe, G. (1996). Public perceptions of everyday food hazards: A psychometric study. *Risk Analysis,* 16 (4), 487-500.

Fishbein, M. (1963). An investigation of the relationship between beliefs about an object and the attitude toward that object. *Human Relations,* 16, 233–239.

Fishbein, M. (1967). A behaviour theory approach to the relations between beliefs about the object and the attitude toward the object. In M. Fishbein (Ed.), Readings in Attitude Theory and Measurement pp. 389-400. New York: Wiley.

Fishbein, M., & Ajzen, I. (1975). Belief, attitude, intention and behaviour: an introduction to theory and research. Reading: Addison-Wesley.

Folsom, A. R., & Demissie, Z. (2004). Fish intake, marine omega-3 fatty acids, and mortality in a cohort of postmenopausal women. *American Journal of Epidemiology,* 160 (10), 1005-1010.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research,* 18 (1), 39-50.

Foxall, G., Leek, S., & Maddock, S. (1998). Cognitive antecedents of consumers' willingness to purchase fish rich in polyunsaturated fatty acids (PUFA). *Appetite,* 31 (3), 391-402.

Foxall, G. R., & Yani-de-Soriano, M. M. (2005). Situational influences on consumers' attitudes and behavior. *Journal of Business Research,* 58 (4), 518-525.

Frewer, L., & Miles, S. (2003a). Temporal stability of the psychological determinants of trust: Implications for communication about food risks. *Health, Risk & Society,* 5 (3), 259-271.

Frewer, L. J., Howard, C., Hedderley, D., & Shepherd, R. (1996a). What determines trust in information about food-related risks? Underlying psychological constructs. *Risk Analysis,* 16 (4), 473-486.

Frewer, L. J., Howard, C., Hedderley, D., & Shepherd, R. (1999). Reactions to information about genetic engineering: impact of source characteristics, perceived personal relevance, and persuasiveness. *Public Understanding of Science,* 8 (1), 35-50.

Frewer, L. J., Howard, C., & Shepherd, R. (1996b). The influence of realistic product exposure on attitudes towards genetic engineering of food. *Food Quality and Preference,* 7 (1), 61-67.

Frewer, L. J., & Miles, S. (2003b). Temporal stability of the psychological determinants of trust: Implications for communication about food risks. *Health, Risk & Society,* 5 (3), 259-271.

Frewer, L. J., Scholderer, J., & Bredahl, L. (2003). Communicating about the risks and benefits of genetically modified foods: The mediating role of trust. *Risk Analysis,* 23 (6), 1117-1133.

Fullmer, S., Geiger, C. J., & Parent, C. R. M. (1991). Consumers knowledge, understanding, and attitudes toward health claims on food labels. *Journal of the American Dietetic Association,* 91 (2), 166-171.

Furst, T., Connors, M., Bisogni, C. A., Sobal, J., & Falk, L. W. (1996). Food choice: A conceptual model of the process. *Appetite,* 26 (3), 247-265.

Galiński, G., Czarnocińska, J., Anioła, J., Zając, K., Kiciak, A., & Babicz-Zielińska, E. (2004). Ocena postaw żywieniowych osób dorosłych w zakresie spożycia ryb i owoców morza (An assessment of adults dietary attitude to fish and fruits of sea consumption). *Polish Journal of Human Nutrition and Metabolism,* 31 (Suppl.2), 116-124.

Geelen, A., Schouten, J. M., Kamphuis, C., Stam, B. E., Burema, J., Renkema, J. M. S., et al. (2007). Fish consumption, n-3 fatty acids, and colorectal cancer: A meta-

analysis of prospective cohort studies *American Journal of Epidemiology,* 166 (10), 1116-1125.

Gempesaw, C. M., Bacon, J. R., Wessells, C. R., & Manalo, A. (1995). Consumer perceptions of aquaculture products. *American Journal of Agricultural Economics,* 77 (5), 1306-1312.

George, L. K., & Landerman, R. (1984). Health and subjective well-being - a replicated secondary data-analysis. *International Journal of Aging & Human Development,* 19 (2), 133-156.

GfK. (2007). Consumer scan panel. Brussels: GfK Panel Services-Benelux, Division Belgium.

Gigerenzer, G., & Todd, P. M. (1999). Simple heuristics that make us smart. Oxford, UK: Oxford University Press.

Gilly, M. C., Graham, J. L., Wolfinbarger, M. F., & Yale, L. J. (1998). A dyadic study of interpersonal information search. *Journal of the Academy of Marketing Science,* 26 (2), 83-100.

Goldberg, J. P. (1992). Nutrition and health communication - the message and the media over 1/2 a century. *Nutrition Reviews,* 50 (3), 71-77.

Goodwin, D. K., Knol, L. L., Eddy, J. M., Fitzhugh, E. C., Kendrick, O. W., & Donahue, R. E. (2006). The relationship between self-rated health status and the overall quality of dietary intake of US adolescents. *Journal of the American Dietetic Association,* 106 (9), 1450-1453.

Gross, S. R., Holtz, R., & Miller, N. (1995). Attitude certainty. In R. E. Petty & J. A. Krosnick (Eds.), Attitude strength: Antecedents and consequences pp. 215-246. Mahwah, NJ: Lawrence Erlbaum Associates.

Gross, T. (2003). Consumer attitudes towards health and food safety. In J. Luten, J. Oehlenschlager & G. Olafsdottir (Eds.), Quality of fish from catch to consumer: labelling, monitoring and traceability pp. 401-411. Wageningen: Wageningen Academic Publishers.

Grunert, K., Raats, M., Nielsen, N. A., & Lumbers, M. (2007). A measure of satisfaction with food-related life. *Appetite*.

Grunert, K. G. (2005). Food quality and safety: consumer perception and demand. *European Review of Agricultural Economics,* 32 (3), 369-391.

Gutteling, J. M., & Wiegman, O. (1996). The source of risk messages. In J. M. Gutteling & O. Wiegman (Eds.), Exploring risk communication pp. 151-169. Dordrecht: Kluwer Academic Publishers.

Haigh, M. S., Nomikos, N. K., & Bessler, D. A. (2004). Integration and causality in International Freight Markets: Modelling with error correction and directed acyclic graphs. *Southern Economic Journal,* 71 (1), 145-162.

Hair, J., Black, W., Babin, B., Anderson, R., & Tatham, R. (2006). Multivariate data analysis. New Jersey: Pearson Education, Inc.

Hanson, G. D., Rauniyar, G. P., & Herrmann, R. O. (1994). Using consumer profiles to increase the use market for seafood - Implications for Aquaculture. *Aquaculture,* 127 (4), 303-316.

Harel, Z., Riggs, S., Vaz, R., White, L., & Menzies, G. (2001). Omega-3 polyunsaturated fatty acids in adolescents: Knowledge and consumption. *Journal of Adolescent Health,* 28 (1), 10-15.

Harris, W. S. (1990). N-3 Fatty acids and serum lipoproteins: human studies. *American Journal of Clinical Nutrition,* 65, 1645S-1654S.

Hawkins, D. I., Best, R. J., & Coney, K. A. (1986). Consumer behaviour: implications for marketing strategy. Plano, TX: Business Publications.

He, K., Song, Y. Q., Daviglus, M., Liu, K., Van Horn, L., Dyer, A., et al. (2004). Fish consumption and coronary heart disease mortality: A meta-analysis of cohort studies. *Circulation,* 109 (7), E107-E107.

Hearty, A. P., McCarthy, S. N., Kearney, J. M., & Gibney, M. J. (2007). Relationship between attitudes towards healthy eating and dietary behaviour, lifestyle and demographic factors in a representative sample of Irish adults. *Appetite,* 48 (1), 1-11.

Hibbeln, J. R., Davis, J. M., Steer, C., Emmett, P., Rogers, I., Williams, C., et al. (2007). Maternal seafood consumption in pregnancy and neurodevelopmental outcomes in childhood (ALSPAC study): an observational cohort study. *Lancet,* 369 (9561), 578-585.

Hiddink, G. J., Hautvast, J. G. A. J., vanWoerkum, C. M. J., Fieren, C. J., & vantHof, M. A. (1997). Consumers' expectations about nutrition guidance: The importance of primary care physicians. *American Journal of Clinical Nutrition,* 65, S1974-S1979.

Holgado, B., Martinez-Gonzalez, M. A., De Irala-Estevez, J., Gibney, M., Kearney, J., & Martinez, J. A. (2000). Sources of information about diet and health in a Mediterranean country - Comparison with other European member states. *European Journal of Public Health,* 10 (3), 185-191.

Homer, P. M., & Kahle, L. R. (1988). A structural equation test of the value attitude behaviour hierarchy. *Journal of Personality and Social Psychology,* 54 (4), 638-646.

Honkanen, P., Olsen, S. O., & Verplanken, B. (2005). Intention to consume seafood - the importance of habit. *Appetite,* 45 (2), 161-168.

Hooper, L., Thompson, R. L., Harrison, R. A., Summerbell, C. D., Ness, A. R., Moore, H., et al. (2006). Risks and benefits of omega 3 fats for mortality, cardiovascular disease, and cancer: systematic review. *British Medical Journal,* 332 (7544), 752-755.

Howard, J., & Sheth, J. N. (1969). The theory of buyer behaviour. New York: John Wiley.

Hunt, S., & Frewer, L. (2001). Trust in source of information about genetically modified food risks in the UK. *British Food Journal,* 103 (1), 46-62.

Idler, E. L., & Kasl, S. V. (1995). Self-ratings of health - do they also predict change in functional ability. *Journals of Gerontology Series B-Psychological Sciences and Social Sciences,* 50 (6), S344-S353.

Iso, H., Kobayashi, M., Ishihara, J., Sasaki, S., Okada, K., Kita, Y., et al. (2006). Intake of fish and n3 fatty acids and risk of coronary heart disease among Japanese - The Japan Public Health Centre-based (JPHC) Study Cohort I. *Circulation,* 113 (2), 195-202.

Jayanti, R. K., & Burns, A. C. (1998). The antecedents of preventive health care behaviour: An empirical study. *Journal of the Academy of Marketing Science,* 26 (1), 6-15.

Johnson, E. J., & Russo, J. E. (1984). Product familiarity and learning new information. *Journal of Consumer Research,* 11 (1), 542-550.

Johnston, V. S. (1999). Why we feel: The science of emotions. Reading, MA: Helix Books.

Jöreskog, K., & Sörbom, D. (1993). Lisrel 8: Structural equation modelling with the SIMPLIS command language: Scientific Software International, Inc.

Jöreskog, K., & Sörbom, D. (1999). Interactive Lisrel, User's guide. Chicago: SSI Scientific Software International, Inc.

Jöreskog, K. G., & Sörbom, D. (1989). LISREL 7: A guide to the program and applications Chicago, IL SPSS Inc.

Juhl, H. J., & Poulsen, C. S. (2000). Antecedents and effects of consumer involvement in fish as a product group. *Appetite,* 34 (3), 261-267.

Jungermann, H., Pfister, H. R., & Fischer, K. (1996). Credibility, information preferences, and information interests. *Risk Analysis,* 16 (2), 251-261.

Kaabia, M. B., Angulo, A. M., & Gil, J. M. (2001). Health information and the demand for meat in Spain. *European Review of Agricultural Economics,* 28 (4), 499-517.

Kaline, K., Bornstein, S. R., Bergmann, A., Hauner, H., & Schwarz, P. E. H. (2007). The importance and effect of dietary fibre in diabetes prevention with particular consideration of whole grain products. *Hormone and Metabolic Research,* 39 (9), 687-693.

Kearney, J. M., Gibney, M. J., Livingstone, B. E., Robson, P. J., Kiely, M., & Harrington, K. (2001). Attitudes towards and beliefs about nutrition and health among a random sample of adults in the Republic of Ireland and Northern Ireland. *Public Health Nutrition,* 4 (5A), 1117-1126.

Kearney, M., Kelly, A., & Gibney, M. J. (1998). Attitudes toward and beliefs about nutrition and health among a nationally representative sample of Irish adults: Application of logistic regression modelling. *Journal of Nutrition Education,* 30 (3), 139-148.

Kiel, G. C., & Layton, R. A. (1981). Dimensions of consumer information seeking behaviour. *Journal of Marketing Research,* 18 (2), 233-239.

Kim, S., & Douthitt, R. (2004). The role of dietary information in women's whole milk and low-fat milk intake. *International Journal of Consumer Studies,* 28 (3), 245-254.

Kim, S. Y., Nayga, R. M., & Capps, O. (2001). Food label use, self-selectivity, and diet quality. *Journal of Consumer Affairs,* 35 (2), 346-363.

Kinsella, J. E., Lokesh, B., & Stone, R. A. (1990). Dietary N-3 polyunsaturated fatty-acids and amelioration of cardiovascular-disease - possible mechanisms. *American Journal of Clinical Nutrition,* 52 (1), 1-28.

Knower, F. H. (1935). Experimental studies of changes in attitude. I. A study of the effect of oral argument on changes of attitude. *Journal of Social Psychology,* 6, 315-347.

Knox, B. (2000). Consumer perception and understanding of risk from food. *British Medical Bulletin,* 56 (1), 97-109.

Kornelis, M., de Jonge, J., Frewer, L., & Dagevos, H. (2007). Consumer selection of food-safety information sources. *Risk Analysis,* 27 (2), 327-335.

Kotler, P., & Armstrong, G. (2001). Principles of marketing. New Jersey: Prentice-Hall.

Krantz, D. H., Luce, R. D., Suppes, P., & Tversky, A. (1971). Foundations of measurement. Volume 1: Additive and polynomial representations. New York: Academic Press.

Kris-Etherton, P. M., Harris, W. S., Appel, L. J., & Comm, A. N. (2003). Omega-3 fatty acids and cardiovascular disease - New recommendations from the American Heart Association. *Arteriosclerosis Thrombosis and Vascular Biology,* 23 (2), 151-152.

Kris-Etherton, P. M., Harris, W. S., Appel, L. J., & Comm, N. (2002). Fish consumption, fish oil, omega-3 fatty acids, and cardiovascular disease. *Circulation,* 106 (21), 2747-2757.

Krosnick, J. A., & Abelson, R. P. (1992). The case for measuring attitude strength in surveys. In J. M. Tanur (Ed.), In questions about questions: inquires into the cognitive bases of surveys pp. 177-203. New York: Russell Sage.

Krosnick, J. A., Boninger, D. S., Chuang, Y. C., Berent, M. K., & Carnot, C. G. (1993). Attitude strength - one construct or many related constructs. *Journal of Personality and Social Psychology,* 65 (6), 1132-1151.

Krosnick, J. A., Judd, C. M., & Wittenbrink, B. (2005). The measurement of attitudes. In D. Albarracin, B. T. Johnson & M. P. Zanna (Eds.), The handbook of attitudes. Mahwah, NJ: Lawrence, Erlbaum.

Kubberod, E., Ueland, O., Tronstad, A., & Risvik, E. (2002). Attitudes towards meat and meat-eating among adolescents in Norway: a qualitative study. *Appetite,* 38 (1), 53-62.

Lands, W. E. M. (2005). Fish, omega-3 and human health. Illinois: AOCS Press.

Larue, A., Bank, L., Jarvik, L., & Hetland, M. (1979). Health in Old-Age - How Do Physicians Ratings and Self-Ratings Compare. *Journals of Gerontology,* 34 (5), 687-691.

Lavidge, R. J., & Steiner, G. A. (1961). A Model for Predictive Measurements of Advertising Effectiveness. *Journal of Marketing,* 25 (4), 59-62.

Lee, B., Barua, A., & Whinston, A. B. (1997). Discovery and representation of causal relationships in MIS research: A methodological framework. *Mis Quarterly,* 21 (1), 109-136.

Leek, S., Maddock, S., & Foxall, G. (2000). Situational determinants of fish consumption. *British Food Journal,* 102 (1), 18-39.

Letarte, A., Dube, L., & Troche, V. (1997). Similarities and differences in affective and cognitive origins of food likings and dislikes. *Appetite,* 28 (2), 115-129.

Levine, T. R., & Hullett, C. R. (2002). Eta squared, partial eta squared, and misreporting of effect size in communication research. *Human Communication Research,* 28 (4), 612-625.

Little, T. D. (1997). Mean and covariance structures (MACS) analyses of cross-cultural data: Practical and theoretical issues. *Multivariate Behavioural Research,* 32 (1), 53-76.

Liu, S. P., Huang, J. C., & Brown, G. L. (1998). Information and risk perception: A dynamic adjustment process. *Risk Analysis,* 18 (6), 689-699.

Lobb, A. (2005). Consumer trust, risk and food safety: a review. *Acta Agriculturae Scandinavica Section C-Economy,* 2 (1), 3-12.

Lobb, A., Mazzocchi, M., & Triaill, W. (2007). Modelling risk perception and trust in food safety information within the theory of planned behaviour *Food Quality and Preference,* 18, 384-395.

Loewenstein, G. F., Weber, E. U., Hsee, C. K., & Welch, N. (2001). Risk as feelings. *Psychological Bulletin,* 127 (2), 267-286.

Louviere, J. J., Hensher, D. A., & Swait, J. D. (2000). Stated choice methods: analysis and applications. Cambridge, UK: Cambridge University Press.

Louviere, J. J., & Woodworth, G. (1983). Design and Analysis of Simulated Consumer Choice or Allocation Experiments - an Approach Based on Aggregate Data. *Journal of Marketing Research,* 20 (4), 350-367.

Luhmann, N. (1988). Familiarity, Confidence, Trust: Problems and Alternatives. In D. Gambetta (Ed.), Trust: Making and Breaking Cooperative Relations pp. 94–107. Oxford: Blackwell.

Lusk, J. L., House, L. O., Valli, C., Jaeger, S. R., Moore, M., Morrow, J. L., et al. (2004). Effect of information about benefits of biotechnology on consumer acceptance of genetically modified food: evidence from experimental auctions in the United States, England, and France. *European Review of Agricultural Economics,* 31 (2), 179-204.

Macinnis, D. J., & Jaworski, B. J. (1989). Information-processing from advertisements - toward an integrative framework. *Journal of Marketing,* 53 (4), 1-23.

Malthora, N. K. (1996). Marketing research: An applied orientation. Upper Saddle River, NJ: Prentice-Hall International Editions.

Manderbacka, K., Lundberg, O., & Martikainen, P. (1999). Do risk factors and health behaviours contribute to self-ratings of health? *Social Science & Medicine,* 48 (12), 1713-1720.

Marshall, D., & Bell, R. (2004). Relating the food involvement scale to demographic variables, food choice and other constructs. *Food Quality and Preference,* 15 (7-8), 871-879.

Mattila, A. S., & Wirtz, J. (2002). The impact of knowledge types on the consumer search process - An investigation in the context of credence services. *International Journal of Service Industry Management,* 13 (3-4), 214-230.

McCarthy, M., Brennan, M., Kelly, A. L., Ritson, C., De Boer, M., & Thompson, N. (2005). Food safety risk communication: considering the views of the public and experts in an all-Ireland study. In B. Maunsell & D. Bolton (Eds.), Food Safety Risk Communication: The Message and Motivational Strategies. Gothenburg.

Mcintosh, W. A., Christensen, L. B., & Acuff, G. R. (1994). Perceptions of risks of eating undercooked meat and willingness to change cooking practices. *Appetite,* 22 (1), 83-96.

Mckay, D. L., Houser, R. F., Blumberg, J. B., & Goldberg, J. P. (2006). Nutrition information sources vary with education level in a population of older adults. *Journal of the American Dietetic Association,* 106 (7), 1108-1111.

McLean-Meyinsse, P. E. (2001). An analysis of nutritional label use in the southern United States *Journal of Food Distribution Research,* 32 (1), 110-114.

Meredith, W. (1993). Measurement Invariance, Factor-Analysis and Factorial Invariance. *Psychometrika,* 58 (4), 525-543.

Michalos, A. C., Hatch, P. M., Hemingway, D., Lavallee, L., Hogan, A., & Christensen, B. (2007). Health and quality of life of older people, a replication after six years. *Social Indicators Research,* 84 (2), 127-158.

Middleton, K. L., & Jones, J. L. (2000). Socially desirable response sets: The impact of country culture. *Psychology & Marketing,* 17 (2), 149-163.

Millar, M. G., & Tesser, A. (1986). Effects of affective and cognitive focus on the attitude behaviour Relation. *Journal of Personality and Social Psychology,* 51 (2), 270-276.

Mitchell, A. A., & Dacin, P. A. (1996). The assessment of alternative measures of consumer expertise. *Journal of Consumer Research,* 23 (3), 219-239.

Mittal, B. (1989). Must consumer involvement always imply more information search. *Advances in Consumer Research,* 16, 167-172.

Mizerski, R. W. (1982). An attribution explanation of the disproportionate influence of unfavourable information. *Journal of Consumer Research,* 9 (3), 301-310.

Moore, W. L., & Lehmann, D. R. (1980). Individual-differences in search behaviour for a nondurable. *Journal of Consumer Research,* 7 (3), 296-307.

Moorman, C., Diehl, K., Brinberg, D., & Kidwell, B. (2004). Subjective knowledge, search locations, and consumer choice. *Journal of Consumer Research,* 31 (3), 673-680.

Moorman, C., & Matulich, E. (1993). A model of consumers preventive health behaviours - the role of health motivation and health ability. *Journal of Consumer Research,* 20 (2), 208-228.

Moorman, R. H., & Podsakoff, P. M. (1992). A metaanalytic review and empirical-test of the potential confounding effects of social desirability response sets in organizational-behaviour research. *Journal of Occupational and Organizational Psychology,* 65, 131-149.

Moorthy, S., Ratchford, B. T., & Talukdar, D. (1997). Consumer information search revisited: Theory and empirical analysis. *Journal of Consumer Research,* 23 (4), 263-277.

Mori, T. A., Beilin, L. J., Burke, V., Morris, J., & Ritchie, J. (1997). Interactions between dietary fat, fish, and fish oils and their effects on platelet function in men at risk of cardiovascular disease. *Arteriosclerosis Thrombosis and Vascular Biology,* 17 (2), 279-286.

Morrow, J. L., Hansen, M. H., & Person, A. W. (2004). The cognitive and affective antecedents of general trust within cooperative organisations. *Journal of Managerial Issues,* 16 (1), 48-64.

Moutinho, L., Goode, M., & Davies, F. (1998). Quantitative analysis in marketing management. New York: John Wiley and Sons.

Mowen, J. C. (1993). Consumer behaviour. New York: Macmillan Publishing Company.

Mozaffarian, D., Ascherio, A., Hu, F. B., Stampfer, M. J., Willett, W. C., Siscovick, D. S., et al. (2005). Interplay between different polyunsaturated fatty acids and risk of coronary heart disease in men. *Circulation,* 111 (2), 157-164.

Mozaffarian, D., Lemaitre, R. N., Kuller, L. H., Burke, G. L., Tracy, R. P., & Siscovick, D. S. (2003). Cardiac benefits of fish consumption may depend on the type of fish meal consumed - The Cardiovascular Health Study. *Circulation,* 107 (10), 1372-1377.

Mozaffarian, D., & Rimm, E. B. (2006). Fish intake, contaminants, and human health - Evaluating the risks and the benefits. *Journal of the American Medical Association,* 296 (15), 1885-1899.

Munoz-Sastre, M. T., & Ferriere, G. (2000). Family decline and the subjective wellbeing of adolescents. *Social Indicators Research,* 49, 69-82.

Myrland, O., Trondsen, T., Johnston, R. S., & Lund, E. (2000). Determinants of seafood consumption in Norway: lifestyle, revealed preferences, and barriers to consumption. *Food Quality and Preference,* 11 (3), 169-188.

Nakamura, Y., Ueshima, H., Okamura, T., Kadowaki, T., Hayakawa, T., Kita, Y., et al. (2005). Association between fish consumption and all-cause and cause-specific mortality in Japan: NIPPON DATA80, 1980-99. *American Journal of Medicine,* 118 (3), 239-245.

Nauman, F. A., Gempesaw, C. M., Bacon, J. R., & Manalo, A. (1995). Consumer choice for fresh fish: factors affecting purchase decisions. *Marine Resource Economics,* 10, 117-142.

Nayga, R. M. (1996). Determinants of consumers' use of nutritional information on food packages *Journal of Agricultural and Applied Economics,* 28 (2), 303-312.

Nayga, R. M. (2000). Schooling, health knowledge and obesity. *Applied Economics,* 32 (7), 815-822.

Nayga, R. M., & Capps, O. (1995). Factors affecting the probability of consuming fish and shellfish in the away from home and at home markets. *Journal of Agricultural and Applied Economics,* 27 (1), 161-171.

Nestel, P. J. (2000). Fish oil and cardiovascular disease: lipids and arterial function. *American Journal of Clinical Nutrition,* 71 (1), 228S-231S.

Netter, P. (1996). Health and pleasure. In D. M. Warburton & N. Sherwood (Eds.), Pleasure and quality and life pp. 81-89. Chichester, UK: John Wiley.

Nielsen, N. A., Sørensen, E., & Grunert, K. (1997). Consumer motives for buying fresh or frozen plaice – a means-end chain approach. In J. Luten, T. Børresen & J. Oehlenschläger (Eds.), Seafood from Producer to Consumer, Integrated Approach to Quality pp. 31-43. Amsterdam: Elsevier Science.

Norat, T., Bingham, S., Ferrari, P., Slimani, N., Jenab, M., Mazuir, M., et al. (2005). Meat, fish, and colorectal cancer risk: The European prospective investigation into cancer and nutrition. *Journal of the National Cancer Institute,* 97 (12), 906-916.

O'Cass, A. (2000). An assessment of consumers product, purchase decision, advertising and consumption involvement in fashion clothing. *Journal of Economic Psychology,* 21 (5), 545-576.

O'Keefe, G. J., Boyd, H. H., & Brown, M. R. (1998). Who learns preventive health care information from where: Cross-channel and repertoire comparisons. *Health Communication,* 10 (1), 25-36.

O'Sullivan, C., Scholderer, J., & Cowan, C. (2005). Measurement equivalence of the food related lifestyle instrument (FRL) in Ireland and Great Britain. *Food Quality and Preference,* 16 (1), 1-12.

Oakes, M. E., & Slotterback, C. S. (2001a). Gender differences in perceptions of the healthiness of foods. *Psychology & Health,* 16 (1), 57-65.

Oakes, M. E., & Slotterback, C. S. (2001b). Judgements of food healthfulness: food name stereotypes in adults over age 25. *Appetite,* 37 (1), 1-8.

Oakes, M. E., & Slotterback, C. S. (2001c). What's in a name? A comparison of men's and women's judgements about food names and their nutrient contents. *Appetite,* 36 (1), 29-40.

Olsen, S. O. (1999). Strength and conflicting valence in the measurement of food attitudes and preferences. *Food Quality and Preference,* 10 (6), 483-494.

Olsen, S. O. (2001). Consumer involvement in seafood as family meals in Norway: an application of the expectancy-value approach. *Appetite,* 36 (2), 173-186.

Olsen, S. O. (2003). Understanding the relationship between age and seafood consumption: the mediating role of attitude, health involvement and convenience. *Food Quality and Preference,* 14 (3), 199-209.

Olsen, S. O., Scholderer, J., Brunso, K., & Verbeke, W. (2007). Exploring the relationship between convenience and fish consumption: A cross-cultural study. *Appetite,* 49 (1), 84-91.

Oomen, C. M., Feskens, E. J. M., Rasanen, L., Fidanza, F., Nissinen, A. M., Menotti, A., et al. (2000). Fish consumption and coronary heart disease mortality in Finland, Italy, and the Netherlands. *American Journal of Epidemiology,* 151 (10), 999-1006.

Osler, M., Heitmann, B. L., Hoidrup, S., Jorgensen, L. M., & Schroll, M. (2001). Food intake patterns, self rated health and mortality in Danish men and women. A prospective observational study. *Journal of Epidemiology and Community Health,* 55 (6), 399-403.

Park, C. W., & Lessig, V. P. (1981). Familiarity and its impact on consumer decision biases and heuristics. *Journal of Consumer Research,* 8 (2), 223-230.

Park, C. W., Mothersbaugh, D. L., & Feick, L. (1994). Consumer knowledge assessment. *Journal of Consumer Research,* 21 (1), 71-82.

Pavot, W., & Diener, E. (1993). Review of the Satisfaction With Life Scale. *Psychological Assessment,* 5 (2), 164-172.

Pavot, W., Diener, E., Colvin, C. R., & Sandvik, E. (1991). Further validation of the satisfaction with life scale - evidence for the cross-method convergence of well-being measures. *Journal of Personality Assessment,* 57 (1), 149-161.

Peters, R. G., Covello, V. T., & McCallum, D. B. (1997). The determinants of trust and credibility in environmental risk communication: An empirical study. *Risk Analysis,* 17 (1), 43-54.

Peterson, R. A. (1994). A metaanalysis of Cronbach coefficient-alpha. *Journal of Consumer Research,* 21 (2), 381-391.

Petrovici, D. A., & Ritson, C. (2006). Factors influencing consumer dietary health preventative behaviours. *BMC Public Health,* 6, 222.

Petty, R. E., & Cacioppo, J. T. (1986). The elaboration likelihood model of persuasion. *Advances in Experimental Social Psychology,* 19, 123-205.

Petty, R. E., & Krosnick, J. A. (1995). Attitude strength: antecedents and consequences. Mahwah: Erlbaum.

Pieniak, Z., Verbeke, W., Brunso, K., & Olsen, S. O. (2006). Consumer knowledge and interest in information about fish. In J. Luten, C. Jacobsen, K. Bekaert, A. Sæøbo & J. Oehlenschlager (Eds.), Seafood research from fish to dish: Quality, safety and processing of wild and farmed fish. pp. 229-241. Wageningen Wageningen Academic Publisher.

Pieniak, Z., Verbeke, W., Fruensgard, L., Brunso, K., & Olsen, S. O. (2004). Determinants of fish consumption: Role and importance of information. *Polish Journal of Human Nutrition and Metabolism,* 31 (Suppl.2), 409-414.

Pieniak, Z., Verbeke, W., Scholderer, J., Brunsø, K., & Olsen, S. O. (2007a). European consumers' use of and trust in information sources about fish. *Food Quality and Preference,* 18, 1050-1063.

Pieniak, Z., Verbeke, W., Scholderer, J., Brunsø, K., & Olsen, S. O. (2007b). Impact of consumers' health beliefs, involvement and risk perception on fish consumption: A study in five European countries. *British Food Journal, in press*.

Pieniak, Z., Verbeke, W., Vermeir, I., Brunsø, K., & Olsen, S. O. (2007c). Consumer interest in fish information and labelling: exploratory insights. *Journal of International Food and Agri-business Marketing,* 19 (2/3), 117-141.

Pieńkowska, B. (2004). Spożycie ryb (Fish consumption). IERiGŻ: Rynek ryb: stan perspektywy. Analizy rynkowe. Warsaw: Dział Wydawnictw IERiGŻ.

Pilgrim, F. (1957). The components of food acceptance and their measurement. *American Journal of Clinical Nutrition,* 5, 171-175.

Piwonska, A., Piotrowski, W., Bielecki, W., Kozakiewicz, K., Gluszek, J., Biela, U., et al. (2006). Health knowledge and it's determinants in general population. Do persons suffered from cardiovascular diseases know more about prevention? *European Heart Journal,* 27, 108-108.

Polivy, J., & Herman, C. P. (2002). If at first you don't succeed - False hopes of self-change. *American Psychologist,* 57 (9), 677-689.

Popkin, B., Zizza, C., & Siega-Riz, A. M. (2003). Who is leading the change? US dietary quality comparison between 1965 and 1996. *American Journal of Preventive Medicine,* 25 (1), 1-8.

Price, L. L., & Feick, L. F. (1984). The role of interpersonal sources in external search - an informational perspective. *Advances in Consumer Research,* 11, 250-255.

Punj, G. N., & Staelin, R. (1983). A model of consumer information - search behaviour for new automobiles. *Journal of Consumer Research,* 9 (4), 366-380.

Raab, C. A., Bock, M. A., Carpenter, K., Medeiros, D., Ortiz, M., Read, M., et al. (1989). Targeting messages to supplement users. *Journal of the American Dietetic Association,* 89 (4), 545-546.

Raats, M. M., & Shepherd, R. (1996). Developing a subject-derived terminology to describe perceptions of chemicals in foods. *Risk Analysis,* 16 (2), 133-146.

Radecki, C. M., & Jaccard, J. (1995). Perceptions of knowledge, actual knowledge, and information search behavior. *Journal of Experimental Social Psychology,* 31 (2), 107-138.

Raju, P. S., Lonial, S. C., & Mangold, W. G. (1995). Differential effects of subjective knowledge, objective knowledge, and usage experience on decision making. *Journal of Consumer Psychology,* 4 (2), 153-180.

Raude, J., Fischler, C., Setbon, M., & Flahault, A. (2005). Scientist and public responses to BSE-related risk: A comparative study. *Journal of Risk Research,* 8 (7-8), 663-678.

Renn, O., & Levine, D. (1991). Credibility and trust in risk communication. In R. Kasperson & P. J. Stallen (Eds.), Communicating Risk to the Public pp. 175-218. Dordrecht: Kluwer Academic Publishers.

Rentz, J. O., Reynolds, F. D., & Stout, R. G. (1983). Analyzing changing consumption patterns with cohort analysis. *Journal of Marketing Research,* 20 (1), 12-20.

Rentz, J. O., & Reynolds, T. J. (1981). Separating age, cohort and period effects in consumer behaviour. *Advances in Consumer Research,* 8, 596-601.

Richardson, N. J., Shepherd, R., & Elliman, N. (1994). Meat consumption, definition of meat and trust in information-sources in the UK population and members of the vegetarian society. *Ecology of Food and Nutrition,* 33 (1-2), 1-13.

Ritson, C., & Hutchins, R. (1995). Food choice and the demand for food. In D. W. Marshall (Ed.), Food choice and the consumer pp. 152-181. London, UK: Blackie Academic & Professional.

Robinson, J. P., Shaver, P. R., & Wrightman, L. S. (1991). Measures of personality and social psychological attitudes. San Diego: Academic Press.

Roininen, K., Lahteenmaki, L., & Tuorila, H. (1999). Quantification of consumer attitudes to health and hedonic characteristics of foods. *Appetite,* 33 (1), 71-88.

Rortveit, A. W., & Olsen, S. O. (2007). The role of consideration set size in explaining fish consumption. *Appetite,* 49 (1), 214-222.

Rosati, S., & Saba, A. (2000). Factors influencing the acceptance of food biotechnology. *Italian Journal of Food Science,* 12 (4), 425-434.

Rosati, S., & Saba, A. (2004). The perception of risks associated with food-related hazards and the perceived reliability of sources of information. *International Journal of Food Science and Technology,* 39 (5), 491-500.

Roselius, T. (1971). Consumer rankings of risk reduction methods. *Journal of Marketing,* 35, 56-61.

Rossiter, J. R., & Eagleson, G. (1994). Conclusions from the arfs copy research validity project. *Journal of Advertising Research,* 34 (3), 19-32.

Rozin, P. (1990). Development in the food domain. *Developmental Psychology,* 26 (4), 555-562.

Rozin, P., & Fallon, A. E. (1987). A perspective on disgust. *Psychological Review,* 94 (1), 23-41.

Rozin, P., Fischler, C., Imada, S., Sarubin, A., & Wrzesniewski, A. (1999). Attitudes to food and the role of food in life in the USA, Japan, Flemish Belgium and France: Possible implications for the diet-health debate. *Appetite,* 33 (2), 163-180.

Rozin, P., Levine, E., & Stoess, C. (1991). Chocolate craving and liking. *Appetite,* 17, 199-212.

Ryff, C. D. (1989). Happiness is everything, or is it? Explorations on the meaning of psychological wellbeing. *Journal of Personality and Social Psychology,* 57 (6), 1069-1081.

Sacharin, K. (2001). Attention! New York: John Wiley and Sons.

Sagiv, L., & Schwartz, S. H. (2000). Value priorities and subjective well-being: direct relations and congruity effects. *European Journal of Social Psychology,* 30 (2), 177-198.

Salaün, Y., & Flores, K. (2001). Information quality: meeting the needs of the consumer. *International Journal of Information Management,* 21, 21-37.

Sapp, S. G., & Jensen, H. H. (1998). An evaluation of the health belief model for predicting perceived and actual dietary quality. *Journal of Applied Social Psychology,* 28 (3), 235-248.

Satia, J. A., Galanko, J. A., & Neuhouser, M. L. (2005). Food nutrition label use is associated with demographic, behavioural, and psychosocial factors and dietary intake among African Americans in north Carolina. *Journal of the American Dietetic Association,* 105 (3), 392-402.

Satorra, A., & Bentler, P. (1988). Scaling corrections for chi-square statistics in covariance structure analysis. American Statistical Association 1988 proceedings of the Business and Economics Sections pp. 308-313. Alexandria, VA: American Statistical Association.

Schapira, D. V., Kumer, N. B., Lyman, C. H., & McMillan, S. C. (1990). The value of current nutrition information. *Preventive Medicine,* 9, 45-53.

Schmidt, E., Skou, H., Christensen, J., & J., D. (2000). n – 3 Fatty acids from fish and coronary artery disease: implications for public health. Review. *Public Health Nutrition,* 3 (1), 91-98(98).

Schmidt, J., & Sperng, R. (1996). A proposed model of external consumer information search. . *Journal of the Academy of Marketing Science,* 24, 246 – 226.

Scholderer, J., Brunso, K., Bredahl, L., & Grunert, K. G. (2004). Cross-cultural validity of the food-related lifestyles instrument (FRL) within Western Europe. *Appetite,* 42 (2), 197-211.

Scholderer, J., & Grunert, K. (2001). Does generic advertising work? A systematic evaluation of the Danish campaign for fresh fish. *Aquaculture Economics and Management,* 5, 253-271.

Scholderer, J., & Grunert, K. (2003). Promoting seafood consumption: an evaluation of the Danish campaign for fresh fish. In J. Luten, J. Oehlenschlager & G. Olafsdottir (Eds.), Quality of fish from catch to consumer: labelling, monitoring and traceability pp. 367-374. Wageninge: Wageningen Academic Publishers.

Scholderer, J., Grunert, K. G., & Brunsø, K. (2005). A procedure for eliminating additive bias from cross-cultural survey data. *Journal of Business Research,* 58, 72-78.

Selnes, F., & Gronhaug, K. (1986). Subjective and objective measures of product knowledge contrasted. *Advances in Consumer Research,* 13, 67-71.

Senauer, B., Asp, E., & Kivey, J. (1991). Food trends and the changing consumer. Minesota: Eagen Press.

Shepherd, R. (1990). Overview of factors influencing food choice. In M. Ashwell (Ed.), Proceedings of the 12th British Nutrition Foundation Annual Conference pp. 12-30. London: British Nutrition Foundation.

Shepherd, R., & Raats, M. (1996). Attitude and beliefs in food habits. In H. L. Meiselman & H. J. H. MacFie (Eds.), Food choice, acceptance and consumption pp. 346-364. London, UK: Blackie Academic & Professional

Shepherd, R., & Sparks, P. (1994). Modeling food choice. In H. J. H. MacFie & D. M. H. Thomson (Eds.), Measurement of food preferences pp. 202-226. London: Blackie Academic & Professional.

Shin, D. C., & Johnson, D. M. (1978). Avowed happiness as an overall assessment of quality of life. *Social Indicators Research,* 5 (4), 475-492.

Sidhu, K. S. (2003). Health benefits and potential risks related to consumption of fish or fish oil. *Regulatory Toxicology and Pharmacology,* 38 (3), 336-344.

Siegrist, M. (2000). The influence of trust and perceptions of risks and benefits on the acceptance of gene technology. *Risk Analysis,* 20 (2), 195-203.

Siegrist, M., & Cvetkovich, G. (2001). Better negative than positive? Evidence of a bias for negative information about possible health dangers. *Risk Analysis,* 21 (1), 199-206.

Silvers, K. M., & Scott, K. M. (2002). Fish consumption and self-reported physical and mental health status. *Public Health Nutrition,* 5 (3), 427-431.

Sioen, I. (2007). The nutritional-toxicological conflict related to seafood consumption. Doctoral Thesis. Ghent University.

Sioen, I., De Henauw, S., Verbeke, W., Verdonck, F., Willems, J., & Van Camp, J. (2008a). Fish consumption is a safe solution to increase the intake of long chain omega-3 fatty acids. *Public Health Nutrition,* in press.

Sioen, I., Van Camp, J., Verdonck, F., Verbeke, W., Vanhonacker, F., J., W., et al. (2008b). Probabilistic intake assessment of multiple compounds as a tool to quantify the nutritional-toxicological conflict in relation to seafood consumption. *Chemosphere,* in press.

Slimani, N., Fahey, M., Welch, A., Wirfält, E., Stripp, C., Bergström, E., et al. (2002). Diversity of dietary patterns observed in the European Prospective Investigation

into Cancer and Nutrition (EPIC) project. *Public Health Nutrition,* 5 (6B), 1311-1328.

Slovic, P. (1992). Perceptions of risk: reflections on the psychometric paradigm. In S. Krimsky & D. Golding (Eds.), Social Theories of Risk. Westport: Praeger.

Slovic, P., Fischhoff, B., & Lichtenstein, S. (1980). Facts and fears – understanding perceive risk. *Health Physics,* 39 (6), 1005-1006

Slovic, P., Peters, E., Finucane, M. L., & MacGregor, D. G. (2005). Affect, risk, and decision making. *Health Psychology,* 24 (4), S35-S40.

Smith, K. M., & Sahyoun, N. R. (2005). Fish consumption: Recommendations versus advisories, can they be reconciled? *Nutrition Reviews,* 63 (2), 39-46.

Sparks, P., & Guthrie, C. A. (1998). Self-identity and the theory of planned behaviour: A useful addition or an unhelpful artifice? *Journal of Applied Social Psychology,* 28 (15), 1393-1410.

Spirtes, P., Glymour, C., & Scheines, R. (2000). Causation, prediction and search. Cambridge: MA: MIT Press.

Stampfer, M. J., Hu, F. B., Manson, J. E., Rimm, E. B., & Willett, W. C. (2000). Primary prevention of coronary heart disease in women through diet and lifestyle. *New England Journal of Medicine,* 343 (1), 16-22.

Steenkamp, J. B. (1997). Dynamics in consumer behaviour with respect to agricultural and food products. In B. Wierenga, A. van Tilburg, K. Grunert, J. B. Steenkamp & M. Wedel (Eds.), Agricultural Marketing and Consumer Behaviour in a Changing World pp. 143-188. Dordrecht: Kluwer Academic Publishers.

Steenkamp, J. B. E. M., & Baumgartner, H. (1998). Assessing measurement invariance in cross-national consumer research. *Journal of Consumer Research,* 25 (1), 78-90.

Steptoe, A., Pollard, T. M., & Wardle, J. (1995). Development of a measure of the motives underlying the selection of food - the food choice questionnaire. *Appetite,* 25 (3), 267-284.

Steward, W. T., Schneider, T. R., Pizarro, J., & Salovey, P. (2003). Need for cognition moderates responses to framed smoking-cessation messages *Journal of Applied Social Psychology,* 33 (12), 2439-2464.

Sumner, J., & Ross, T. (2002). A semi-quantitative seafood safety risk assessment. *International Journal of Food Microbiology,* 77 (1-2), 55-59.

Sutton, S. (1998). Predicting and explaining intentions and behaviour: How well are we doing? *Journal of Applied Social Psychology,* 28 (15), 1317-1338.

Swan, J. E. (1969). Experimental analysis of predecision information seeking. *Journal of Marketing Research,* 6, 192-197.

Swanson, V., Power, K., Kaur, B., Carter, H., & Shepherd, K. (2006). The impact of knowledge and social influences on adolescents' breast-feeding beliefs and intentions. *Public Health Nutrition,* 9 (3), 297-305.

Tellegen, A., Watson, D., & Clark, L. A. (1999). On the dimensional and hierarchical structure of affect. *Psychological Science,* 10 (4), 297-303.

The American Dietetic Association. (1995). Nutrition Trends Survey. Executive Summary. Chicago: The American Dietetic Association.

Thiede, M. (2005). Information and access to health care: is there a role for trust? *Social Science & Medicine,* 61 (7), 1452-1462.

Thorelli, H. B. (1971). Concentration of information power among consumers. *Journal of Marketing Research,* VIII, 427-432.

Tidwell, P. S., Sadowski, C. J., & Pate, L. M. (2000). Relationships between need for cognition, knowledge, and verbal ability. *Journal of Psychology,* 134 (6), 634-644.

Trafimow, D., & Finlay, K. A. (1996). The importance of subjective norms for a minority of people: Between-subjects and within-subjects analyses. *Personality and Social Psychology Bulletin,* 22 (8), 820-828.

Trafimow, D., & Sheeran, P. (1998). Some tests of the distinction between cognitive and affective beliefs. *Journal of Experimental Social Psychology,* 34 (4), 378-397.

Trafimow, D., Sheeran, P., Lombardo, B., Finlay, K. A., Brown, J., & Armitage, C. J. (2004). Affective and cognitive control of persons and behaviours. *British Journal of Social Psychology,* 43, 207-224.

Triandis, H. C., Bontempo, R., Leung, K., & Hui, C. H. (1990). A method for determining cultural, demographic, and personal constructs. *Journal of Cross-Cultural Psychology,* 21 (3), 302-318.

Trondsen, T., Braaten, T., Lund, E., & Eggen, A. E. (2004a). Consumption of seafood - the influence of overweight and health beliefs. *Food Quality and Preference,* 15 (4), 361-374.

Trondsen, T., Braaten, T., Lund, E., & Eggen, A. E. (2004b). Health and seafood consumption patterns among women aged 45-69 years. A Norwegian seafood consumption study. *Food Quality and Preference,* 15 (2), 117-128.

Trondsen, T., Scholderer, J., Lund, E., & Eggen, A. E. (2003). Perceived barriers to consumption of fish among Norwegian women. *Appetite,* 41 (3), 301-314.

Truelsen, T., Mahonen, M., Tolonen, H., Asplund, K., Bonita, R., Vanuzzo, D., et al. (2003). Trends in stroke and coronary heart disease in the WHO MONICA project. *Stroke,* 34 (6), 1346-1352.

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty - heuristics and biases. *Science,* 185 (4157), 1124-1131.

Urban, G. L., & Hauser, J. R. (1993). Design and marketing of new products. Englewood Cliffs: Prentice Hall.

van Dillen, S. M. E., Hiddink, G. J., Koelen, M. A., de Graaf, C., & van Woerkum, C. M. J. (2004). Perceived relevance and information needs regarding food topics and preferred information sources among Dutch adults: results of a quantitative consumer study. *European Journal of Clinical Nutrition,* 58 (9), 1306-1313.

Verbeke, W. (2005). Agriculture and the food industry in the information age. *European Review of Agricultural Economics,* 32 (3), 347-368.

Verbeke, W. (2007). Consumer attitudes toward genetic modification and sustainability: implications for the future of biorenewables. *Biofuels, Bioproducts and Biorefining,* 1 (3), 215-225.

Verbeke, W., Brunsø, K., & Vermeir, I. (2007a). Consumer evaluation of fish quality as basis for fish market segmentation *Food Quality and Preference,* 18 (4), 651-661.

Verbeke, W., & Pieniak, Z. (2006). Benefit beliefs, attitudes and behaviour towards fresh vegetable consumption in Poland and Belgium. *Acta Alimentaria,* 35 (1), 5-16.

Verbeke, W., Sioen, I., Pieniak, Z., Van Camp, J., & De Henauw, S. (2005). Consumer perception versus scientific evidence about health benefits and safety risks from fish consumption. *Public Health Nutrition,* 8 (4), 422-429.

Verbeke, W., & Vackier, I. (2004). Profile and effects of consumer involvement in fresh meat. *Meat Science,* 67 (1), 159-168.

Verbeke, W., & Vackier, I. (2005). Individual determinants of fish consumption: application of the theory of planned behaviour. *Appetite,* 44 (1), 67-82.

Verbeke, W., & Van Kenhove, P. (2002). Impact of emotional stability and attitude on consumption decisions under risk: The Coca-Cola crisis in Belgium. *Journal of Health Communication,* 7 (5), 455-472.

Verbeke, W., Van Oeckel, M. J., Warnants, N., Viaene, J., & Boucque, C. V. (1999a). Consumer perception, facts and possibilities to improve acceptability of health and sensory characteristics of pork. *Meat Science,* 53 (2), 77-99.

Verbeke, W., Vermeir, I., & Brunso, K. (2007b). Consumer evaluation of fish quality as basis for fish market segmentation. *Food Quality and Preference,* 18 (4), 651-661.

Verbeke, W., & Viaene, J. (2001). Effects of communication (advertising or news) on sales of commodity. In L. Frewer, E. Risvik & H. Schifferstein (Eds.), Food, people and society: A European perspective of consumers' food choice pp. 299-315. Berlin: Springer.

Verbeke, W., Viaene, J., & Guiot, O. (1999b). Health communication and consumer behavior on meat in Belgium: From BSE until dioxin. *Journal of Health Communication,* 4 (4), 345-357.

Verbeke, W., & Ward, R. W. (2001). A fresh meat almost ideal demand system incorporating negative TV press and advertising impact. *Agricultural Economics,* 25 (2-3), 359-374.

Verbeke, W., & Ward, R. W. (2006). Consumer interest in information cues denoting quality, traceability and origin: An application of ordered probit models to beef labels. *Food Quality and Preference,* 17 (6), 453-467.

Verplanken, B., Herabadi, A. G., Perry, J. A., & Silvera, D. H. (2005). Consumer style and health: The role of impulsive buying in unhealthy eating. *Psychology & Health,* 20 (4), 429-441.

Verplanken, B., & Orbell, S. (2003). Reflections on Past Behaviour: A Self-Report Index of Habit Strength. *Journal of Applied Social Psychology,* 33 (6), 1313-1330.

Visser, P. S., Krosnick, J. A., & Simmons, J. P. (2003). Distinguishing the cognitive and behavioral consequences of attitude importance and certainty: A new approach to testing the common-factor hypothesis. *Journal of Experimental Social Psychology,* 39 (2), 118-141.

Vrijens, B., De Henauw, S., Dewettinck, K., Talloen, W., Goeyens, L., De Backer, G., et al. (2002). Probabilistic intake assessment and body burden estimation of dioxin-like substances in background conditions and during a short food contamination episode. *Food Additives and Contaminants,* 19 (7), 687-700.

Wandel, M. (1995). Merking av matvarer – til gagn eller bry? . Work report No. 5. Oslo, Norway.: National Institute for Consumer Research

Wandel, M. (1997). Food labelling from a consumer perspective. *British Food Journal,* 99 (6), 212-220.

Wandel, M., & Bugge, A. (1997). Environmental concern in consumer evaluation of food quality. *Food Quality and Preference,* 8 (1), 19-26.

Wang, G. J., Fletcher, S. M., & Carley, D. H. (1995). Consumer Utilization of Food Labeling as a Source of Nutrition Information. *Journal of Consumer Affairs,* 29 (2), 368-380.

Wannamethee, G., & Shaper, A. G. (1991). Self-assessment of health-status and mortality in middle-aged British men. *International Journal of Epidemiology,* 20 (1), 239-245.

Wansink, B., Westgren, R. E., & Cheney, M. M. (2005). Hierarchy of nutritional knowledge that relates to the consumption of a functional food. *Nutrition,* 21, 264-268.

Ware, J. E., Snow, K. K., Kosinski, M., & Gandek, B. (1993). SF-36® health survey manual and interpretation guide. Boston: New England Medical Centre, The Health Institute.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and Validation of Brief Measures of Positive and Negative Affect - the Panas Scales. *Journal of Personality and Social Psychology,* 54 (6), 1063-1070.

Wedel, M., & Kamakura, W. A. (2000). Market segmentation: Conceptual and methodological foundations Boston: Kluwer Academic Publishers.

Welch, A. A., Lund, E., Amiano, P., Dorronsoro, M., Brustad, M., Kumle, M., et al. (2002). Variability of fish consumption within the 10 European countries participating in the European Investigation into Cancer and Nutrition (EPIC) study. *Public Health Nutrition,* 5 (6B), 1273-1285.

Wiener, N. (1954). The human use of human beings; cybernetics and society. Boston, New York: Doubleday; Houghton Mifflin.

Wildavsky, A., & Dake, K. (1990). Theories of risk perception: Who fears what and why. *Deadalus,* 119 (41-60).

Wilke, W. H. (1934). An experimental comparison of the speech, the radio and the printed page as propaganda devices. *Archives of Psychology,* 169.

Wilson, W. (1967). Correlates of avowed happiness. *Psychological Bulletin,* 67, 294-306.

Wolfe, R. N., & Grosch, J. W. (1990). Personality-correlates of confidence in ones decisions. *Journal of Personality,* 58 (3), 515-534.

Wood, W. (1982). Retrieval of attitude-relevant information from memory - effects on susceptibility to persuasion and on intrinsic motivation. *Journal of Personality and Social Psychology,* 42 (5), 798-810.

Wood, W., Rhodes, N., & Biek, M. (1993). Working knowledge and attitude strength: An information-processing analysis. In R. E. Petty & J. A. Krosnick (Eds.), Attitude strength: Antecedents and consequences Mahwah: Erlbaum.

World Health Organization. (2002). The world health report 2002: reducing risks, promoting healthy life. Geneva.

World Health Organization. (2003). Diet, nutrition and the prevention of cardiovascular diseases. WHO Technical report series, 916. Geneva: WHO.

Worsley, A., & Lea, E. (2003). Consumers' personal values and sources of nutrition information. *Ecology of Food and Nutrition,* 42 (2), 129-151.

Yancy, W. S., Westman, E. C., French, P. A., & Califf, R. M. (2003). Diets and clinical coronary events - The truth is out there. *Circulation,* 107 (1), 10-16.

Yeung, R., & Morris, J. (2006). An empirical study of the impact of consumer perceived risk on purchase likelihood: a modelling approach. *International Journal of Consumer Studies,* 30, 294-305.

Zaichkowsky, J. L. (1985). Measuring the involvement construct. *Journal of Consumer Research,* 12, 341-352.

Zaltman, G., & Duncan, R. (1977). Strategies for planned social change. New York: Wiley.

SCIENTIFIC CURRICULUM VITAE

Zuzanna Alicja Pieniak was born in Wrocław (Poland) on March 12, 1979. She completed secondary education at the II 'Liceum Ogólnokształcące im. S.Batorego', in Warsaw, in 1998. The same year, she started studying at the Faculty of Human Nutrition and Consumption Sciences, at the Warsaw University of Life Sciences (SGGW). She received her engineer diploma in Food Technology and Human Nutrition, option: Economics and Consumption Sciences in 2002, obtained with greatest distinction. She continued her academic education at the Ghent University, Faculty of Agricultural and Applied Biological Science, where she obtained the Master of Science in Food Technology degree in July 2003 with great distinction.

In March 2004, she started working at the Ghent University, Department of Agricultural Economics, as a PhD student on the Consumer Pillar of the European Integrated Project SEAFOODplus. In March 2007 she was hosted at the Aarhus School of Business (MAPP), University of Aarhus in Denmark for a training activity 'Use of Structural Equation Modelling (LISREL) in the analysis of consumer's needs for seafood information and development of effective seafood communication'. She successfully completed the Doctoral Training Program at the Faculty of Bioscience Engineering in September 2007.

She participated in many national and international scientific conferences, seminars and workshops with oral and poster contributions. At the 2nd Congress on Food, Nutrition and Health in Poland Integrated with European Union held in June 2004 in Warsaw (Poland) she won the Best Poster Presentation Award with her poster 'Determinants of fish consumption: Role and importance of information'. At the 4th SEAFOODplus Conference held in June 2007 in Bilbao (Spain) she won the Best Oral Presentation Award with her presentation 'Health beliefs as drivers to seafood consumption'.

Articles in peer-reviewed international journals included in the Science Citation Index (A1)

Verbeke, W., Sioen, I., Pieniak, Z., Van Camp, J., and De Henauw, S. (2005). Consumer perception versus scientific evidence about health benefits and safety risks from fish consumption. *Public Health Nutrition*, 8, 422-429.

Verbeke, W. & Pieniak, Z. (2006). Benefit beliefs, attitudes and behaviour towards fresh vegetable consumption in Poland and Belgium. *Acta Alimentaria*, 35 (1), 5-16.

Pieniak, Z., Verbeke, W., Scholderer, J., Brunsø, K. & Olsen, S.O. (2007). European consumers' use of and trust in information sources about fish. *Food Quality and Preference,* 18, 1050-1063.

Pieniak, Z., Verbeke, W., Scholderer, J., Brunsø, K. & Olsen, S.O. (2008). Comparison between Polish and Western European fish consumers in their attitudinal and behavioural patterns. *Acta Alimentaria,* in press

Pieniak, Z., Verbeke, W., Brunsø, K. & De Henauw, S. (2007). Determinants of fish consumption among CVD and non-CVD respondents. Resubmitted to *BMC Public Health*

Pieniak, Z., Verbeke, W., Scholderer, J., Brunsø, K., Olsen, S.O. (2008). Impact of consumers' health beliefs, involvement and risk perception on fish consumption: A study in five European countries. *British Food Journal,* in press

Vanhonacker, F., Pieniak, Z., Verbeke, W. (2008). Fish market segmentation based on consumers' motives, barriers and risk perception in Belgium. *Journal of Aquatic Food Product Technology*

Articles in peer-reviewed international journals not included in the Science Citation Index (A2)

Pieniak, Z. & Verbeke, W. (2004). Consumer motivation for eating fresh vegetables: comparing Poland and Belgium. *Polish Journal of Human Nutrition and Metabolism*, 31 (Suppl.2), 227-233.

Pieniak, Z., Verbeke, W., Fruensgard, L., Brunsø, K. & Olsen, S.O. (2004). Determinants of fish consumption: Role and importance of information. *Polish Journal of Human Nutrition and Metabolism*, 31 (Suppl.2), 409-414.

Pieniak, Z., Verbeke, W., Brunsø, K. & Olsen, S.O. (2007). Consumer interest in fish information, traceability and labelling: exploratory insights. *Journal of International Food and Agribusiness Marketing,* 19 (2&3), 117-141.

Publications in books/proceedings

Pieniak, Z. and Verbeke, W. (2007). How satisfied are European consumers with their lives? In: Skrzypek, E. (Ed). Conditions for the quality of life in the information society (Uwarunkowania jakości życia w społeczeństwie informacyjnym). Lublin, Poland: UMCS Publisher, Part I, 427-434.

Pieniak, Z., Verbeke, W., Brunsø, K. & Olsen, S.O. (2006). Consumer knowledge and interest in information about fish. In: Luten, J., Jacobsen, C., Bekaert, K., Sæøbo, A. and Oehlenschlager, J. (eds.). Seafood research from fish to dish: Quality, safety and processing of wild and farmed fish. Wageningen: Wageningen Academic Publisher, 229-240.

Verbeke, W., Pieniak, Z., Brunsø, K. & Olsen, S.O. (2008). Evaluating consumer information needs in the purchase of seafood products. In: Børresen, T. (Ed.). Improving seafood products for the consumer.

Abstracts, Conferences

Pieniak, Z., Verbeke, W., Fruensgard, L., Brunsø, K. & Olsen, S.O. (2004). Determinants of fish consumption: Role and importance of information. II Congress on Food, Nutrition and Health in Poland Integrated with European Union (23-26 June 2004), Warsaw, Poland.

De Lange, I., Sioen, I., Pieniak, Z., Verbeke, W., Van Camp, J. & De Henauw, S. (2004). Health benefits and safety risks from fish consumption: consumer perception versus scientific evidence. 7th Food and Health Congress - "7e voedings- en gezondheidscongres" (19-20 November 2004), Brussels, Belgium.

Pieniak, Z., Verbeke, W., De Lange, I., Sioen, I., Van Camp, J. & De Henauw, S. (2004). Determinants of fish consumption: Application of the Theory of Planned Behaviour. 7th Food and Health Congress - "7e voedings- en gezondheidscongres" (19-20 November 2004), Brussels, Belgium.

Verbeke, W., Pieniak, Z. & Brunsø, K. (2005). Consumer needs and interest in traceability of seafood. "2nd SEAFOODplus Conference" (5 October 2005), Granville, France.

Scholderer, J., Olsen, S. O., Brunsø, K. Honkanen, P. Verbeke, W. & Pieniak, Z. (2006). The relative importance of habitual and deliberative factors in food consumer behaviour. *Appetite*, 47 (2), 276.

Scholderer, J., Olsen, S. O., Brunsø, K. Honkanen, P. Verbeke, W. & Pieniak, Z. (2006). The relative importance of habitual and deliberative factors in food consumer behaviour. "Food Choice Conference" (21 April 2006), Birmingham, UK.

Scholderer, J., Brunsø, K., Olsen, S.O., Pieniak, Z. & Verbeke, W. (2006). Go East: Differences between Poland and Western European countries in the motivational structures underlying seafood consumption. "13th Biennial Conference if the International Institute of Fisheries Economics and Trade" (11-14 July 2006), Porthsmouth, UK.

Honkanen, P., Toften, K., Olsen, S.O., Pieniak, Z., Verbeke, W., Brunsø, K.& Scholderer, J. (2006). Cross cultural differences in fish consumption: The SEAFOODplus consumer survey in five European countries. "13th Biennial Conference if the International Institute of Fisheries Economics and Trade" (11-14 July 2006), Porthsmouth, UK.

Pieniak, Z., Verbeke, W., Brunso, K. & Scholderer, J. (2007). Health beliefs as drivers to seafood consumption. "4th SEAFOODplus Conference" (5 June 2007), Bilbao, Spain.

Pieniak, Z. & Verbeke, W. (2007). Health and seafood. "Sjømatkonferansen 2007 (the Norwegian Seafood conference 2007)" (9 October 2007) Bergen, Norwey.

Pieniak, Z., Verbeke, W., Brunso, K. & Scholderer, J. (2007). How European consumers perceive fish in terms of health benefits and safety risks? "37th WEFTA Conference" (23-25 October 2007), Lisbon, Portugal.

Vanhonacker, F., Pieniak, Z. & Verbeke (2007). Consumer interest in fish information, traceability and labelling: exploratory insights "37th WEFTA Conference" (23-25 October 2007), Lisbon, Portugal.


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