Consumer Responses to Risk-Benefit Information about Food

Heleen van Dijk

Thesis committee

Thesis supervisor
Prof. dr. L.J. Frewer
Professor of Food Safety and Consumer Behaviour
Wageningen University

Thesis co-supervisors
Dr. ir. A.R.H. Fischer
Assistant professor, Marketing and Consumer Behaviour Group
Wageningen University

Dr. ir. P.W. van Kleef
Assistant professor, Marketing and Consumer Behaviour Group
Wageningen University

Other members
Prof. dr. C.M.J. van Woerkum, Wageningen University, the Netherlands
Dr. J.M. Gutteling, University of Twente, Enschede, the Netherlands
Prof. dr. L. Lähteenmäki, Aarhus School of Business, Denmark
Prof. dr. R.M. Nayga Jr., University of Kansas, United States of America

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Heleen van Dijk

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To Shahar, Nathan en Maya

ABSTRACT

Communication about the healthiness of consuming different food products has typically involved *either* health messages about the associated risks *or* benefits. In reality, consumption decisions often involve consumers "trading-off" the risks and benefits associated with the consumption of a particular food product. If consumers are to make informed choices about food consumption, they may need to simultaneously understand both risk and benefit information associated with consuming different foods. However, it is not known how this potentially conflicting information can best be communicated. Effective risk-benefit communication is also important because, increasingly, risk assessment and regulatory decision-making is focused on risk *and* benefit associated with a specific food issue, which will also need to be communicated to consumers. This thesis therefore examines consumer responses to information about both risks and benefits associated with food, in order to provide insights into effective ways to communicate this information. For this purpose, three lines of research are explored: (1) consumer perceptions and responses to *integrated risk-benefit metrics*, (2) *potential barriers* to effective risk-benefit communication, and (3) consumer responses to communication about *risk management practices* associated with food hazards.

In *Chapter* 2 consumer preferences regarding several integrated risk-benefit metrics describing the combined impact of risks and benefits associated with food consumption on health are qualitatively explored. *Chapter 3* examines consumer perceptions of quality-adjusted-life-years (QALYs) as a tool for describing the combined impact of risks and benefits associated with food consumption, and in *Chapter 4* it is examined whether integrated risk-benefit information in terms of QALYs can facilitate informed decision making for consumers, including how this information can best be presented. The research regarding potential barriers to effective risk-benefit communication focuses on optimism regarding risks and benefits associated with food consumption (*Chapter 5*), and on the role of initial attitudes on the occurrence of negativity effects after the provision of balanced risk-benefit information (*Chapter 6*). Finally, the impact of information about risk management practices associated with food hazards on consumer perceptions of food risk management quality are examined (*Chapter 7*).

Overall, the results of this thesis provide useful insights for the development of effective risk-benefit communication, including the communication of information about integrated risk-benefit assessments, and for the development of effective ways to communicate about risk management practices associated with food hazards.

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CONTENTS

1

GENERAL INTRODUCTION

Communication about the healthiness of consuming different food products has typically involved *either* health messages about the associated risks *or* benefits. In the past, communication about food safety issues has tended to focus on risks (Frewer et al., 2004; Hansen, Holm, Frewer, Robinson, & Sandoe, 2003), while health benefits associated with consumption of the same foods tended to have been communicated separately as nutrition information (e.g. Grunert & Wills, 2007). In reality, consumption decisions often involve consumers "trading-off" the risks and benefits associated with the consumption of a particular food product. For example, the health effects associated with the consumption of a specific food product may be weighed against product characteristics such as taste, price, and the extent to which a consumer perceives its production to be associated with potential environmental risks, or concerns about sustainable production. In other instances consumers will have to balance positive health effects against negative ones. A case in point is fish consumption, which has both beneficial effects on health (from omega-3 fatty acids), such as increased cardiovascular protection, and harmful effects related to toxic contaminants (such as methyl mercury, dioxins or PCBs, Mozaffarian & Rimm, 2006).

Research on how the public perceive different types of risks has identified several qualitative dimensions of hazards that play a role in the acceptance and perceptions of those hazards (Fischhoff, Slovic, Lichtenstein, Read, & Combs, 1978; Slovic, 1987). For example, the public's negative reactions to certain technological hazards (e.g. nuclear technology, genetic modification) could be attributed to a perception that risk exposure is involuntary, and not under the control of the individual. Other potential psychological factors of relevance include the dreadedness of the particular hazard under consideration, and perceived inequity in the distribution of risks and benefits (for example, across different population groups, or between industry and citizens, Slovic, 1987). The psychometric paradigm has also been applied to study perceptions of different types of food hazards (Fife-Schaw & Rowe, 1996; Miles & Frewer, 2001; Sparks & Shepherd, 1994), and after various food safety incidents such as the BSE-crisis, and public opposition to the application of genetic modification in food, an

understanding of how the public perceives food risks has become increasingly important (Frewer, 2003; Frewer & Salter, 2002).

There is evidence to support the idea that the acceptance and perceptions of food hazards and food production technologies are not only determined by perceptions of risks, but also by perceptions of benefits associated with the hazard or technology (Fife-Schaw & Rowe, 1996; Frewer, 2003; Frewer, Howard, & Shepherd, 1997; Gaskell et al., 2004; Hu, Hünnemeyer, Veeman, Adamowicz, & Srivastava, 2004; Savadori et al., 2004; Siegrist, 1999, 2000). Nevertheless, research underpinning effective communication about both benefits and risks, generally and specifically related to food, is relatively limited compared to research on risk communication *per se* (Fischhoff, 1995).

It is important that people have information about both risks and benefits associated with a particular activity, in order to make informed choices based on a comprehensive evaluation of all relevant information. In other words, if consumers are to make informed choices about food consumption, they may need to simultaneously understand both risk and benefit information associated with consuming different foods. However, it is not known how this potentially conflicting information can best be communicated. *This thesis therefore describes research which examines consumer responses to information about both risks and benefits associated with food, in order to provide insights into effective ways to communicate this information.*

Effective risk-benefit communication is also important because, increasingly, risk assessment and regulatory decision-making is focused on the potential risks and benefits associated with a specific food issue (EFSA, 2006; Renwick et al., 2004). Quantitative methods which enable the conversion of adverse and beneficial effects into a single common metric for risk-benefit assessments may provide integrated information on the *net* health impact of both risks and benefits. As a result of increased emphasis in policy circles on the need to implement open and transparent communication with consumers about food safety policy procedures and decision making practices (Byrne, 2002; FSA, 2002; Millstone & Van Zwanenberg, 2002), the assessment basis for regulatory action will need to be communicated to consumers (Wentholt, Rowe, König, Marvin, & Frewer, 2009). This places a new challenge for risk communication as it is unknown how consumers respond to this type of integrated risk-benefit information

As regulatory decision-making is increasingly focused on risk and benefit associated with a specific food issue, this information will need to be communicated

in an effective way that facilitates informed decision-making for consumers. It therefore becomes important to understand how consumers perceive and respond to different integrated risk-benefit metrics describing the combined impact of risks and benefits associated with food consumption, and how this information can best be communicated. A better understanding of how consumers perceive different metrics for describing the combined impact of risks and benefits on health, and insights into consumer responses to integrated risk-benefit information in terms of such metrics can provide insights into whether and how integrated risk-benefit metrics can promote the development of more effective risk-benefit communication to consumers.

Psychological phenomena exist which may act as potential barriers to effective risk-benefit communication. For example, *unrealistic optimism*, or optimistic bias, refers to the phenomenon whereby individuals tend to perceive themselves as less susceptible to risks, including those which are health related, compared to other people (Weinstein, 1980). Unrealistic optimism has also been found for positive events, in which case people believe that positive events are more likely to happen to them than to others (Weinstein, 1980; White, Eiser, Harris, & Pahl, 2007). Furthermore, people may be optimistic regarding their personal knowledge about (risks and benefits associated with) foods. In other words, they perceive that they personally know more about food-related hazards than other people (Frewer, Shepherd, & Sparks, 1994).

These optimistic bias effects may influence the effectiveness of food safety communication in changing perceptions of personal risks and benefits and subsequent food consumption behaviors. For example, unrealistic optimism regarding personal risk may hinder efforts to promote risk-reducing behavior because people believe that they are less at risk than are others (Weinstein, 1989), and hence may be less motivated to adjust their behavior. In addition, it can reduce peoples motivation to process risk information (Radcliffe & Klein, 2002; Zhao & Cai, 2009), and increase resistance to changing risk perceptions (Avis, Smith, & McKinlay, 1989). Optimism regarding personal benefits, on the other hand, may lead to increased motivation to process benefit information, and increased impact of benefit information, because people believe they are more likely to personally benefit than are others. Optimism about personal knowledge may reduce the impact of health information because people may believe the information is aimed at the 'ignorant' other (c.f. Frewer, Howard, Hedderley, & Shepherd, 1998).

In the area of dietary choice, these optimistic biases have been shown for risks (Miles & Scaife, 2003), but not for benefits. As optimism regarding perceptions and knowledge of risks and benefits associated with food consumption may influence the effectiveness of risk-benefit information in influencing perceptions of personal risks and benefits, there is a need to examine the existence of these barriers across consumers when risks *and* benefits are involved. Insights into the existence of these potential psychological barriers to the effective communication of risk-benefit information may provide insights on how to increase the effectiveness of health communications where both risks and benefits are involved.

Another psychological phenomenon which may act as a potential barrier to the effective communication of risks and benefits is *negativity bias*, which refers to the phenomenon that negative information usually has a larger impact on overall evaluations than equally large positive information (Ajzen, 2001; Klein & Ahluwalia, 2005). Such increased impact of risk information may lead to an undermining of potential beneficial effects associated with food issues. Several theories describing potential underlying causes of the negativity bias rest on the assumption that people have a moderately positive reference point, such as existing attitudes or expectations (Fiske, 1980; Sherif & Sherif, 1967; Skowronski & Carlston, 1989). This implies that a negativity bias would be restricted to situations where people hold moderately positive expectations, and that the dominant impact of negative information over positive information on post-information attitudes may be contingent upon the existence of positive attitudes towards the underlying issue. As a result, there is a need to consider initial attitudes when examining the negativity bias. Nevertheless, research on the negativity bias on post-information attitudes has often been conducted in situations where initial attitudes are of little importance, for example, in the case of impression formation of fictitious people or hypothetical products. In other cases there has been little variance within initial attitudes, making their explanatory value limited. Insights into the existence of potential negativity effects across a range of attitudes can provide insights on how to increase the effectiveness of risk-benefit communications about food issues where existing attitudes are involved.

Risk-benefit messages are the outcome of risk management decisions and practices. It might be expected, therefore, that food safety communication should not only include information about the risks and benefits associated with different food hazards, but also what is being done by risk managers to mitigate associated risks and/or to promote associated health benefits. In response to decreased public

confidence as a result of various food safety incidents, there has been increasing emphasis in policy circles on open and transparent communication with consumers about food risk management practices (Byrne, 2002). Increased transparency results in risk management practices also becoming transparent and open to public scrutiny. As a consequence, it has become increasingly important to ascertain the best ways to communicate with the public about how food risks are *managed*, as well as about food safety problems *per se*. However, there is a paucity of research in this area (Houghton, Van Kleef, Rowe, & Frewer, 2006; Van Kleef et al., 2006). Communication about what is being done by food risk managers to protect or enhance consumer health may be extremely relevant to societal responses to existing and emerging food risks, as well as generating trust among consumers in the process and practice of risk analysis. Insights into consumer responses to communication about food risks and associated management practices can provide insights into effective ways to communicate about food safety issues that may increase consumer perceptions of food risk management quality.

1.1 Aim and outline of the thesis

The aim of this thesis is to develop insights into consumer responses to information about risks and benefits associated with food. For this purpose, three lines of research were explored: (1) consumer perceptions and responses to *integrated risk-benefit metrics*, (2) *potential barriers* to effective risk-benefit communication, and (3) consumer responses to communication about *risk management practices* associated with food hazards. As risk assessment and regulatory decision-making is increasingly focused on risk *and* benefit associated with a specific food issue, and this will need to be communicated to consumer, the first part of the thesis will report on research examining consumer perceptions and responses to *integrated risk-benefit metrics* describing the combined impact of risks and benefits associated with food consumption.

Chapter 2 reports research focused on consumer information needs regarding risk benefit information related to foods, and also explores consumer preferences regarding several risk-benefit metrics describing the combined impact of risks and benefits associated with food consumption on health.

In order to develop insights into whether integrated risk-benefit metrics can facilitate communication of integrated risk-benefit information to consumers with different characteristics, *Chapter 3* examines consumer perceptions of quality-adjusted-

life-years (QALYs) as a metric for describing the combined impact of risks and benefits associated with food consumption on health.

In addition, *Chapter 4* focuses on consumer responses to integrated risk-benefit information associated with food consumption in terms of QALYs, including how this information can best be presented, in order to develop insights into whether and how QALYs can facilitate informed decision making for consumers. Related to the need for a concrete example, information about fatty fish was used in this research as consumption of fatty fish is related to both risks and benefits to human health.

The second part of the thesis will focus on *potential barriers* to the effective communication of risks and benefits. Optimistic biases may influence the impact of risk-benefit information, but have only been examined in relation to risks in the area of food consumption. *Chapter 5* therefore focuses on consumer perceptions of health risks *and benefits* associated with the consumption of fish, and looks at how differences across consumers in these perceptions relate to optimism in terms of perceptions and knowledge about the risks and benefits.

As a negativity bias may undermine potential beneficial effects associated with a food issue, but may also depend on existing attitudes towards the target issue, *Chapter 6* examines the occurrence of negativity effects after the provision of balanced risk-benefit information across a range of existing attitudes associated with different food production methods.

The third part of the thesis examines consumer responses to communication about risk *management practices* associated with food hazards. As communication about food risk management practices may be extremely relevant to societal responses to existing and emerging food risks, as well as generating trust among consumers in the process and practice of risk analysis, *Chapter 7* examines the impact of information about food risks and associated risk management practices on consumer perceptions of food risk management quality.

In *Chapter 8* overall conclusions and a general discussion will be provided. Figure 1.1 provides an overview of the outline of the thesis.

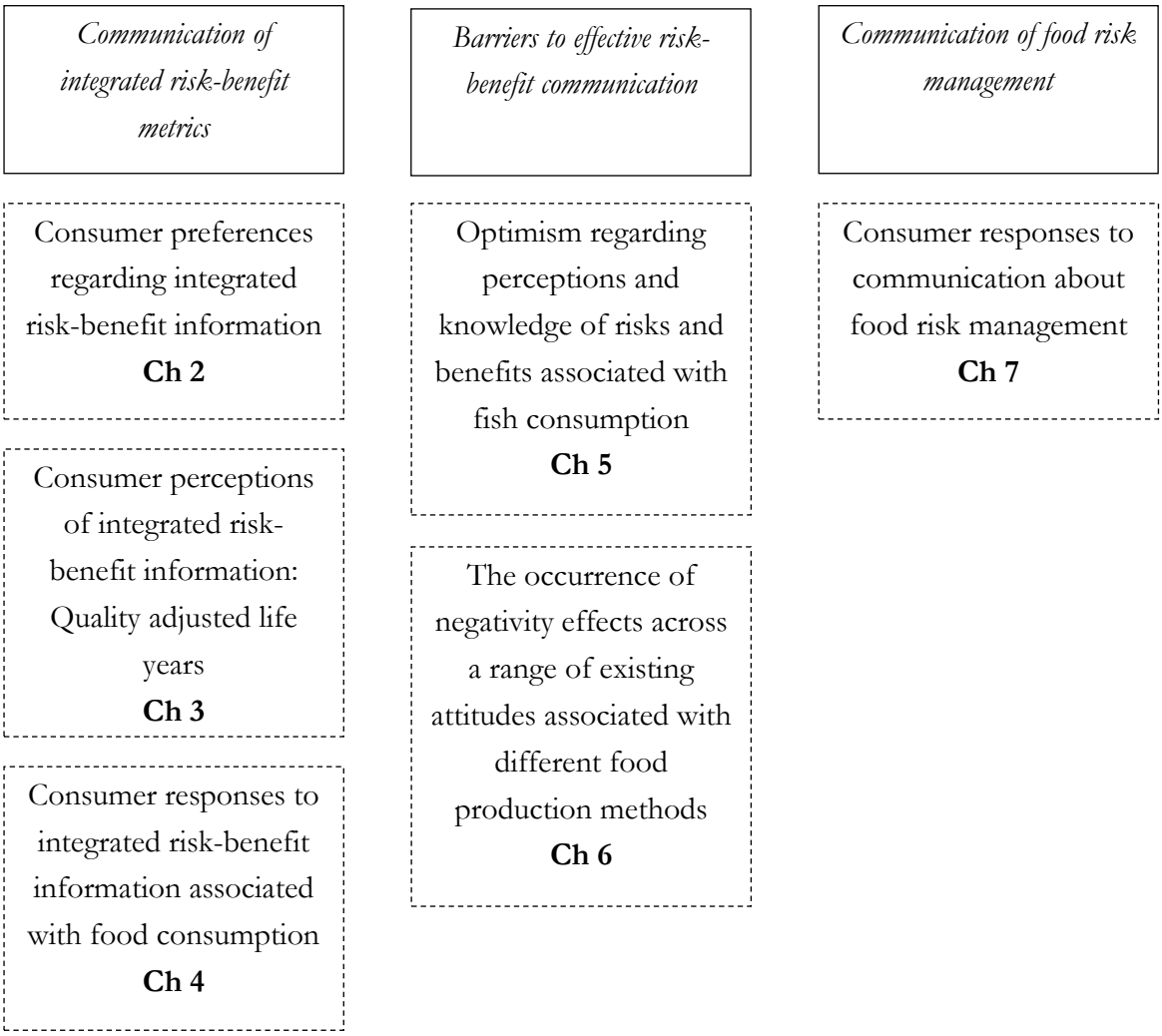

Fig.1.1 Outline of the thesis

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CONSUMER PREFERENCES REGARDING FOOD-RELATED RISK-BENEFIT MESSAGES

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ABSTRACT

Purpose - The aim of this study was to identify and explore consumer preferences and information needs regarding the simultaneous communication of risks and benefits associated with food consumption. The focus was on the *net* health impact of risks and benefits on life expectancy, quality of life, and Disability Adjusted Life Years (DALYs).

Methodology - Focus groups were conducted in four countries (Iceland, Netherlands, Portugal, UK). All sessions were audio-taped, transcribed and content analyzed.

Findings - Current risk-benefit communication is perceived as 'asymmetrical', confusing, and often distrusted. Participants expressed a preference for more balanced and scientifically derived information. Information about the net health impact on both life expectancy and quality of life was found to be meaningful for food decision making. DALYs were thought to be too complicated.

Research implications/limitations - Findings confirm the importance of incorporating consumers' viewpoints when developing communications about risk and benefits. The results provide insights into potential issues related to the communication of risk and benefit information. The limitations of the qualitative approach adopted in this study suggest that further research utilizing nationally representative samples is needed, which may explore additional metrics to communicate net health effects to consumers.

Originality/value - Common measures for assessing both risks and benefits are expected to facilitate the communication of the results of risk-benefit assessment as part of risk analysis. However, research incorporating consumers' perspectives on this issue is scarce. A better understanding of how consumers perceive these measures may promote the development of more effective integrated risk benefit communication.

2.1 Introduction

Communication about the health impact of foods has typically involved *either* health messages about the associated risks *or* benefits. In the past, communication about food safety issues has focused almost exclusively on risks (Frewer et al., 2004; Hansen, Holm, Frewer, Robinson, & Sandoe, 2003), while health benefits associated with consumption of the same foods have been communicated separately as nutrition information. When making healthy food choices, consumers frequently need to make tradeoffs between the risks and benefits associated with dietary choices. For example, fish is a product where consumers will have to balance the health benefits of regular fish consumption against possible risks (Ponce et al., 2000; Verbeke, Sioen, Pienak, Van Camp, & De Henauw, 2005). Consuming fatty fish results in both increased consumption of omega-3 fatty acids and toxins (Mozaffarian & Rimm, 2006). Informed choice about fish consumption is dependent on simultaneously understanding both risk and benefit information (Burger & Gochfeld, 2006). How best to communicate this potentially conflicting information is not currently understood. The aim of this study is to identify and explore consumer preferences and information needs regarding the simultaneous communication of both risks and benefits associated with the consumption of specific food products.

Information on risks and benefits is usually presented separately. For example, there is an extensive research on communicating nutrition information on food labels (Cowburn & Stockley, 2005; Grunert, Fernández-Celemín, Wills, Bonsmann, & Nureeva, 2009; Grunert & Wills, 2007; Van Kleef, Van Trijp, Paeps, & Fernández-Celemín, 2008; Verbeke, 2005), which has shown that consumers are interested in nutrition information on food packages, but that this interest varies across different situations and indeed cultural contexts, food products and between different individuals. However, it has been shown that increased use of food labels is associated with healthier nutrient consumption (Ollberding, Wolf, & Contento, 2010). Consumer responses to health claims on food products has been shown to depend on

factors such as the type of health claim (for example, physiologically orientated (e.g. reduces the risk of heart diseases) versus psychologically orientated (e.g. reduces stress) health claims), the type of food product to which the health claim is attached, the consumer's familiarity with the active ingredient, and the formulation of the health claim (such as the length and framing of the health claim) (Grunert et al., 2009; Van Kleef, Van Trijp, & Luning, 2005; Verbeke, Scholderer, & Lähteenmäki, 2009; Williams, 2005). In addition, there is an extensive research literature focused on the impact of food-related risk communication and, from this, health warnings associated with different foods, and their impact on consumer perceptions and behaviours (Fischhoff & Downs, 1997; Frewer, 2004b; Frewer, Miles, & Marsh, 2002; Kornelis, De Jonge, Frewer, & Dagevos, 2007; Kuttschreuter, 2006; Lofstedt, 2006; McGloin, Delaney, Hudson, & Wall, 2009; Renn, 2005; Verbeke, Viaene, & Guiot, 1999; Voordouw et al., 2009). However, combined risk-benefit messages may be preferable because they can provide consumers with information about the *balance* of risks and benefits.

Several theories may be relevant for explaining how consumers may respond to combined positive and negative information. For example, based on consistency theories such Festinger's theory of cognitive dissonance (Festinger, 1957), it may be expected that receiving combined risk-benefit information in one message may lead to negative affective reactions like feelings of dissonance. This, in turn, may motivate people to engage in cognitive strategies that allow them to restore consistency (Eagly & Chaiken, 1993). For example, people can engage in biased information processing (i.e. selective elaboration of information consistent with one's existing attitude) in order to reduce discomfort resulting from an ambivalent message (Nordgren, van Harreveld, & van der Pligt, 2006). Previous research has shown that people frequently process information in an attitude-congruent way (i.e. a confirmation bias, Ajzen, 2001; Jonas, Schulz-Hardt, Frey, & Thelen, 2001), which may lead to attitude polarization (e.g. Eagly & Chaiken, 1993; Lord, Ross, & Lepper, 1979; Pomerantz, Chaiken, & Tordesillas, 1995). In addition, research has shown that people may be more influenced by negative information than positive information (Ajzen, 2001; Rozin & Royzman, 2001; Verbeke, 2005), and that this negativity effect can depend on existing attitudes towards the target issue (Van Dijk, Fischer, De Jonge, Rowe, & Frewer, in press). Information integration theory (Anderson, 1971) assumes that the process by which positive and negative information is combined into peoples' attitudes can be described by some sort of algebraic integration (e.g. the sum or

average) of the valuation of information (i.e. positive or negative) multiplied by the weight or importance attached to that information.

Effective risk-benefit communication is also important because, increasingly, risk assessment and regulatory decision-making are focused on the risks *and* benefits associated with specific food issues (EFSA, 2006). An integrated risk-benefit assessment can balance risks and benefits by expressing them in a common measure of health impact. The result provides an indication of the overall net health impact (Fransen et al., 2010; Hoekstra et al., 2008; Ponce et al., 2000). A common scale for assessing both risks and benefits is expected to facilitate the communication of the results of risk-benefit assessment as part of risk analysis (EFSA, 2006).

Various common measures exist to express the impact of both risks and benefits on health. Some focus on single health outcome metrics, such as life expectancy or health related quality of life (i.e. the subjective evaluation of physical, mental and social functioning). Other methods focus on indices that combine the impact of a disease on both life expectancy and quality of life, such as Disability Adjusted Life Years (DALYs) and Quality Adjusted Life Years (QALYs, Wong et al., 2003). Both DALYs and QALYs include information on premature mortality and the influence of an imperfect health on quality of life. For example, if someone develops cancer as a result of consuming contaminants in a food product, this may lead to premature death and will also reduce their quality of life. When considering both benefits and risks associated with consuming a particular food product, the positive and negative health effects are first expressed in a common measure of health impact and then combined to form the *net health impact*.

Which metric should be used under which circumstances is still unclear. Selection will depend on the availability of data and experience with different approaches (EFSA, 2006). An important consideration in choosing a measure is the end-user of the information (EFSA, 2006). As a result of increased emphasis within policy circles on the need to implement open and transparent communication with consumers about food safety policy procedures and decision making practices (Byrne, 2002; FSA, 2002; Millstone & Van Zwanenberg, 2002), the assessment basis for regulatory action will need to be communicated to consumers (Wentholt, Rowe, König, Marvin, & Frewer, 2009). Therefore, it is important that the outputs of integrated risk-benefit assessments are communicated in an effective way which is both intelligible to consumers, and facilitates consumer decision making. In the current study, consumer responses to different metrics describing the net health impact from risk-benefit assessment outputs will be examined. Specifically, the following issues will be

explored: a) consumer perceptions of the adequacy of current information provision about health risks and benefits associated with food consumption, and b) consumer preferences and reactions to different metrics describing the net health impact from risk-benefit assessment outputs.

2.2 Method

In July 2007, four consumer focus groups were conducted in Iceland, the Netherlands, Portugal and the UK. These European countries were selected based on their different fish consumption levels, in order to ensure a broad spectrum of possible responses. While Iceland and Portugal have relatively high consumption of fish *per capita per year* (90 kg and 59 kg respectively), the Netherlands and the UK fish consumption levels are relatively low (24 and 23 kg *per capita per year* respectively; FAOSTAT, 2003). The qualitative method of focus group discussions was selected in order to provide greater insight into why opinions are held (Kitzinger, 1995), and to enable identification of key issues and questions (Tonkiss, 2004). The food product 'fatty fish' was used as a case study for eliciting consumer responses because it is a good example of a product where consumers will have to balance both risks and benefits to health (Ponce et al., 2000; Verbeke, Sioen, Pienak, Van Camp, & De Henauw, 2005). An interview guide was developed to promote consistency across the different countries in methodology and the delivery of comparable results (Krueger, 1994). The interview guide and materials used for the focus group discussions were translated to Dutch, Icelandic and Portuguese by members of the national research teams.

2.2.1 Participants

A total of 33 consumers participated in the focus group discussions (Iceland n=9, the Netherlands n=7, Portugal n=9, and the UK n=8). Efforts were made to recruit diverse groups based on age, gender and educational level. Consumers with a background in food safety or who were employed in the fish industry were excluded. In addition, all participants reported to consume fish. The average age of participants varied from thirty two years in Portugal (range 23 - 50) to forty years in the Netherlands (range 20 - 62). Nineteen of the participants were female, fourteen were male. Educational level ranged from vocational education to university degree.

2.2.2 Procedure and materials

After a few introductory questions regarding the importance of health for participants when making food consumption choices, participants heard a short introduction from the moderator regarding the occurrence of *both* risks and benefits related to food consumption, illustrated with the example of fatty fish. Subsequently, participants were asked a set of questions regarding the adequacy of current information about both risks and benefits related to food consumption in general, and fatty fish in particular. For example, participants were asked which information they would like to receive about risks and benefits related to food consumption and how communication may be improved.

In the second phase, consumer preferences for measures describing the net health impact of both risks and benefits associated with eating fatty fish were assessed. In particular, they were asked about the usefulness of information about the net health impact associated with eating fatty fish expressed in terms of a) life expectancy, b) quality of life and c) Disability Adjusted Life Years (DALYs). For example, participants were asked whether they thought life expectancy represented a useful measure for communicating the net health impact of eating fatty fish. Consumer responses to DALYs was selected for detailed discussion as this metric was being discussed in the context of European risk assessment. The examples used to illustrate the health impact of fatty fish for each of the three metrics were developed in collaboration with experts in risk assessment (see Appendix A).

The focus group discussions lasted approximately two hours, and were moderated by staff of professional social research agencies. All moderators received a protocol describing the purpose and background of the study prior to conducting the focus groups, together with the interview guide translated into their national language. Following the discussion, each participant completed a background questionnaire and received a small reward. The focus group sessions were audio-taped and transcribed *verbatim*. Dutch, Icelandic and Portuguese focus group discussions were subsequently translated into English before further analyses were conducted.

2.2.3 Data analysis

Two researchers developed an overarching, exclusive and exhaustive set of codes from the English transcripts. Based on a preliminary examination of the data, an initial set of codes was developed, which was subsequently applied to a subsection of

the data. Differences were resolved and coding schemes were adjusted. This procedure was repeated until both coders agreed on a final coding scheme, containing 20 codes (see Appendix B). English transcripts were analyzed using Atlas.Ti, a software package that facilitates the qualitative analysis of large quantities textual data. In the following section a summary of the main findings from the focus groups is outlined. Quotes from participants are included to exemplify the results. The use of the symbol […] in the quotations indicates the omission of pieces of text.

2.3 Results

2.3.1 Perceptions of current information provision about risks and benefits related to food consumption

The amount of information available about the health impacts of food was reported to be limited and one-sided. While information is perceived to be available on TV and the internet, information on product packaging and in shops was reported to be limited. In addition, even when it is available, it was not always easy to understand. When participants were asked about the adequacy of current information about the risks and benefits related to food consumption in general, as well as to fatty fish in particular, almost all participants perceived this to be focused mainly on the positive health effects. Many participants argued that information on products is often misleading due to vested interests on the part of manufacturers who report only benefits, even when the product is unhealthy (e.g. crisps cooked in sunflower oil).

While most participants expressed the need for a more unbiased discussion about the positive and negative health effects of food consumption, some reported reservations regarding the communication of negative health effects, which they thought might alarm consumers unnecessarily. A few participants even preferred not to hear about negative health effects at all. Participants also indicated that they were confused about the healthiness of food products as a result of conflicting information being provided.

> 'There can be difference between papers - sometimes one sees a survey from Sweden which shows this and the day after another one that says something totally different' (Iceland).

Participants described different strategies to deal with conflicting information, including not paying attention to information, not taking information seriously, not relying on others to provide them with the correct information or cooking for

themselves in order to know the contents of the meal. In relation to concerns about the reliability of information, participants mentioned the importance of 'scientific proof', as well as reference to the information source.

> 'So many times you hear different stories. I frequently feel betrayed. […] And [the person providing the information] doesn't even need to have a scientific foundation, he can also represent a company' (Netherlands).

Many participants mentioned that information is often too technical and unclear regarding how different ingredients (such as E numbers) impact on health. Concrete information about the health impacts of different ingredients or food products was thought to be more meaningful, easier to remember and would facilitate consumption decision-making.

People also expressed a preference for personalized information such as personalized health effects and consumption recommendations depending on actual food intake levels and physical traits such as height and weight. In addition, participants expressed a need for personalized recommendations targeted to people who are more vulnerable to certain health effects. In relation to this, participants wanted information about how food products can provide 'solutions' to a certain disease.

2.3.2 Preferences for measures describing the net health impact of risks and benefits associated with food consumption

Table 2.1 summarizes the key positive and negative points taken from the discussions on different measures for describing the net health impact of both risks and benefits. In the next section these results will be discussed in more detail for each of the measures.

Life expectancy

While some participants considered information about the impact on life expectancy useful information for communicating health impacts because it is concrete and easily comparable, many participants also thought the size of the impact was too small to influence their consumption levels. Other participants also had reservations regarding information about the impact on life expectancy because it can be frightening and reduce the pleasure of eating. Some participants did not consider information about the impact on life expectancy personally relevant.

> 'I want a piece of fish for my tea; I don't want to have to think about whether it's going to make me live 10 years longer' (UK).

Related to this, younger participants also indicated that information about life expectancy might not be very relevant to younger people as the endpoints are far removed in terms of life years.

Table 2.1 Key positive and negative points from the discussions on the three measures for describing the net health impact associated with food consumption

	Positive	Negative
Life expectancy	▪ Useful for comparing and reaching conclusions. ▪ Concrete.	▪ A few months difference is considered a too small effect to consider. ▪ It places too much emphasis on health and takes away the pleasure of eating. ▪ Does not feel relevant personally, particularly if end of life is still perceived to be far away (younger people). ▪ Does not provide enough information; lacks information about quality of life.
Quality of life	▪ Important and relevant information.	▪ Terminology, negative measure is counterintuitive. ▪ Complicated, difficult to understand. ▪ Emphasis is on the negative aspects, such as disability and disease. ▪ Not enough on its own; lacks information about life expectancy.
DALY	▪ Combines both life expectancy and quality of life.	▪ Complicated, difficult and confusing. ▪ Too much time needed to understand. ▪ Not useful.

Quality of life

Impact on life expectancy was considered a useful indicator for describing the health impact of food consumption. However, this information by itself was not adequate because it implied that people will be healthy during the remainder of their life. Information about the impact of food choice on quality of life was found to be useful and important. However, many participants had problems with how it was communicated in the example given (a disability weighted year), which was reported to be too complicated and difficult to understand. In addition, the fact that losing disability weighted years indicates a beneficial effect was very confusing and counterintuitive for participants in the study. Some participants indicated that the

information would be easier to understand when it emphasized that the net health impact is positive.

> '… I find the way in which it [disability weighted years] is worked out less good. Because disability is indeed negative… and because you lose more… I have the idea that it is bad for you. So the positive should be emphasized….' (Netherlands).

Related to this, information about disability or disease was perceived as rather negative by some participants, independent of whether the net effect was positive or not.

Disability Adjusted Life Year

Although people indicated that they preferred information about the net impact of risks and benefits on both life expectancy and quality of life, participants also found the DALY too complicated to understand. In addition, too much time was needed to understand the measure.

2.4 Discussion

This study examined consumer preferences and information needs regarding the communication of both risks and benefits associated with food consumption. The results highlight the importance of providing balanced information that is trustworthy and not confusing. Participants perceived current information on foods as unbalanced because the focus is mainly on the benefits, and expressed the need for a more unbiased discussion about both risks and benefits. However, when information about both risks and benefits *was* provided, (for example, in newspapers and other media), participants reported experiencing confusion from differing opinions and changing recommendations, resulting in distrust in the information source. They also tended to ignore the information. These results illustrate the potential relevance of consistency theories for explaining consumer responses to combined risk-benefit information, as these theories predict that conflicting information can cause a negative affective state in people, which in turn may lead to biased information processing in order to reduce what is experienced as an unpleasant affective state (Festinger, 1957; Nordgren, van Harreveld, & van der Pligt, 2006). Results also show that scientific proof of health impact becomes increasingly important for consumers under these circumstances. The scientific basis of risk and benefit information needs to demonstrated. A *de minimis* would be proof of the scientific credibility of information sources, perhaps

involving governmental institutes and consumer organizations, or collaborations between industry and other food chain actors (see also Verbeke, 2005).

Consumer preferences regarding the communication of risk-benefit assessment outputs indicate that information about the net health impact of consuming particular foods may be useful to consumers, in particular information about the net impact on *both* life expectancy and quality of life. While people may be aware that some products or ingredients are good or bad for their health, they may not be knowledgeable about the exact health impacts. Specific information about how certain products or ingredients may influence health, for example in terms of changes in life expectancy and quality of life, may increase the meaningfulness of the information for consumers. For most participants, receiving only information about life expectancy or quality of life was not sufficient information to make an informed decision. DALYs may not be the best way for communicating the combined impact on life expectancy and quality of life to consumers, as this metric was considered complicated and difficult to comprehend. Furthermore, the expression of a positive health effect in terms of losing DALYs was considered counterintuitive by some participants. In addition, being confronted with terms such as diseases and disability had negative associations. This is of importance, as it has also been shown in previous research (Ferraro et al, 2005), that reminding people about diseases, disability and death may impact a variety of behavioral responses and even negatively impact self-esteem. Future research may usefully explore the use of other metrics for describing the combined impact on life expectancy and quality of life of risks and benefits associated with the consumption of specific food products to consumers, such as Quality Adjusted Life Years (QALYs).

One issue raised in the results was the need to target information to the needs of vulnerable populations. This might be operationalized through personalized consumption recommendations based on actual food intake levels and vulnerabilities to certain health effects. Future research may usefully look at how personalized information may facilitate the communication of risks and benefits associated with food consumption to consumers, although further advances in the development of integrated risk-benefit assessment methodology may be required before this can be practically introduced. Factoring in information about genetic difference in susceptibilities and potential health benefits is also highly relevant (see, for example, Stewart-Knox et al, 2009).

Some limitations of the research reported here can be identified. Focus groups utilize small, non-representative samples and can provide useful directions for further,

possibly more quantitative research utilizing nationally representative samples. The finding that there were few cross-cultural differences in consumer responses across focus groups implies that the use of only one group in each study was not so problematic, despite national differences in levels of fish consumption, although further research is needed to confirm this. A weakness of the focus group methodology applied in this research is social desirability bias which results from people's tendency to present themselves in a favorable light. For example, in studies where participants self-report data, as is the case in focus groups, the majority of participants tend to report high personal awareness and use of nutrition information (e.g. Borra, 2006). In reality a considerably smaller percentage of consumers have been observed scrutinizing nutrition information on food labels in stores (Grunert, Fernández-Celemín, Wills, Bonsmann, & Nureeva, 2009). Note that this may also reflect habitual or repeat purchasing of foods which the consumer perceives to be associated with particular nutritional qualities.

In conclusion, this study has raised a number of important issues for the development of risk-benefit communications. A need for more balanced and scientifically derived consumer information about the risks and benefits associated with food consumption was identified. In addition, most participants found information about the net health impact of risks and benefits on *both* life expectancy and quality of life most meaningful for decision making. However, DALYs appear to be counterintuitive and too difficult to understand for consumers. Future research may explore the use of other metrics such as QALYs for the communication of net health effects to consumers.

APPENDIX A

Texts used to illustrate the impact of positive and negative health effects associated with eating fatty fish on life expectancy, quality of life and Disability Adjusted Life Years [a].

The overall impact of positive and negative health effects associated with fatty fish on life expectancy.

Life expectancy is the number of years people are normally expected to live.

Considering both the positive and negative health effects associated with eating fatty fish, the life expectancy of a person that eats the average amount of fatty fish consumed in the UK (which is 1 portion of fatty fish every three weeks), is expected to be 6 months longer than a person who eats no fatty fish.

Quality of life.

Having an illness may not only reduce your life expectancy, but also reduce the quality of life of the time that you live with the illness.

Quality of life is an evaluation of physical, mental, and social functioning.

Quality of life expressed in disability weighted years.

The amount of disability weighted years lost due to illness=

Severity of the illness x the number of years someone lives with the illness.

Applied to the fatty fish example:

Considering both positive and negative health effects involved with eating fatty fish, for a person that eats no fatty fish it is expected that they will lose half a disability weighted year more compared to a person who eats 1 portion of fatty fish every three weeks.

Disability Adjusted Life Years (DALYs).

Disability Adjusted Life Years is a combination of both the effects of a disease on life expectancy and quality of life.

Disability Adjusted Life Years=

number of life years lost when people die prematurely due to a disease

&

number of disability weighted years lost when one suffers from the disease.

For example, the life expectancy of a person that eats no fatty fish is expected to be 6 months shorter than for people who eat the average amount of fatty fish. Adding the impact on quality of life, they are expected to lose 1 'Disability Adjusted Life Year' more in total.

[a] The examples are developed in collaboration with experts in risk assessment and are hypothetical estimates of the impact of eating fatty fish on life expectancy, quality of life and DALYs

APPENDIX B

Codes used to analyze the transcripts of the focus group discussions.

1. Limited risk-benefit information provision
2. Asymmetrical provision of risk-benefit information
3. Confusing information/mixed messages
4. Distrust of information
5. Vested interests
6. Technical/unclear information
7. Need for unbiased discussion risks and benefits
8. Need for scientific based information
9. Preference for concrete information (e.g. impact on health/disease)
10. Personalized information
11. Life expectancy;
    a Useful
    b Size
    c Frightening
    d Relevance for different people
    e Not enough alone
12. Quality of life;
    a Useful and important
    b Complicated/difficult to understand
    c Counterintuitive
    d Emphasizes disability/disease
13. DALY complicated

3

CONSUMER PERCEPTIONS OF INTEGRATED RISK-BENEFIT INFORMATION RELATED TO FOOD CONSUMPTION: QUALITY ADJUSTED LIFE YEARS

This chapter is submitted for publication as a short communication as Van Dijk, H., Fischer, A.R.H. and Frewer, L. (submitted). Consumer perceptions of integrated risk-benefit information related to food consumption: Quality adjusted life years.

ABSTRACT

Objective - To investigate whether quality-adjusted-life-years (QALYs) can facilitate communication of integrated risk-benefit information to consumers with different characteristics.

Design - Internet questionnaires were used to assess consumer perceptions of QALYs. A 9x2 between subject design varied the size and the direction of putative health effects.

Setting - The Netherlands.

Subjects - Adults (N=1006), mean age 47.1 years.

Results - QALYs were perceived as sufficiently *useful* for communicating integrated risk-benefit information to participants personally, to policy makers, and to people working in health care. Perceptions of usefulness were positively related to age and perceived personal health, and negatively related to educational level. Information about the impact of risks and benefits on QALYs was sufficiently *understandable,* although somewhat less *credible*. Understandability was higher for older people, and more highly educated individuals. Perceived *importance* of the health effects increased as the number of QALYs increased, and was higher for older people, women, and people who perceived their personal health to be relatively high. Direction of the health effect had no impact on perceived importance.

Conclusions - QALYs can provide useful information about health risks and benefits related to food consumption in understandable terms. Perceptions of understandability, usefulness and importance of QALYs also depend on individual characteristics, implying the need for targeted communication.

3.1 Introduction

Risk assessment and regulatory decision-making is increasingly focused on risks *and* benefits associated with specific food issues (EFSA, 2006; Renwick et al., 2004). One method to evaluate the impact of both risks and benefits on health is quality-adjusted-life-years (QALYs), which combines the impact of a disease on *life expectancy* and *quality of life* (Wong et al., 2003). By using a common measure for both risks and benefits, positive and negative health effects can be summarized into a *net health impact*.

Increased emphasis is being placed on the need to implement transparent communication between consumers and policy makers about food related decision-making practices (Byrne, 2002; FSA, 2002; Millstone & Van Zwanenberg, 2002). The assessment basis for regulatory action must also be communicated to the public (Wentholt, Rowe, König, Marvin, & Frewer, 2009). It therefore is important to investigate whether QALYs can facilitate communication of integrated risk-benefit information to consumers.

If the QALY measure is to be used as a communication tool, consumers must find it a *useful* measure for describing health effects associated with food consumption. Consumer perceptions of the usefulness of QALYs may also be important for building and maintaining trust in risk-benefit assessment and risk management decisions, and may increase consumer acceptance of associated policy decisions and recommendations.

Information about the impact of risks and benefits associated with eating food products on QALYs should be *understandable* and *credible*. Furthermore, it is assumed that an increasing number of QALYs affected is perceived as increasingly *important*. Consumer perceptions of the importance of different health changes in terms of QALYs may also depend on whether the change is positive (i.e. QALYs gained) or a prevented reduction (i.e. avoided loss of QALYs). The latter may be perceived as more important (c.f. Kahneman & Tversky, 1979).

Individual characteristics of consumers, such as educational level, age, gender and perceived personal health, may influence consumer responses to QALY based

information. For example, people with a higher education may find QALYs more understandable. Older people and people with poor perceived personal health may have had a more negative experience with health and health-related quality of life, and thus find QALYs more useful for describing health effects compared to younger people and people with relatively good perceptions of personal health. Women, older people, and less healthy people may find changes in QALYs more important than men, younger people, and relatively healthy people because the former are more concerned about health, and the nutritional value of foods (Moon et al., 1998). Individual differences in perceptions of QALYs may have implications for targeting information to specific audiences.

The current study examined consumer perceptions of the usefulness of the QALY measure, and perceived importance, understandability and credibility of information about changes in QALYs resulting from food consumption. Furthermore, individual differences in consumer responses were examined.

3.2 Experimental methods

3.2.1 Participants and design

Data were collected in the Netherlands by means of an Internet questionnaire (May 2009). A research agency recruited 1332 consumers from an Internet panel, quota sampled on age, gender and educational level. 1006 valid responses were returned. 52% were from women. 36% of respondents reported a low level of education, 39% a mid-level, and 25% a high level. The mean age of participants was 47.10 years (*SD*=15.38).

A 2 x 9 design was used, with direction of health effect (gain, avoided loss) and size of health effect (¼, ½, 1, 2, 4, 6, 8, 10 or 15 QALY years) as between subject factors.

3.2.2 Materials

All constructs were measured with a single item on a 7-point rating scale anchored at 'completely disagree' to 'completely agree' for perceived usefulness, 'extremely hard to understand' to 'extremely easy to understand' for understandability, 'not credible at all' to 'extremely credible' for credibility, and 'extremely unimportant' to 'extremely important' for perceived importance. Respondents were asked to indicate the

perceived usefulness of QALYs for them personally, for policy makers, and for people working in health care, measured on the item "*Healthy life years* is a useful measure for describing the combined impact of risks and benefits on health". Understandability and credibility were measured with the item "Information about the impact of risks and benefits associated with eating food products on '*healthy life years'* is…". The item for perceived importance asked "How important is it for you to gain [avoid losing] X *healthy life years*?".

3.2.3 Procedure

All participants received an introduction about potential risks and benefits associated with food consumption, and an explanation of QALYs[1]. Participants were then asked to indicate the perceived usefulness of QALYs for describing the combined impact of health risks and benefits associated with food for them personally, for policy makers, and for people working in health care. Participants were randomly assigned to one of 18 conditions. Participants' ratings of the importance of a gain or avoided loss of a certain amount of QALYs were measured, together with the understandability and credibility of the information. Finally, respondents were asked to provide demographic background information (educational level, age, and gender), and rate their perceived personal health status. After completion of the survey respondents received a small reward in the form of "credits" that respondents can save up to be exchanged for a gift coupon.

3.2.4 Analysis

The impact of individual characteristics on perceived usefulness of QALYs for participants personally, for policy makers, and for people working in health care was analyzed with a multivariate mixed linear model. Educational level, age and perceived personal health were included as continuous variables. Gender was included as a factor. The impact of individual characteristics and information variables on understandability, credibility and perceived importance of a change in QALYs was analyzed using mixed linear models, where number of QALYs, educational level, age and perceived personal health were included as continuous variables. Direction of health effect and gender were included as factors. All statistical analyses were done using SPSS 15.0.1.

[1] The texts used in the questionnaires can be requested from the author.

3.3 Results

3.3.1 Usefulness of QALY measure

QALYs were perceived as sufficiently useful for describing the combined impact of positive and negative health effects associated with food consumption for participants personally (above scale midpoint: M=4.77, SD=1.56, t(1005)=15.56, p<.01), for policy makers (above scale midpoint: M=4.77, SD=1.41, t(1005)=17.30, p<.01), and for people working in health care (above scale midpoint: M=4.89, SD=1.44, t(1005)=19.72, p<.01).

Age, perceived personal health and educational level had significant effects on the dependent variables, F(3, 999)=17.36, p<.01, F(3, 999)=4.65, p<.01, and F(3, 999)=10.23, p<.01, respectively. Gender had no significant effects F(3, 999)=1.92, p=.12. Subsequent uni-variate tests show how the three potential users of information were independently affected (Table 3.1). Age was positively related to perceived usability of QALYs for describing health effects for all three potential users of the information. Perceived personal health was also positively related to perceived usability of QALYs for describing health effects to participants personally and policy makers. Educational level was negatively related to perceived usability of QALYs for describing health effects for participants personally and people working in health care.

Table 3.1 Impact of individual characteristics on perceived usefulness of QALYs for describing health effects for participants personally, for policy makers and for health care professionals

Source	*df*	*F*		
		Usefulness personal [a]	Usefulness policy makers [b]	Usefulness health care professionals [c]
Age	1	49.62**	21.12**	19.38**
Gender	1	3.39	0.50	0.04
Perceived personal health	1	9.82**	6.90**	2.16
Educational level	1	6.09*	1.62	9.79**
Error	1001	(2.28)	(1.95)	(2.01)

Note: Values enclosed in parentheses represent mean square errors.

* p<.05. ** p<.01.

[a] $R^{2=}$.06; [b] $R^{2=}$.02; [c] $R^{2=}$.03

3.3.2 Understandability and credibility of QALY information

Information about the impact of risks and benefits on QALYs was sufficiently understandable (above scale midpoint: M=4.29, SD=1.69, t(1005)=5.47, p<.01), although somewhat less credible (below scale midpoint: M=3.81, SD=1.62, t(1005)=-3.75, p<.01).

Understandability increased as QALY values increased. The direction of the health effect, gender and perceived personal health had no effect on understandability. Understandability was higher for older people and for more highly educated individuals. The information variables and individual characteristics had no effect on credibility of the information (Table 3.2).

Table 3.2 Predictors of understandability and credibility of QALY information

Source		*F*	
	df	Understandability [a]	Credibility [b]
Number of QALYs	1	6.91**	3.31
Direction health effect	1	3.68	2.61
Age	1	6.39*	0.14
Gender	1	1.49	1.04
Perceived personal health	1	2.10	0.14
Educational level	1	27.12**	3.60
Error	999	(2.75)	3.31

Note: Values enclosed in parentheses represent mean square errors.

* p<.05. ** p<.01.

[a] $R^{2=}$.04; [b] $R^{2=}$.01

3.3.3 Perceived importance of a change in QALYs

More QALYs increased perceived importance, indicating that greater health gains are perceived as more important. Direction of the health effect had no impact on perceived importance. The perceived importance of changes in QALYs was higher for older people, women, and people who perceived their personal health to be relatively high. Educational level had no impact on perceived importance (Table 3.3).

Table 3.3 Predictors of perceived importance of changes in QALYs

Source	*df*	*F*
Number of QALYs	1	49.43**
Direction health effect	1	1.33
Age	1	34.30**
Gender	1	18.82**
Perceived personal health	1	12.17**
Educational level	1	0.21
Error	999	(1.55)

Note: Values enclosed in parentheses represent mean square errors.
** $p<.01$.
$R^{2=}.10$

3.4 Discussion

The QALY measure was generally perceived as useful for describing health effects associated with food consumption, independent of whether the user of this information were consumers personally, policy makers or people working in health care. This suggests that QALYs may facilitate the communication of integrated risk-benefit information to consumers, and consumers may accept the use of QALYs as a basis for decision-making by risk managers and health care professionals.

The perceived importance of the health effects increased as the number of QALYs increased, suggesting that consumers interpreted QALYs as intended. Framing QALYs in terms of health gains or avoided health loss did not influence perceived importance. Thus loss is not perceived as more influential than gain.

QALYs information was understandable, but *not* credible. Furthermore, this limited credibility was independent of the number of QALYs affected and whether the effect was a health gain or avoided health loss, and independent of individual characteristics. This implies that efforts should be made to increase the credibility of the information when communicating about the impact of food consumption on QALYs, for example by attributing the information to a highly credible source.

The finding that younger people find QALYs less useful for describing health effects associated with food consumption compared to older people may be a result of these individuals having generally less experience with illness-related reductions in quality of life. Future research may usefully examine whether there are more effective ways to communicate similar messages to younger people. Alternatively, the reduced perceived importance of changes in QALYs by younger people suggests that other

information in addition to health information may be needed for younger people to comply with food consumption recommendations, and research might usefully focus on strategies to better target this information to this population group.

More educated people found QALYs more understandable, and less useful for describing health effects (to them personally and to health care professionals). Women found health changes in terms of QALYs more important, implying that QALY information will be used more in food consumption decisions by women. People with relatively poor perceived personal health found QALYs *less* useful for describing health effects (to them personally and to policy makers), and health changes in terms of QALYs *less* important. As suggested by some of the comments made by participants, people may be somewhat skeptical about the relative impact of food consumption on health when they have experienced, or are experiencing, serious illnesses (for example, "I do try my best, but based on my own experience I don't think that you can extend your life with eating healthy alone").

In conclusion, integrated risk-benefit information in terms of QALYs can enhance the transparency of regulatory decision-making by providing useful information about health risks and benefits related to food consumption in terms understandable to consumers, providing other information conditions are met (for example, source credibility). Future research should examine why QALYs are less useful for specific groups (younger, unhealthier, and higher educated people) and whether there are more useful ways to target communication about the positive and negative health effects associated with food consumption to these population groups.

4

CONSUMER RESPONSES TO INTEGRATED RISK-BENEFIT INFORMATION ASSOCIATED WITH THE CONSUMPTION OF FOOD

This chapter is accepted for publication as Van Dijk, H., Fischer, A.R.H. and Frewer, L. (in press). Consumer responses to integrated risk-benefit information associated with the consumption of food. *Risk Analysis*.

ABSTRACT

The risk analysis of the health impact of foods is increasingly focused on integrated risk-benefit assessment, which will also need to be communicated to consumers. It therefore becomes important to understand how consumers respond to integrated risk-benefit information. A quality adjusted life year (QALYs) is one measure which can be used to assess the balance between risks and benefits associated with a particular food. The effectiveness of QALYs for communicating both positive and negative health effects associated with food consumption to consumers was examined, using a 3x2 experiment varying information about health changes in terms of QALYs associated with the consumption of fish (N=325). The effect of this information on consumer perceptions of the *usefulness* of QALYs for describing health effects, on *risk and benefit perceptions*, *attitudes*, and *intentions* to consume fish was examined. Results demonstrated that consumers perceived QALYs as useful for communicating health effects associated with food consumption. QALYs communicated as a net effect were preferred for food products associated with negative net effects on health, while separate communication of both risks and benefits may be preferred for food products associated with positive or zero net health effects. Information about health changes in terms of QALYs facilitated informed decision making by consumers, as indicated by the impact on risk and benefits perceptions as intended by the information. The impact of this information on actual food consumption choices merits further investigation.

4.1 Introduction

When making healthy food choices, consumers frequently need to make tradeoffs between the risks and benefits associated with the consumption of food products. For example, fish represents a product where consumers will have to balance the health benefits of regular fish consumption against possible risks (Ponce et al., 2000; Verbeke, Sioen, Pienak, Van Camp, & De Henauw, 2005), because consuming fatty fish results in both increased consumption of omega three fatty acids and toxins (Mozaffarian & Rimm, 2006).

If consumers are to make informed choices about food consumption, they will need to base these decisions on information about both risks and benefits (Burger & Gochfeld, 2006). As a consequence, communication about both nutritional benefits and risk is required. It is not clear how this potentially conflicting information can best be communicated. Consumers may face difficulties in balancing potential risks against health benefits related to consumption changes when faced with conflicting information about both risks and benefits (Verbeke, Sioen, Pienak, Van Camp, & De Henauw, 2005; Verbeke, Frewer, Sioen, De Henauw, & Van Camp, 2008). In addition, when people are confronted with conflicting information about risks and benefits, existing opinions towards the target issue may influence the directional impact of the information on risk and benefit perceptions and attitudes (Van Dijk, Fischer, De Jonge, Rowe, & Frewer, submitted). This suggests clear information about both risks and benefits is needed in order for consumers to make informed choices about food consumption.

In concordance with the need for clear information about both risks and benefits, regulatory decision-making is increasingly focused on risk *and* benefit associated with a specific food issue (EFSA, 2006). The assessment of the impact of foods and nutrients is also increasingly focused on integrated risk-benefit assessment (Renwick et al., 2004). Various methods have been developed in recent years which have the capacity for evaluating the impact of both risks and benefits on public health and well-being. A common metric for assessing both risks and benefits is expected to facilitate the communication of the results of risk-benefit analysis (EFSA, 2006). Some of these metrics focus on health-related quality of life indices that combine the impact of a disease on life expectancy and quality of life, such as disability-adjusted-life-years (DALYs) and quality-adjusted-life-years (QALYs, Wong et al., 2003). Both DALYs and QALYs include information on premature mortality and the influence of an imperfect health on quality of life. For example, if someone develops cancer as a

result of consuming contaminants in a food product, this may not only reduce their life expectancy but can also reduce their quality of life. When considering both benefits and risks associated with consuming a particular food product, the positive and negative health effects are summarized into a *net health impact*. In recent years DALYs and QALYs have been applied to assess the effects of food consumption on health, including the impact of total diet (Van Kreijl, Knaap, & Raaij, 2006), the consumption of specific food products such as fish (Cohen et al., 2005; Guevel, Sirot, Volatier, & Leblanc, 2008; Ponce et al., 2000), as well as single food components such as vitamin A, iodine and zinc (WHO, 2002).

The aim of the current study was to examine consumer responses to integrated risk-benefit information, in order to develop insights into whether and how integrated risk-benefit information can effectively be used to communicate both positive and negative health effects associated with the consumption of food to consumers. As a result of increased emphasis within policy circles on the need to implement open and transparent communication with consumers about food safety policy procedures and decision making practices (Byrne, 2002; FSA, 2002; Millstone & Van Zwanenberg, 2002), the assessment basis for regulatory action will need to be communicated to consumers (Wentholt, Rowe, König, Marvin, & Frewer, 2009). It therefore becomes increasingly important to understand how consumers respond to integrated risk-benefit information. In the current study QALYs were chosen as the integrated risk-benefit measure from which the communication was derived, as this measure focuses more on health effects for individuals and therefore may be closer to the experience of consumers compared to DALYs, which is focused more on health at population level[1].

4.1.1 Consumer responses to integrated risk-benefit information

The effectiveness of food consumption recommendations based on integrated risk-benefit information can be assessed on several outcome measures, including the facilitation of informed decision making, as well as the adoption of healthy consumption behavior.

Information about the impact of food consumption on health in terms of QALYs can be used for facilitating informed decision making by consumers by transferring knowledge about the healthiness of food consumption to consumers. However, before this knowledge transfer can be successful, consumers need to perceive the

[1] See QALIBRA, www.qalibra.eu, accessed on 26th October 2009.

QALY as *useful* for describing the combined impact of positive and negative health effects associated with food consumption. When information about the impact of food consumption on QALYs is perceived as useful, this will potentially increase successful knowledge transfer, and the use of the information in consumers' food consumption choices.

Successful knowledge transfer and associated facilitation of informed decision making as a result of integrated risk-benefit information in terms of QALYs is likely to be reflected in changes in the *perceptions of healthiness* of a food product, such as perceptions of the risks and benefits associated with the consumption of a food product.

An additional aim of communicating about the impact of food consumption on QALYs may be to improve the healthiness of food choices. Consumption behavior is often reflected in *attitudes* towards consuming a specific food product and *intentions* to consume that product (c.f. Theory of Planned Behavior, Ajzen, 1991). Attitudes and intentions to consume a specific food product may be determined by taste and habit as well as perceived healthiness (Roininen et al., 2001; Steptoe, Pollard, & Wardle, 1995; Verbeke & Vackier, 2005). Therefore it is relevant to examine whether and how integrated risk-benefit information in terms of QALYs contributes to attitudes and behavioral intentions to consume a specific food product.

4.1.2 Effects of information format on consumer responses

The way risk-benefit information is presented may influence responses to integrated risk-benefit information. QALYs can be communicated as a net effect (e.g. gain a potential of 4 QALYs from consuming a product), or separately for both risks and benefits in one message (e.g. gain 8 QALYs due to health benefits and lose 4 QALYS due to health risks associated with consuming a product). Information is needed to indicate which presentation format is more meaningful in terms of usefulness for describing health effects for consumer. Different ways of presenting risk-benefit information may differentially influence risk and benefit perceptions, post-information attitudes, as well as behavioral intentions to consume the food product under consideration. For example, people may be more influenced by risk information when presented with separate risk-benefit information (Ajzen, 2001; Rozin & Royzman, 2001), which may result in higher risk perceptions, more unfavorable attitudes and lower intentions to consume a food product compared to when the risk-benefit impact is presented as a net effect.

4.1.3 Effects of individual characteristics on consumer responses

Consumer responses to integrated risk-benefit information may also depend on individual characteristics, such as age, gender and perceived personal health. For example, older people and people with lower perceptions of personal health may perceive QALYs as more useful for describing health effects, because they are likely to have had more experience with illness related reductions in quality of life compared to younger people, and people with good perceptions of personal health. In addition, women and older people and have been shown to be more concerned about the nutritional value of food than men and younger people (Moon et al., 1998; Nayga, 1997). As a result of this increased concern, QALY information may have an increased impact on perceptions, attitudes and intentions to change consumption behavior for these people. Similarly, because the impact on health as a result of changes in food consumption may be especially relevant for people who are at increased risk of certain diseases, QALY information may have an increased impact on people with poor perceptions of personal health.

The aim of the current study was to examine the impact of information about *positive and negative health changes* in terms of QALYs on the perceived *usefulness* of the QALY measure for describing health effects associated with food consumption, *risk and benefit perceptions*, *attitudes* towards consuming a specific food product, and *intentions* to consume a specific food product. The influence of *information format* on these variables was also examined. Finally, the impact of *individual characteristics* of respondents (age, gender and perceived personal health) on the impact of information about positive and negative health changes in terms of QALYs was examined. In order to examine the impact of information about health changes in terms of QALYs, information about potential risk and benefits associated with consumption of a specific food product was used. Fatty fish was chosen for this purpose as consumption of fatty fish is related to both risks and benefits to health (Mozaffarian & Rimm, 2006).

4.2 Method

4.2.1 Participants and design

Data were collected from a nationally representative sample of 325 respondents in the Netherlands by means of an Internet questionnaire during June 2009. The response

rate was 73%. Participants were recruited from an Internet panel by a professional social research agency and were representative of the national population regarding age, gender and educational level. In the introduction to the questionnaire participants were informed that the purpose of the study was to examine the opinion of Dutch consumers regarding information about the impact of food consumption on health, with the aim of improving communication about food and health with consumers. Participants were debriefed about the fictitiousness of the information they had received about the impact on health associated with eating fatty fish, and were told where they could find further information about the actual health effects associated with eating fatty fish. Of the 325 respondents, 53% were woman, 35% had a low educational level, 43% had a mid-educational level, and 22% had a high educational level. In the total sample, the mean age of participants was 46.8 years (*SD*=15.8).

The experiment had a 3 (information about net health change: positive, negative, zero) x 2 (information format: integrated risk-benefit information, separate risk-benefit information) between subject design.

4.2.2 Materials

Information

All respondents received a short introductory text on the topic of risks and benefits associated with the consumption of fatty fish, followed by an explanation of the use of QALYs for describing positive and negative health effects associated with food consumption (see Appendix).

Six different information conditions were included in the study: separate or integrated information about the impact of positive and negative health effects associated with the consumption of fatty fish on QALYs, with a positive, negative or zero net effect. The information used in the separate risk-benefit information condition with a positive net health change is provided below as an example.

> Using *"healthy life years"*, scientists have assessed the total health impact of the positive and negative health effects of eating one portion of fatty fish a week, compared to eating no fatty fish.
> Considering the <u>positive</u> health effects associated with eating fatty fish, it is expected that Dutch people can gain, on average, <u>eight</u> "*healthy life years"* when eating one portion of fatty fish a week.

> Considering the negative health effects associated with eating fatty fish, it is expected that Dutch people can lose, on average, four "*healthy life years*" when eating one portion of fatty fish a week.

The impact on QALYs for the different information conditions are provided in Table 4.1. The direction and the size of the net effects used in the different information conditions may not reflect the actual health impact of consuming fatty fish for an average consumer. Several studies have examined the health impact of increased fish consumption in terms of QALYs or DALYs e.g. (Cohen et al., 2005; Guevel, Sirot, Volatier, & Leblanc, 2008; Ponce et al., 2000; Van Kreijl, Knaap, & Raaij, 2006). Estimates suggest a gain of 46.000 DALYs per year in the Netherlands (Van Kreijl, Knaap, & Raaij, 2006) to over 400.000 QALYs per year in the United States (Cohen et al., 2005) on the basis of population impacts. It should be noted, however, that the studies differ in terms of the health effects included, and that some estimates are based on positive health effects alone. This is partly because the scientific basis does not allow a quantitative risk-benefit assessment of all the health effects associated with fish consumption (Becker, Darnerud, & Petersson-Grawé, 2007). In addition, the (accurate) calculation of the impact of fish consumption on health also depends on the rest of the diet. For example, reduced intake of fish may result in an increased consumption of other food products, which may be related to other health effects. The studies also differ in the types of fish investigated, the level of increase in fish consumption, initial intake levels, and other assumptions made. In addition, the net result is dependent on the population included in the study. For example, the health benefits related to fish consumption for women after menopause and men (i.e. reduced risk of cardiovascular disease) are likely to be higher compared to the health risks associated with contaminants in fish for this group of people (Verbeke, Frewer, Sioen, De Henauw, & Van Camp, 2008). However, for people for whom health benefits from nutrients in fish are particularly important, but who are also more vulnerable to the potential health risks associated with contaminants in fish consumption (e.g. children and pregnant or nursing women), the net effect is likely to be smaller.

Whereas research suggests that the expected average impact of fatty fish consumption on QALYs for the average consumer may be smaller, in the context of this controlled study an average net impact of 4 QALYs was chosen. As the aim of the current study was to examine whether and how QALYs can effectively be used to communicate both positive and negative health effects associated with the

consumption of food to consumers, a larger number of QALYs was chosen as this would increase likely effects on the dependent variables if they exist.

Table 4.1 Impact on QALYs used in the six information conditions

Format of risk-benefit information	Net health change		
	Positive	Negative	Zero
Integrated	Gain 4 QALYs	Lose 4 QALYs	Neither gain or lose QALYs
Separate	Gain 8 QALYs and lose 4 QALYs	Gain 4 QALYs and lose 8 QALYs	Gain 4 QALYs and lose 4 QALYs

Measured variables

The perceived usefulness of QALYs for describing positive and negative health effects associated with food consumption was measured with three items that were rated on 7-point Likert scales with endpoints labeled from 1 'completely disagree' to 7 'completely agree'. The items used for measuring perceived usefulness of QALYs for describing health effects included "*Healthy life years* is a useful measure for describing the positive and negative health effects for me personally", "*Healthy life years* is a useful measure for describing the positive and negative health effects for policy makers", and "*Healthy life years* is a useful measure for describing the positive and negative health effects for people working in health care" (Cronbach α=.86).

Perceived risks and perceived benefits to health associated with eating fatty fish were measured with two items each that were rated on 7-point semantic differential scales with endpoints labeled from 1 'very low' to 7 'very high'. Perceived risks (Cronbach α=.65) and benefits (Cronbach α=.69) were measured after the information was provided, using the items "The health risks [benefits] associated with eating fatty fish to me personally are …", and "The health risks [benefits] associated with eating fatty fish to the average Dutch person are …".

Attitudes towards eating fatty fish were measured with 6 items, 7-point semantic differential scales (extremely dislikable – extremely likeable, extremely bad - extremely good, extremely unpleasant - extremely pleasant, extremely against - extremely for, extremely unfavorable - extremely favorable, and extremely negative - extremely positive (Cronbach α=.94) (Verbeke & Vackier, 2005).

In order to measure intentions to consume fatty fish respondents were asked how many times in the following month they intended to eat fatty fish on an 8-point scale ranging from never (0 times) to more than 8 times a month.

Perceived personal health was measured with a 7-point semantic differential item "How do you perceive your current health?" with endpoints labeled from 1 'very bad' to 7 'very good'.

Manipulation checks

Understandability and credibility of the introductory information about the risks and benefits associated with eating fatty fish, and the information explaining the use of QALYs for describing positive and negative health effects associated with eating fatty fish, were measured on 7-point semantic differential scales ranging from extremely hard to understand to extremely easy to understand and from extremely low in credibility to extremely high in credibility.

4.2.3 Procedure

Participants were randomly assigned to one of the six information conditions. Participants then received an introductory text about risks and benefits associated with eating fatty fish, followed by the text explaining the use of QALYs and the impact of the risks and benefits associated with eating fatty fish on QALYs. The order of presentation of the risk-benefit information in the separate information conditions was randomized. All participants then indicated their ratings of risk and benefit perceptions associated with eating fatty fish, followed by their attitude towards consuming fatty fish and the intended frequency of fatty fish consumption during the next month. Next, participants were asked to rate the perceived usefulness of QALYs for describing the positive and negative health effects, which was followed by ratings of the understandability and credibility of the information. At the end of the survey, respondents were asked to provide some demographic background information, including age, gender, educational level, income level and perceived personal health status. Finally, respondents were debriefed about the purpose of the survey and were informed that the information they had received about the impact on health associated with eating fatty fish was fictional, why they had received fictional information, and directions where they could find further information about the actual health effects associated with eating fatty fish. Following their completion of

the survey participants received a small reward from the research agency in the form of "credits" that respondents can save up to be exchanged for a gift coupon.

4.2.4 Analysis

The impact of *information about net health changes*, *format of the information,* and individual characteristics *age*, *gender* and *perceived personal health* on the dependent variables perceived *usefulness* of QALYs for describing health effects, *risk and benefit perceptions*, *attitudes* and *behavioral intentions* was analyzed with an ANOVA for each dependent variable. Information about net health changes (positive; negative; zero), format of the information (separate risk-benefit information; integrated risk-benefit information), age (18-34; 35-54; 55+ years) and gender were included as factors. Perceived personal health was entered as covariate (centered on its grand mean). The models included the main effects and the two-way interaction effects of information about health changes with information format. In addition, in order to examine whether the impact of QALY information was dependent on age, gender and perceived personal health, the interaction effects of these variables with information about health changes were included in the models for risk and benefit perceptions, attitudes and intention. These interactions were not included in the model for perceived usefulness, as it was not expected that increased perceived usefulness of QALYs as a result of personal characteristics was dependent on the direction of the information.

4.3 Results

4.3.1 Manipulation checks

The introductory information about the risks and benefits associated with eating fatty fish was sufficiently understandable (above scale midpoint: M=5.20, t(324)=16.73, p<.001) and credible (M=4.88, t(324)=11.67, p<.001). Similarly, the explanation of QALYs for describing positive and negative health effects associated with food consumption was sufficiently understandable (above scale midpoint: M=5.08, t(324)=14.66, p<.001) and credible (M=4.81, t(324)=11.15, p<.001). These results indicate that there is no reason to assume that participants failed to understand or believe the provided information.

In order to examine whether understandability and credibility differed for the different information conditions, and whether understandability and credibility of the QALY information were dependent on educational level of respondents, the impact of *information about net health changes*, *format of the information*, and *educational level* on understandability and credibility of the QALY information was examined with a (full factorial) ANOVA. Educational level was included as a factor (low; middle; high). The results of this analysis indicate that the different information conditions were equally understandable and credible, and that this did not depend on respondents' educational level (Table 4.2).

Table 4.2 Impact of information variables and educational level on understandability and credibility of the QALY information

Source		*F*	
	df	Understandability	Credibility
Net effect	2	0.24	1.95
Information format	1	0.15	0.01
Educational level	2	0.29	1.68
Net effect x Information format	2	2.79	1.59
Net effect x Education	4	1.74	0.74
Information format x Education	2	0.34	1.40
Net effect x Information format x Education	4	0.11	0.63
Error	307	(1.78)	(1.70)

Note: Values enclosed in parentheses represent mean square errors.

4.3.2 Perceived usefulness of QALYs for describing health effects

Whereas direction of the net effect and information format had no significant main effects on perceived usefulness of QALYs for describing health effects, F (2,315)=0.53, p=.59 and F (1,315)=0.68, p=.41 respectively, the interaction effect was significant F (2,315)=3.25, p<.05[2]. These results indicate that perceived usefulness of QALYs for describing health effects depended on the format and the direction of the information. Integrated QALY information was perceived as more useful for describing a *negative* net effect on health compared to separate QALY information for

[2] Educational level had no significant effect on perceived usefulness of QALYs for describing health effects, risk perceptions, benefit perceptions, attitudes and intentions, nor did it influence the impact of information about net health changes on these variables.

risks and benefits (⊿*M*=0.45, *p*<.05), separate risk-benefit information was perceived as more useful for describing a *zero* net effect on health (⊿*M*=-0.58, *p*<.05). Perceived usefulness for describing a *positive* net effect on health was similar for integrated and separate risk-benefit information (⊿*M*=-0.30, *p*>.05), with the direction of the effect similar to a zero net effect (Figure 4.1).

The results regarding the impact of individual characteristics will be discussed together with the impact of these characteristics on the other dependent variables (i.e. benefit and risk perceptions, attitudes and intention) in section 4.3.6.

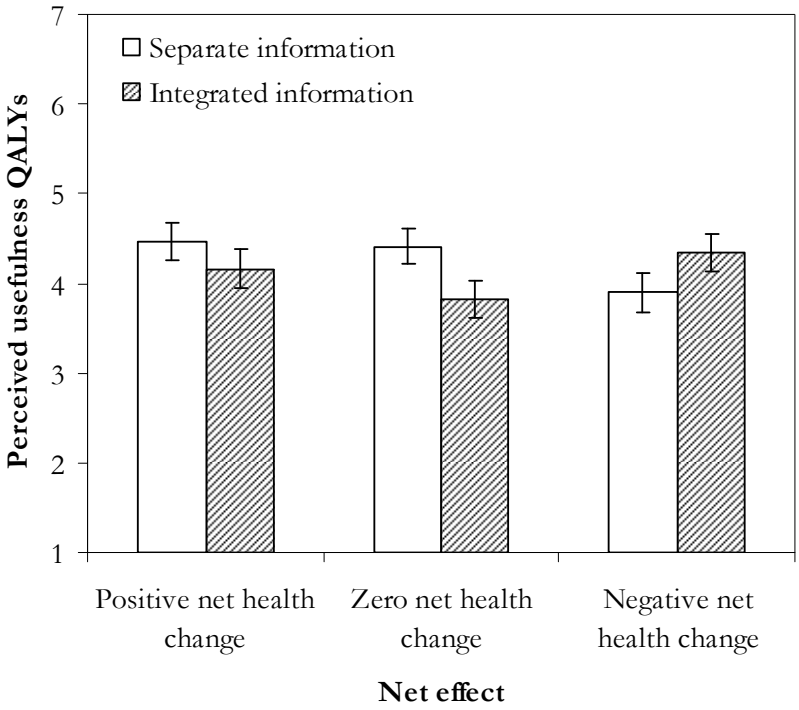

Fig. 4.1 Mean perceived usefulness (with 95% confidence interval) of QALYs for describing positive (n=51, n=55), negative (n=55, n=51) or zero (n=54, n=59) net health effects for integrated *versus* separate risk-benefit information.

4.3.3 Benefit and risk perceptions

The results of the ANOVAs calculating the impact of the information variables and individual characteristics on benefit and risk perceptions are presented in Table 4.3[2]. A significant main effect for *information about net health changes* on both benefit and risk perceptions was identified. The highest benefit perception (*M*=4.80, *SE*=.11) was found for information with a positive net effect, followed by a zero net effect (*M*=4.56, *SE*=.10) and closed with a negative net effect (*M*=4.40, *SE*=.10). Pair wise comparisons showed a marginal significant difference between the information with a

zero net effect and a positive net effect (⊿*M*=-0.25, *p*=.09) and no significant difference between the information with a zero net effect and a negative net effect (⊿*M*=0.15, *p*=.28, see figure 4.2). These results indicate that only information with a positive net health change resulted in marginally increased benefit perceptions compared to benefit perceptions after information provision with a zero net health change. In the case of risk perceptions, the highest risk perception (*M*=3.62, *SE*=.10) was found for information with a negative net effect, followed by a zero net effect (*M*=3.33, *SE*=.10) and closed with a positive net effect (*M*=3.20, *SE*=.10). Pair wise comparisons showed a significant difference between the information with a zero net effect and a negative net effect (⊿*M*=-0.29, *p*<.05) and no significant difference between the information with a zero net effect and a positive net effect (⊿*M*=-0.13, *p*=.38, see figure 4.2). These results indicate that providing information with a negative net health change increased risk perceptions compared to providing information with a zero net health change, whereas providing information with a positive net health change did not decrease risk perceptions.

The main effects of information *format* indicate that providing risk-benefit information either as a net effect, or separately in one message, had no differential impact on either benefit or risk perceptions. The interaction effects between information about net health changes and information format on benefit and risk perceptions were also not significant, indicating that the impact of information about net health changes on benefit and risk perceptions did not depend on the format in which the information was provided.

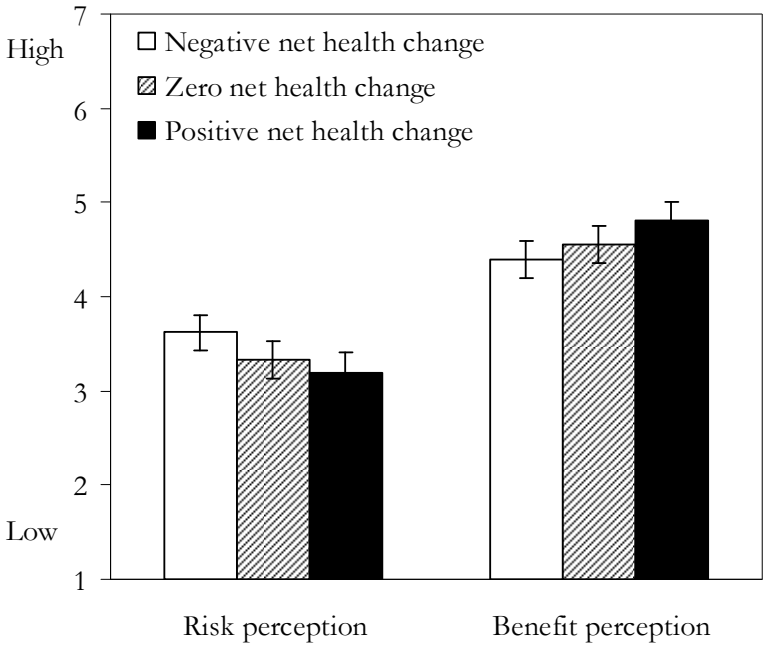

Fig. 4.2 Mean benefit and risk perceptions (with 95% confidence interval) after information with a positive (n=106), negative (n=106) and zero net health change (n=113).

Table 4.3 Impact of information and individual characteristics on benefit and risk perception, attitude and intention

Source		*F*			
	df	Benefit perception	Risk perception	Attitude	Intention
Net effect	2	3.82*	4.48*	0.79	1.33
Information format	1	0.15	0.36	0.60	0.06
Age	2	11.28**	4.59*	6.94**	23.92**
Gender	1	0.19	0.18	0.45	0.11
Perceived personal health	1	3.66	2.77	6.59*	3.37
Information format x Net effect	2	0.09	0.31	1.22	0.56
Age x Net effect	4	1.75	0.77	1.00	1.54
Gender x Net effect	2	0.96	3.34*	0.72	0.41
Health x Net effect	2	0.10	0.43	0.34	0.31
Error	307	(1.06)	(1.03)	(1.96)	(3.41)

Note: Values enclosed in parentheses represent mean square errors.
* $p<.05$. ** $p<.01$.

4.3.4 Attitudes towards the consumption of fatty fish

No significant main effects for information about net health changes and information format on attitudes towards eating fatty fish were identified, nor was their interaction effect significant (Table 4.3)[2]. These results indicate that attitudes towards eating fatty fish were similar after providing information about a positive, negative, or zero net health effect of eating fatty fish on QALYs, that there were no significant differences in attitudes after integrated *versus* separate risk-benefit information, and that this was the case for positive, negative and zero net health changes.

4.3.5 Intention to eat fatty fish

No significant main effects for information about net health changes and information format on intention to eat fatty fish were identified, nor was their interaction effect significant (Table 4.3)[2]. These results indicate that intention to eat fatty fish was similar after providing information about a positive, negative, or zero net effect of eating fatty fish on QALYs, that there were no significant differences in intention after integrated *versus* separate risk-benefit information, and that this was the case for positive, negative and zero net health changes.

4.3.6 Impact of individual characteristics

Age was negatively related to risk perceptions, and positively related to benefit perceptions, attitudes towards eating fatty fish, and intentions to eat fatty fish (Table 4.3). Age did not moderate the impact of direction of the net effect on any of the dependent variables (Table 4.3), nor was age related to the perceived usefulness of QALYs for describing health effects, F (2,315)=0.88, p=.42. Similarly, whereas perceived personal health was positively related to attitudes towards eating fatty fish, the interaction effects between personal health and direction of the net effect were not significant (Table 4.3). In addition, perceived personal health was not related to perceptions of the usefulness of QALYs for describing health effects, F (1,315)=0.32, p=.58. Contrary to expectations, these results indicate that the impact of information on any of the dependent variables did not depend on age and perceived personal health, and that age and perceived personal health did not influence perceptions of the usefulness of QALYs for describing health effects.

Whereas gender was also not related to the perceived usefulness of QALYs for describing health effects, F (1,315)=0.75, p=.39, it did influence the impact of information on risk perceptions (Table 4.3). The results indicate that risk perceptions after information about a negative net effect had been provided were higher for women, but not for men, compared to the condition in which information about a zero net effect was provided (ΔM=0.62, p<.05 for women and ΔM=-0.04, p>.05 for men). For both men and women risk perceptions did not differ between the conditions where information was provided about a positive and zero net health effect (ΔM=-0.08, p>.05 for women and ΔM=-0.17, p>.05 for men, see Figure 4.3).

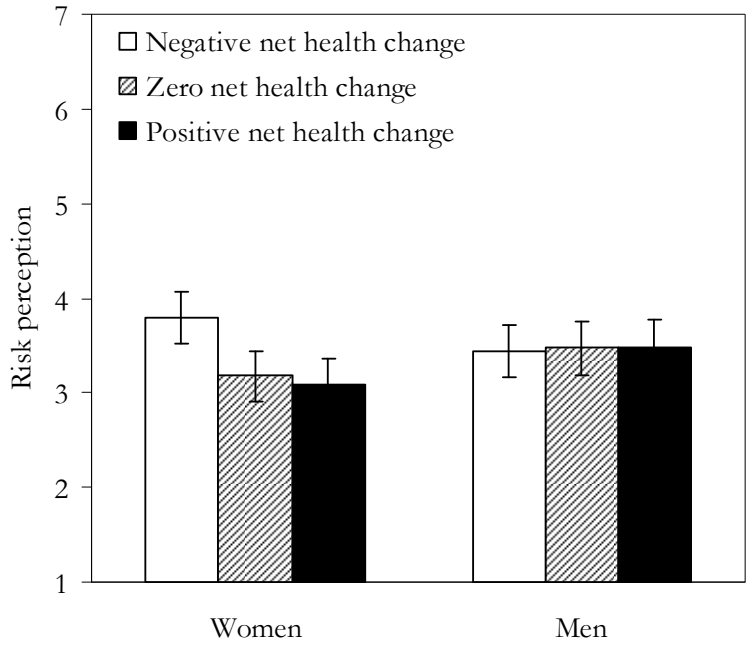

Fig. 4.3 Mean risk perceptions (with 95% confidence interval) of women and men after information with a negative (n=54, n=52), zero (n=61, n=52) and positive (n=56, n=50) net health effect.

4.4 Discussion

In the study reported here, it was evaluated whether and how QALYs can be effectively used to communicate both positive and negative health effects associated with the consumption of food. For this purpose, the impact of information about health changes in terms of QALYs, and whether QALY information was presented separately for both risks and benefits or as a net effect, on the *perceived usefulness* of the QALY measure for describing health effects was examined. In addition, the impact of

these information variables on *risk and benefit perceptions*, *attitudes* towards consuming a specific food product, and *intentions* to consume a specific food product was examined. Finally, it was examined whether perceived usefulness, risk and benefit perceptions, attitudes and intentions were dependent on individual characteristics of consumers, and whether individual characteristics were related to the impact of QALY information.

The research highlights the importance of information format for consumer perceptions of the *usefulness* of QALYs as a communication tool for describing health effects associated with food consumption. People perceive information about the net impact on QALYs as more useful compared to separate QALY information for the associated health risk and benefits when consumption of a food product is associated with a *negative* net health effect. When a food product is associated with a *zero* net effect on health, people perceive separate risk-benefit information as more useful compared to integrated information. A similar pattern was found when the net effect was *positive*, although the difference in perceived usefulness was not significant. These differences in perceived usability of integrated *versus* separate QALY information may be due to the increased importance of risk information compared to benefit information. For example, when the net effect is negative people may find information about associated benefits less relevant, whereas people may still perceive risk information as relevant when the net effect is zero or positive.

The current study also shows that information about the impact of food consumption on QALYs may facilitate informed decision making by consumers, as information about negative or positive net health changes influenced *risk and benefit perceptions* respectively, compared to information about no health change as a result of food consumption. This means that the information only influenced the health perception that is congruent to the net effect of the risks and benefits, implying a successful transfer of knowledge. In addition, providing integrated or separate risk-benefit information did not differentially influence the impact of information on health perceptions. These results do not support the hypothesis that differential processing of separate risk-benefit information occurs compared to integrated risk-benefit information when consumers are provided with the information. This implies that communicating integrated *versus* separate risk-benefit information can be equally effective in transferring knowledge about food safety, although differences in perceptions of the usefulness of QALYs for communicating health effects may still warrant communication of either integrated or separate risk-benefit information depending on the net effect.

QALYs may be perceived as useful for communicating health effects associated with food consumption. However, the actual impact of QALY information on subsequent food consumption choices may be limited, as indicated by the absence of an effect of information on *attitudes* and *behavioral intentions* to consume the product under consideration. Attitudes and intentions to consume a specific food product may be influenced more readily by factors other than perceptions of healthiness. For example, research has shown that, in the case of fish consumption, taste is an important driver for eating fish (Verbeke & Vackier, 2005). Given that the current study included a representative sample of the general population, it can be expected that respondents were included who dislike consuming fish. It is possible that health information in terms of QALYs may have an increased impact on attitudes and intentions to change fish consumption for people who like fish. Furthermore, QALY information may still impact actual consumption behavior as the relation between intentions to perform a specific behavior and actual behavior can be rather weak (Armitage & Conner, 2001). Finally, information about QALYs may influence attitudes and intentions when the health impact is larger than used in the present research. For example, health information may influence intentions to eat fish when the difference between the health risks and benefits is large (Knuth, Conelly, Sheeshka, & Patterson, 2003).

In the current study information was provided about gaining or losing four QALYs as a result of changes in fish consumption. Research may indicate, however, that the average impact of increased fish consumption in terms of QALYs for the average consumer may be much smaller. Similarly, the average health impact of changing consumption of one food product in terms of QALYs may be rather small, and is also likely to depend on the rest of the diet. Future research should address whether QALYs are also perceived as useful for describing smaller health effects associated with food consumption, and whether this information influences perceptions of healthiness as intended by the information. Future research may also usefully compare results of the current study with other tools for describing risks and benefits associated with food consumption, such as DALYs, incidence rates, or days of work lost (Eiser, Stafford, & Fazio, 2008).

The impact of health information in terms of QALYs on risk and benefit perceptions was not dependent on age and perceived personal health, indicating that QALYs can facilitate informed decision making for people of different ages and personal health status. In addition, QALYs were perceived as equally useful for describing health effects associated with food consumption by these people. The

finding that perceptions of personal health status was not influential may be due to the different level of abstraction for the item for measuring perceptions of personal health (i.e. health in general) and the specificity of the described health effects associated with fish consumption (i.e. reduced risk of cardiovascular diseases and increased risk of cancer). Thus, compared to participants with perceptions of good personal health, participants with perceptions of poor personal health associated with health issues other than cardiovascular diseases may have considered the information about the impact of fish consumption on QALYs of equal relevance, and this information may have had an equal impact on perceptions of healthiness. Gender was found to be related to the impact of QALY information on risk perceptions. QALY information had an increased impact on risk perceptions for women compared to men. This result may be due to an increased concern about the nutritional value of food in general by women compared to men (Moon et al., 1998; Nayga, 1997), which may result in an increased impact on risk perceptions.

As a result of an increased emphasis within policy circles on the need to implement open and transparent communication with consumers about food safety policy procedures and decision making practices (Byrne, 2002; FSA, 2002; Millstone & Van Zwanenberg, 2002), consumers will increasingly be exposed to information related to integrated risk-benefit assessments. It therefore becomes important to understand how consumers respond to such information, and how this information can best be communicated. The current study shows that although the impact of information about health effects in terms of QALYs on actual food consumption choices may be limited and merits further investigation, consumers generally perceive QALYs as a useful tool for describing both health risks and benefits associated with food consumption. When food products are associated with negative net effects on health, consumers prefer the impact on QALYs communicated as a net effect, while separate communication of both risks and benefits may be preferred for food products associated with positive or zero net health effects. Information about the impact of food consumption on QALYs may also facilitate informed decision making by consumers, as it is likely to influence risk and benefit perceptions as intended by the information.

APPENDIX

Introductory text to health effects associated with food consumption

Health effects associated with food consumption

Some food products have *either* positive or negative effects on your health. Other food products, however, can have *both* positive and negative effects on health.

An example is fatty fish (for example, salmon, herring and mackerel). Fatty fish are an important source of omega-3-fatty acids, vitamin D, and other healthy nutrients. Eating fatty fish reduces the risk of cardiovascular diseases, such as strokes and heart attacks. On the other hand, contaminants like heavy metals, dioxins and pesticides are also found in fatty fish, which can have toxic effects and, among others, can increase the risk of some cancers.

Text used in the questionnaire for explaining the use of QALYs

"Healthy life years" describes the total health impact of the positive and negative effects associated with the consumption of food

A measure that can be used for describing the total health impact of positive and negative effects associated with food consumption is *"healthy life years"*.

"Healthy life years" is a measure that combines the impact of eating certain food products on both *life expectancy* and *quality of life*.

Life expectancy is the number of years people are on average expected to live; for example, in the Netherlands the life expectancy is 78 years for men and 83 years for women.

Quality of life is another measure, which is an evaluation of how good a person's experience of life is. It contains evaluations of physical, mental, and social functioning. For example, people living with a chronic disease may experience a lower quality of life, than people who are completely healthy.

Both life expectancy and quality of life may be affected at the same time. For example, if someone develops cancer as a result of consuming contaminants in a food product, this may not only reduce their *life expectancy* but can also reduce the *quality of life* experienced by the individual as some of the time that this person is alive will be with a disease.

"*Healthy life years*" is a measure of life expectancy which takes into account the quality of life experienced by an individual.

5

PERCEPTIONS OF HEALTH RISKS AND BENEFITS ASSOCIATED WITH FISH CONSUMPTION AMONG RUSSIAN CONSUMERS

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ABSTRACT

Knowledge about differences in consumer perceptions of health risks and benefits related to fish consumption is important for the development of targeted health interventions associated with dietary choice. The purpose of this study is to identify individual differences in Russian consumers according to their perceptions of health risks and benefits associated with fish consumption. By application of a cluster analysis on perceptions of personal risks and benefits associated with the consumption of fish, four groups of Russian consumers were classified as: very positive; positive; moderately positive; and 'high risk high benefit' about the healthiness of fish consumption. Differences in perceptions of personal risks and benefits across consumers were related to self-reported fish consumption, optimism about personal risks and benefits, and optimism about personal knowledge about risks and benefits. Implications for the development of targeted health interventions to influence perceptions of risks and benefits associated with fish consumption, and ultimately fish consumption, are discussed. It is concluded that optimism regarding perceptions and knowledge of health *risks*, and health *benefits* should be taken into account when developing interventions aimed at consumer health.

5.1 Introduction

Regular fish consumption is part of a healthy diet (Gezondheidsraad, 2006). However, actual fish consumption levels are often far below dietary advice recommending consumption of two portions per week (Welch et al., 2002). Health is an important motive for fish consumption (Verbeke & Vackier, 2005), and so health interventions may focus on increasing consumer perceptions of the healthiness of including fish in their diet. The effectiveness of such interventions may depend on initial perceptions of personal health risks and benefits associated with fish consumption, and how these vary between consumers.

Fish consumption is associated with both risks and benefits to human health. For example, omega three fatty acids in fatty fish can substantially reduce the risk of cardiovascular disease (De Goede, Geleijnse, Boer, Kromhout, & Verschuren, 2010; Mozaffarian & Rimm, 2006; Sidhu, 2003; Wang et al., 2006), and fatty fish is an important source of vitamin D compared to other food products, which can improve the development of bones (Holick, 2004). However, stacking or bioaccumulation of heavy metals in fish tissue (notably methyl mercury) may pose toxicological hazards to humans (Gochfeld & Burger, 2005; Mozaffarian & Rimm, 2006).

Dietary advice provided to citizens recommends the consumption of two portions of fish a week, of which one should be fatty fish. In practice, consumers in many countries eat less than this recommended amount of fish (Welch et al., 2002), which is suboptimal from the point of view of public health (Sidhu, 2003). Especially in countries where cardiovascular disease leads to many premature deaths, an increase in (fatty) fish consumption may positively contribute to consumer health.

Research has shown that one important motive for food choice (Grunert, 2005; Honkanen & Frewer, 2009), including fish (Verbeke & Vackier, 2005), is health. Fish consumption may therefore be expected to be partially dependent on perceptions of both associated risks and benefits to health. Perceived risk is a central construct in models of health behavior (Aiken, Gerend & Jackson, 2001). The Health Belief Model suggests that health behavior (for example, following nutrition recommendations) may be partly predicted by perceptions of benefits associated with a specific health behavior, as well as barriers to implementing that behavior (Rosenstock, 1982). Specifically in the context of fish, it has been shown that the perceived *risk* of food poisoning associated with consuming fish is negatively related to fish consumption (Pieniak, Verbeke, Scholderer, Brunso, & Olsen, 2008). Research on the relationship between perceptions of health *benefits* associated with fish

consumption and fish consumption behavior is, however, more limited (but see Verbeke, Vermeir, & Brunsø, 2007).

The literature has indicated that the consumption of fish is perceived as having relatively high health benefits compared to safety risks (Honkanen, 2010; Verbeke, Sioen, Pienak, Van Camp, & De Henauw, 2005). However, there may be individual differences in the extent to which people judge benefits as high and risks as low, or *vice versa* (Alhakami & Slovic, 1994). For example, there may be a group of consumers who perceive both high personal benefits and high risks associated with the consumption of fish. Such differences in perceptions of health risks and benefits related to fish consumption have implications for the development of targeted health interventions associated with fish consumption.

The current study examined consumer perceptions of risks and benefits associated with fish consumption, and how these perceptions relate to (self-reported) fish consumption. The study also sought to identify homogenous subgroups of consumers who differed in their perceptions of personal health risks and benefits associated with fish consumption.

As fish consumption may be partly dependent on perceptions of health risks and benefits, health interventions may attempt to increase fish consumption levels by influencing perceptions of personal risks and benefits associated with fish consumption. An additional aim of health campaigns may be to increase informed decision making by providing information about the associated risks and benefits. However, perceptions of personal health risks and benefits may also be subject to biases, which may act as barriers or facilitators to changing risk and benefit perceptions and subsequent fish consumption levels. In addition, biases in perceived personal knowledge about associated risks and benefits may act as barriers to changing perceptions and subsequent consumption behavior.

Perceptions of personal risks may be subject to unrealistic optimism (also known as optimistic bias or comparative optimism), which is the tendency to perceive others as more vulnerable to specific risks when compared to the self (Weinstein, 1980). Whereas an individual can be correct in perceiving his or her personal risk of developing cancer as a result of consumption of dioxin contaminated fish to be lower than the risk to the average person, this optimism becomes unrealistic when all people within a group (which is representative of the whole population) perceive their personal risk as lower than the average person. Unrealistic optimism regarding

personal risks has been shown in relation to different food related hazards, including health risks associated with food-related lifestyle (Miles & Scaife, 2003).

Unrealistic optimism regarding personal risk may hinder efforts to promote risk-reducing behavior because people believe that they are less at risk than others are (Weinstein, 1989), and hence may be less motivated to adjust their behavior. For example, optimism about personal risks reduces peoples' intentions to change unhealthy behavior (Branstrom, Kristjansson, & Ullen, 2006). Optimism about personal risks may thus be expected to reinforce existing fish consumption behavior and act as a barrier to interventions aimed at influencing risk perceptions and subsequent fish consumption levels.

Unrealistic optimism has also been found for positive events, in which case people believe that positive events are more likely to happen to them than to others (Weinstein, 1980; White, Eiser, Harris, & Pahl, 2007). To our knowledge, there is no published research examining optimism about personal benefits associated with dietary choice. People who are optimistic about personal benefits associated with fish consumption may be more motivated to increase their consumption of fish compared to people who are not optimistic about the benefits, because they perceive their personal benefits as being relatively high.

Knowledge about health risks and benefits is important for making informed food consumption decisions. Actual consumer knowledge about the health effects of fish consumption is, however, rather poor (Burger & Gochfeld, 2009; Verbeke, Sioen, Pienak, Van Camp, & De Henauw, 2005). In addition, people believe that their personal knowledge about "lifestyle" food-related hazards (i.e. those over which they perceive high levels of personal control) is greater than that of other people (Frewer, Shepherd, & Sparks, 1994). Such optimism about personal knowledge may reinforce beliefs about the accuracy of existing perceptions of personal risks and benefits, even if these perceptions are overly optimistic. Increased certainty about existing perceptions of personal risks and benefits may result in decreased potential to change these perceptions (c.f. Krosnick & Petty, 1995), which in turn may influence the potential to change existing fish consumption behavior.

To summarize, optimism in terms of perceptions and knowledge of risks and benefits associated with fish consumption may act as barriers or facilitators for changing fish consumption behavior. The current study will therefore examine whether consumers show unrealistic optimism in terms of their knowledge and perceptions of personal risks and benefits related to fish consumption. In addition, whether and how groups of consumers with specific patterns of risk benefit

perceptions differ in the extent to which they are optimistic about their knowledge and perceptions of personal risks and benefits will be assessed.

5.2 Method

5.2.1 Participants

Data were collected from respondents in four Russian cities in May 2007: Moscow, Nizhny Novgorod, Taganrog, and Engels. The dietary patterns among Russian consumers are quite unhealthy, including low levels of fish consumption (Ganskau, 2006), and Russia is among those European countries with the lowest level of public health; female life-expectancy is 72 years, while male life-expectancy is 58 years and still declining (Marquez, Suhrcke, McKee, & Rocco, 2007). One of the main causes of death in Russia is cardiovascular disease (Marquez, Suhrcke, McKee, & Rocco, 2007). Increasing the consumption of (fatty) fish may reduce the risk of cardiovascular disease (Mozaffarian & Rimm, 2006).

The data were collected as part of a larger survey concerning the Russians' food consumption habits. The sample was therefore chosen to obtain data from cities reflecting different sizes and regions in the European part of Russia (Table 5.1)[1]. The survey is thus not representative for the whole Russian Federation, but does represent a relevant target population for increased public health through increased fish consumption. Data were collected with two surveys (collected two weeks apart in order to prevent consistent answering tendencies). The first survey consisted of closed questions related to perceptions and was collected *via* face-to-face interviews[2]. Respondents were subsequently contacted by telephone to complete the second survey, which consisted of questions related to frequency of fish consumption. Twelve hundred respondents were recruited to ensure at least 1000 usable questionnaires. After the second questionnaire 1081 usable questionnaires for the analysis were completed.

The surveys were constructed in English and translated to Russian, and four pilot interviews were conducted in order to check the language, phrasing and understanding of questions. The surveys were conducted by a professional social research company.

[1] For a description of the cities see Honkanen and Frewer (2009).
[2] For the specifics of sampling see Honkanen and Frewer (2009).

Table 5.1 Characteristics of study participants across the cities in the study

	Moscow (*n*=419)	Nizhny Novgorod (*n*=214)	Taganrog (*n*=226)	Engels (*n*=222)	Total sample (*N*=1081)
Gender					
Male	49.4 %	49.5 %	50.4 %	50.0 %	49.8 %
Age (years)					
mean	35.7	36.0	36.1	36.4	36.0
SD	13.3	13.6	13.8	14.0	13.6
Educational level [a]					
Low	4.8 %	7.0 %	6.6 %	5.0 %	5.6 %
Middle	67.6 %	69.6 %	69.1 %	77.9 %	70.5 %
High	27.6 %	23.4 %	24.3 %	17.1 %	23.9 %

[a] Lower education level: elementary school; middle education level: senior secondary school, technikum, incomplete higher education; higher education level: basic higher education (4 years), postgraduate higher education (5-6 years)

5.2.2 Materials

The first questionnaire asked people about the following topics.

Risk and benefit perceptions

Items for measuring perceptions of risks and benefits associated with eating fish included "The health risks [benefits] associated with eating fish *to me personally* are…" and "The health risks [benefits] associated with eating fish *to the average Russian person of your age and gender* are…" (see Miles & Scaife, 2003, for a discussion on measures for optimistic bias in the food domain). Items were rated on a scale ranging from 1=very low to 7=very high.

Perceived knowledge about risks and benefits

Items for measuring perceived knowledge about risks and benefits associated with eating fish included "How much knowledge do you think you personally have about the health risks [benefits] of eating fish?" and "How much knowledge do you think the average Russian person of your age and gender has about the health risks [benefits] of eating fish?" Respondents rated their perceived knowledge on a 7 point scale ranging from 1=very low to 7=very high.

Health motivation in food choice

Health motivation in relation to food choice was measured with a health motivation scale adopted from the food choice questionnaire designed by Steptoe, Pollard and Wardle (1995). The health motivation scale consisted of six items (Cronbach α=.72). Respondents were asked to evaluate the statement "it is important to me that the food I eat on a typical day …" for each item, and to evaluate the importance on a scale from 1="not at all important" to 7="very important". Items included "is high in fiber and roughage", "is nutritious", "contains a lot of vitamins and minerals", "is high in protein", "keeps me healthy" and "is good for my skin/teeth/hair/nails, etc.".

Perceived current health

Respondents were asked to assess their perceptions of current personal and family health on a 7-point Likert scale ranging from 1="very poor" to 7="very good". Items for measuring perceived current health included "How would you assess your current health?" and "How would you assess the current health of your family?".

Fish consumption

In the second survey respondents were asked to indicate how often they consumed ten different fish items on a 7-point scale ranging from "never" and "once a month or more seldom" to "once or several times a day". This response scale was recoded into frequencies per week (never=0, once a month or more seldom=0.05, two to three times a week=0.625, one to two times a week=1.5, three to four times a week=3.5, five to six times a week=5 and once or several times a day=7). The ten fish items included salted herring, other herring, mackerel, salmon and trout, freshwater fish (pike, perch, carp), cod and codfish, sprat, pikeperch, shellfish, and other fish, which gave a reliable estimate of overall fish consumption (Cronbach α=.77).

Additional questions were included in the surveys which are discussed in separate papers (Honkanen, 2010; Honkanen & Frewer, 2009).

5.2.3 Data analysis

In order to assess the relation between perceptions of personal risks and benefits associated with fish consumption with self-reported fish consumption, a multiple regression was conducted where self-reported fish consumption was regressed on perceptions of personal risks and benefits to health associated with fish consumption.

Optimism regarding perceptions and knowledge of health risks and benefits associated with fish consumption was assessed using paired sample t-tests, comparing respondents' scores on the items for perceived personal risks, benefits, and knowledge about risks and benefits, with respondents' scores on these items for the average Russian person.

In order to examine whether homogenous subgroups of consumers exist that differ in their perceptions of personal health risks and benefits associated with fish consumption a two-step cluster analysis was applied to the variables risk and benefit perceptions to oneself (a hierarchical cluster analysis using Ward's method (Ward, 1963) was applied to determine the number of clusters, followed by a K-means cluster analysis to determine cluster membership). The clusters were profiled with univariate ANOVAs and Pearson Chi-square statistic to test significant differences. In order to profile the clusters, self-reported consumption of fish, optimism regarding personal risks and benefits, optimism regarding personal knowledge about risks and benefits, health motivated food choice, perceived personal and family health, and socio-demographic variables were used.

5.3 Results

5.3.1 Relations between perceptions of personal risks and benefits and self-reported fish consumption

Perceptions of risk were negatively correlated with perceptions of benefit, $r(1079)=-.21$, $p<.001$, indicating that on average perceptions of high personal benefits were related to perceptions of low personal risks, and *vice versa*.

A multiple regression analysis showed that perceptions of personal benefits and risks explained a significant but small proportion of variance in self-reported fish consumption, $R^2=.01$, $F(2, 1078)=5.62$, $p=.004$, with only perceptions of benefits having a significantly positive relation with self-reported fish consumption, $\beta=.10$, $t(1078)=3.35$, $p=.001$ for benefit perceptions and $\beta=.02$, $t(1078)=0.51$, $p=.61$ for risk perceptions.

5.3.2 Optimism about perceptions and knowledge of risks and benefits

Results provide evidence for the existence of an optimistic bias regarding both personal risks and benefits associated with the consumption of fish. On average, perceptions of personal risk were significantly lower compared to perceptions of risk

for the average Russian person of the same age and gender, $t(1080)=-5.72$, $p<.001$. Similarly, perceptions of personal benefits were significantly higher than perceptions of benefits for the average person, $t(1080)=7.66$, $p<.001$.

Results showed no evidence of optimistic biases about personal knowledge of the health risks and benefits associated with fish consumption. That is, perceptions of knowledge about risks and benefits of oneself *versus* the average Russian person were on average not significantly different, $t(1080)=-0.69$, $p=.49$ for knowledge about risks, and $t(1080)=1.25$, $p=.21$ for knowledge about benefits.

5.3.3 Cluster analyses

A cluster analysis was conducted in order to examine whether homogenous subgroups of consumers exist that differ in their perceptions of personal health risks and benefits associated with the consumption of fish. In addition, it was examined whether and how these different consumer groups differed in terms of self-reported consumption of fish, optimism about perceptions and knowledge of personal risks and benefits, health motivated food choice, health beliefs and socio-demographic variables.

Consumer group classifications

Four clusters were identified on the basis of perceptions of personal risks and benefits associated with the consumption of fish, consisting of 39.4 %, 31.4 %, 19.0 % and 10.2 % of the respondents in the sample respectively (Figure 5.1). Mean ratings on the classification variables (risk and benefit perceptions associated with the consumption of fish for oneself) are shown in Table 5.2. Across all clusters, average perceptions of benefits were higher than average perceptions of risks, indicating that the consumption of fish was generally perceived as more beneficial than harmful for health. Nevertheless, differences between clusters existed in the absolute levels of perceived benefits and risks associated with the consumption of fish (Table 5.2).

Cluster 1: Moderately positive perceptions of the healthiness fish consumption. Respondents in the first and largest cluster can be typified as being *moderately positive* about the healthiness of fish consumption, as they perceived associated risks as moderately low and benefits as moderately high. Compared to the other clusters, perceptions of the healthiness of fish consumption in this cluster were least positive, as benefit perceptions were relatively low and risk perceptions relatively high.

Cluster 2: Very positive perceptions of healthiness fish consumption. Respondents in cluster two perceived on average the highest benefits compared to the other clusters and, together with cluster three, low risks. These respondents were *very positive* about the healthiness of fish consumption.

Cluster 3: Positive perceptions of healthiness fish consumption. Respondents in the third cluster were *positive* about the healthiness of fish consumption, as they perceived low risks and moderately high benefits associated with the consumption of fish.

Cluster 4: Perceptions of high risks and high benefits associated with fish consumption. Cluster four was the smallest cluster. Respondents in this cluster perceived the highest risks compared to the other clusters, in addition to high benefits.

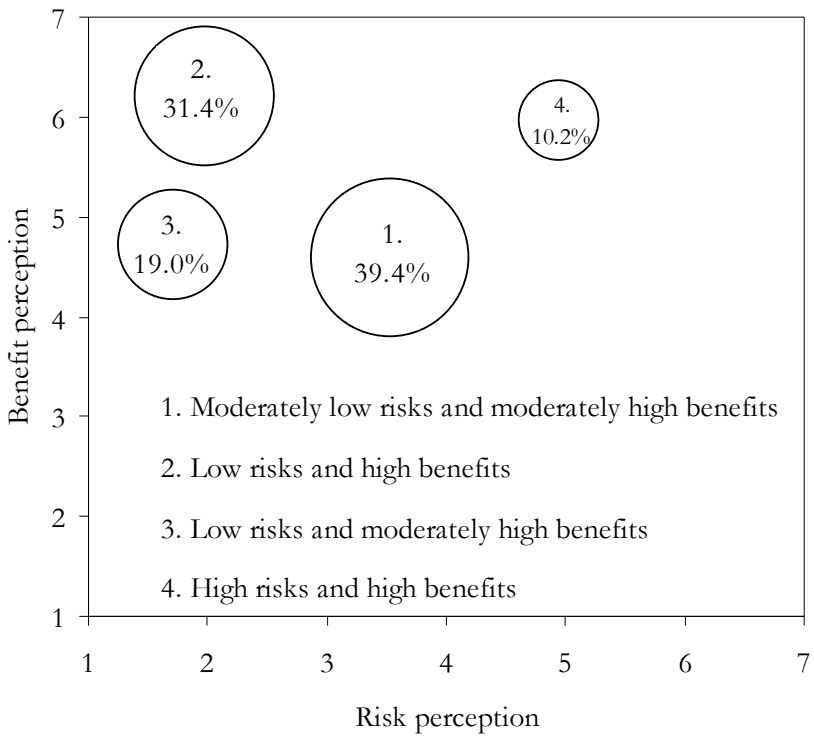

Fig. 5.1 The consumer groups identified in the analysis.

Table 5.2 Cluster descriptors: Perceptions of personal risk and benefit associated with the consumption of fish

Cluster descriptor	Cluster 1: moderately positive (*n*=426)		Cluster 2: very positive (*n*=340)		Cluster 3: positive (*n*=205)		Cluster 4: high risks and high benefits (*n*=110)		*F*	*p*-value
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*		
Perceived personal risk	3.54 [I, a]	0.57	1.98 [I, b]	0.69	1.71 [I, c]	0.46	4.95 [I, d]	0.82	1038.20	<0.001
Perceived personal benefit	4.61 [II, a]	0.65	6.21 [II, b]	0.41	4.71 [II, a]	0.64	5.96 [II, c]	0.72	579.95	<0.001

Notes:
Scores with a different Roman numeral are significantly different within clusters at $p<.05$.
Scores with a different superscript letter are significantly different between clusters at $p<.05$.

Consumer group profiles

Self-reported fish consumption. Differences in personal risk and benefit perceptions across clusters are reflected in significant differences in self-reported fish consumption (Table 5.3). Consumers in the moderately positive and the positive clusters (clusters one and three) reported the lowest consumption of fish. Consumers in the very positive and 'high risk high benefit' clusters (clusters two and four) reported the highest fish consumption levels. These were also the consumers with the highest benefit perceptions associated with fish consumption (Table 5.2). Nevertheless, consumers in these clusters reported to eat on average only between 0.56 to 0.63 times fish a week, which is only about 30% of the recommended consumption of two portions of fish a week.

Optimism personal risks and benefits. The clusters also differed in terms of optimism regarding personal risks and benefits associated with the consumption of fish (Table 5.3). Consumers in the largest, moderately positive, cluster (cluster 1) showed no optimism regarding personal risks and benefits associated with the consumption of fish. That is, benefits for oneself were not perceived as significantly higher than benefits for the average Russian person of the same age and gender. Similarly, personal risks were not perceived to be lower. Consumers in the very positive cluster (cluster 2) were optimistic regarding both their personal risks and benefits. Consumers in the positive cluster (cluster 3) were only optimistic regarding their

Table 5.3 Differences between the clusters in self-reported fish consumption and optimism regarding perceptions and knowledge of risks and benefits

Profile variable	Cluster 1: moderately positive		Cluster 2: very positive		Cluster 3: positive		Cluster 4: High risks and high benefits		*F*	*p*-value
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*		
Consumption of fish per week	0.47 [I]	0.46	0.56 [II, III]	0.45	0.48 [I, II]	0.48	0.63 [III]	0.51	4.65	0.003
Optimism regarding [a]										
Personal risks	-0.01 [I]	0.57	0.25 *, [II]	0.69	0.36 *, [III]	0.65	-0.28 *, [VI]	0.73	33.75	<0.001
Personal benefits	0.01 [I]	0.65	0.43 *, [II]	0.80	-0.02 [I]	-0.72	0.38 *, [II]	0.70	29.31	<0.001
Optimism regarding personal knowledge [a]										
About risks	-0.14 *, [I]	0.77	0.06 [II]	0.85	-0.06 [I, II]	0.87	0.30 *, [III]	0.87	9.84	<0.001
About benefits	-0.12 *, [I]	0.68	0.17 *, [II]	0.94	0.02 [III]	0.75	0.19 *, [II, III]	0.82	10.22	<0.001

Note: Scores with a different Roman numeral are significantly different between clusters at $p<.05$.

* Mean differences are significant at $p<.05$

[a] Scores higher than zero indicate optimism, scores lower than zero indicate pessimism

personal risks, while neither optimistic nor pessimistic regarding personal benefits. Consumers in the 'high risk high benefit' cluster (cluster 4) were optimistic about their personal benefits, but in addition were pessimistic regarding their personal risks (Table 5.3).

Optimism personal knowledge risks and benefits. Respondents in the moderately positive cluster (cluster 1) were pessimistic about their knowledge of risks and benefits. Respondents in the very positive cluster (cluster 2) were optimistic about their knowledge of benefits, but showed no optimism regarding their knowledge of the associated risks. Respondents in the positive cluster (cluster 3) were neither optimistic about their knowledge of risks nor benefits, whereas respondents in the 'high risk high benefit' cluster (cluster 4) were optimistic about their knowledge of both risks and benefits associated with fish consumption. Consumers in the 'high risk high benefit' cluster were on average also the most optimistic regarding their personal knowledge about the risks and the benefits associated with fish consumption (Table 5.3).

Health motivation for food choice. Health was an important motive for food choice across the four clusters. For respondents in the very positive and 'high risk high benefit' clusters (clusters 2 and 4) health was a more important motive for food choice than for respondents in the other two clusters. Health motivation was generally lowest for respondent in the positive clusters (cluster 3, Table 5.4).

Perceived personal and family health. Differences in personal risk and benefit perceptions across clusters are not related to perceptions of personal and family health (Table 5.4).

Table 5.4 Differences in health motivation and perceived personal and family health between the clusters

Profile variable	Cluster 1: moderately positive		Cluster 2: very positive		Cluster 3: positive		Cluster 4: high risks and high benefits		*F*	*p*-value
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*		
Health motivation	5.42 [I]	0.72	5.54 [II]	0.71	5.26 [III]	0.78	5.67 [II]	0.73	10.17	<0.001
Perceived personal health	4.78	1.16	4.66	1.18	4.90	1.15	4.92	1.11	2.58	0.053
Perceived family health	4.62	0.97	4.63	1.09	4.71	0.93	4.85	1.00	1.78	0.148

Note: Scores with a different Roman numeral are significantly different between clusters at $p<.05$.

Socio-demographic variables. Table 5.5 presents the demographic variables per cluster. In terms of absolute age, the four clusters did not differ extensively. Respondents in the positive cluster (cluster 3) were on average somewhat younger than respondents in the very positive and 'high risk high benefit' clusters (clusters 2 and 4). Men and women were equally distributed across the four consumer segments.

The consumer segments had different profiles according to which of the cities they lived in. A relatively low proportion of respondents in the moderately positive cluster (cluster 1) lived in Moscow, whereas an above-average proportion of respondents came from Taganrog. In the very positive cluster (cluster 2) a relatively high proportion of respondents came from Moscow and relatively few people came from Taganrog. In the positive cluster (cluster 3) a relatively low proportion of respondents came from Moscow. The 'high risk high benefit' cluster (cluster 4) comprised a relatively high proportion of respondents from Moscow and a low proportion of respondents from Engels. A relatively high proportion of respondents in the very positive cluster (cluster 2) had completed higher education. A relatively high proportion of respondents in the very positive (cluster 2) and 'high risk high benefit' (cluster 4) clusters had a household income higher than 22,000 rubles before taxes.

Table 5.5 Differences in socio-demographic variables between the clusters

Demographic variable	Cluster 1: moderately positive	Cluster 2: very positive	Cluster 3: positive	Cluster 4: high risks and high benefits	*F*/Pearson Chi-square	*p*-value
Age					3.21	0.022
Mean	35.5 [I,II]	37.2 [I]	34.0 [II]	37.8 [I]		
SD	13.6	13.5	13.6	13.2		
Gender					2.88	0.411
Male	46.9 %	50.3 %	52.2 %	54.4 %		
City					36.97	<0.000
Moscow	33.6 % [I]	43.5 % [II]	31.7 % [I]	57.3 % [II]		
Nishny Novgorod	19.7 %	20.0 %	22.9 %	13.6 %		
Taganrog	23.9 % [I]	15.6 % [II]	23.4 % [I,II]	20.9 % [I,II]		
Engels	22.8 % [I]	20.9 % [I]	22.0 % [I]	8.2 % [II]		
Educational level [a]					18.27	0.006
Low	6.8 %	6.2 %	4.9 %	0.9 %		
Middle	72.3 % [I,II]	63.8 % [I]	71.7 % [I,II]	80.9 % [II]		
High	20.9 % [I]	30.0 % [II]	23.4 % [I,II]	18.2 % [I,II]		
Income					27.68	0.006
Don't know/refuse to answer	22.8 %	18.2 %	15.6 %	16.4 %		
<6000 rubles	11.5 %	10.3 %	9.8 %	10.9 %		
6001-13000 rubles	28.9 %	22.4 %	23.9 %	24.5 %		
13001-18000 rubles	14.1 %	12.9 %	19.5 %	10.9 %		
18001-22000 rubles	6.8 %	10.3 %	11.7 %	9.1 %		
>22000 rubles	16.0 % [I]	25.9 % [II]	19.5 % [I, II]	28.2 % [II]		

Note: Scores with a different Roman numeral are significantly different between clusters at $p<.05$.

[a] Lower education level: elementary school; middle education level: senior secondary school, technikum, incomplete higher education; higher education level: basic higher education (4 years), postgraduate higher education (5-6 years)

5.4 Discussion

Perceptions of personal health benefits associated with the consumption of fish were positively related to self-reported fish consumption levels, whereas perceptions of personal risk did not predict self-reported fish consumption. Unrealistic optimism about both personal risks and benefits associated with fish consumption was identified. No evidence was found for unrealistic optimism about personal knowledge regarding the associated risks and benefits in the overall sample. Different homogeneous segments among Russian consumers were identified according to their perceptions of personal health risks and benefits associated with fish consumption. These clusters showed differences regarding self-reported fish consumption, optimism regarding perceptions and knowledge of risks and benefits associated with fish consumption, health motivated food choice, and socio-demographic variables.

Perceptions of personal health benefits were positively related to self-reported fish consumption levels, which was not the case for personal health risks. These results suggest that perceived health benefits may be more important determinants of fish consumption than perceived health risks. The finding that risk perceptions are not related to fish consumption may be a result of the positive image fish has among Russian consumers. Perceptions of health risk may become more influential determinants of fish consumption when perceived risks increase, for example after exposure to risk information. In support of this view, research has shown that people eat less fish after information about high risks, regardless of the benefit levels presented in the information (Knuth, Conelly, Sheeshka, & Patterson, 2003).

Four groups of Russian consumers were identified that differed in terms of their perceptions of personal risks and benefits associated with fish consumption, described as very positive, positive, moderately positive, and 'high risk - high benefit' about the healthiness of fish consumption. These differences in perceptions of personal risks and benefits across consumers were reflected in differences in self-reported fish consumption, where consumers in the clusters with the highest perceived personal benefits reported the highest levels of fish consumption. Nevertheless, consumption levels were below the recommended amount of two portions of fish a week across all segments, even for people with very positive perceptions of the healthiness of fish consumption and despite the fact that health was an important motive for food choice across all segments. A possible explanation for these low levels of fish consumption is that Russian consumers have a strong preference for the consumption of meat (Honkanen, 2010).

Individual differences in perceptions of personal risks and benefits have implications for the potential of health campaigns to increase the perceived healthiness of fish consumption and subsequent fish consumption behavior. For example, interventions aimed at increasing perceptions of personal health benefits may have more impact on people who perceive moderately high benefits associated with the consumption of fish than on people who already perceive high benefits due to a possible ceiling effect.

Effective interventions may also depend on optimism regarding perceptions and knowledge of associated risks and benefits. For example, in the moderately positive cluster there is a relatively high potential to increase perceptions of personal benefits and subsequent fish consumption, as consumers in this cluster do not only have moderate perceptions of personal benefits and relatively low fish consumption levels, but they are also pessimistic about their personal knowledge about associated benefits. This may make them less certain about their existing perceptions of personal benefits, which may increase the potential to change perceptions of personal benefits. These consumers were not optimistic about their personal benefits, which may reduce motivation to increase fish consumption. Developing interventions focused on increasing perceptions of *personal* benefits may increase motivation to increase fish consumption levels.

Consumers in the positive cluster showed no optimism about their personal benefits associated with fish consumption, nor were they optimistic regarding their knowledge about the associated benefits. In combination with relatively low initial perceptions of personal benefits and self-reported fish consumption, there is a high potential to increase benefit perceptions and subsequent fish consumption in this cluster. Lack of optimism about personal knowledge regarding associated benefits may make perceptions of personal benefits more amenable compared to benefit perceptions of people who are optimistic about their personal knowledge (i.e. consumers in the very positive and 'high risk high benefit' clusters), but less amenable compared to perceptions of consumers who are pessimistic about their personal knowledge (i.e. consumers in the moderately positive cluster).

The potential to increase perceptions of personal benefits and subsequent fish consumption may be limited in the very positive and 'high risk - high benefit' clusters, as these consumers did not only have high initial perceptions of personal benefits, but they were also optimistic about their personal knowledge about associated benefits. For consumers in the 'high risk - high benefit' cluster it may be more effective to increase fish consumption by reducing risk perceptions, as these were relatively high

compared to the other clusters, and people were also pessimistic about their personal risks. However, optimism regarding personal knowledge about associated risks may pose a barrier to reducing risk perceptions for this group of consumers, as it may increase the strength of their beliefs about their personal risks.

Optimism regarding perceptions and knowledge of risks and benefits may not only influence motivation to change fish consumption and the certainty with which perceptions are held, but also processing of information about risks and benefits, and how this information may impact subsequent perceptions of healthiness. For example, optimism about personal risk can reduce peoples motivation to process risk information (Radcliffe & Klein, 2002; Zhao & Cai, 2009), and increase resistance to changing risk perceptions (Avis, Smith, & McKinlay, 1989). Optimism regarding personal benefits, on the other hand, may lead to increased motivation to process benefit information, and increased impact of benefit information, because the personal relevance of this information may increase when people believe they are more likely to personally benefit from fish consumption. Increased personal relevance of information has been shown to increase motivation to process the information (Eagly & Chaiken, 1993), as well as the persuasiveness or impact of that information (Petty, Cacioppo, & Goldman, 1981). Optimism about personal knowledge may reduce the impact of health information on risk and benefit perceptions because people may believe the information is aimed at the 'ignorant' other (c.f. Frewer, Howard, Hedderley, & Shepherd, 1998). In addition, when people perceive they have sufficient personal knowledge, this may reduce motivation to search and systematically process information (Griffin, Dunwoody, & Neuwirth, 1999). Future research may usefully examine potential differences in reactions to risk benefit information as a result of differences in optimism regarding perceptions and knowledge about the health risks and benefits associated with fish consumption.

Whereas homogeneous groups of consumers in terms of perceptions of personal risk and benefit associated with the consumption of fish were identified, the current study did not include a measure of actual personal risk and benefits. As a result, optimism regarding personal risks or benefits within groups of consumers does not necessary reflect *unrealistic* optimism. For example, consumers in the 'high risk high benefit' cluster may indeed be expected to have higher health benefits from fish consumption than the average Russian consumer if they have a personal or family history of cardiovascular diseases. Similarly, optimism about personal knowledge within segments of consumers can not be considered as *unrealistic* optimism, since

consumers' actual knowledge about the health effects associated with fish consumption are not known in the current study.

Although no measure of actual risks and benefits was included, the current study did indicate that the identified consumer groups did not differ in terms of perceptions of personal and family health. Future research might usefully focus on whether there are subgroups of consumers within each cluster that are more at risk. For example, if there is a subgroup of pregnant women in the very positive cluster, optimism about personal benefits and risks from fish consumption may put these women (or, more specifically, their children) at increased risk by potentially uncritically accepting general information about benefits and ignoring general information about risks. From a practical perspective, it is necessary to test the impact of different interventions on risk and benefit perceptions, and to relate these to behavioral change. In addition, the generalizability of these results to other areas of food choice merits further investigation. A final point relates to the overall impact of dietary choice on health, given that the prevalence of cardiovascular disease in Russia is at least for some part dependent on other factors such as high levels of smoking and alcohol consumption (Notzon et al., 1998). Fish consumption may contribute to a healthier lifestyle but other health interventions are also important. It may also be relevant to test these results in other areas of health intervention.

In conclusion, groups of Russian consumers can be identified who differ in their perceptions of personal risks and benefits associated with the consumption of fish. In addition, distinct patterns of risk benefit perceptions are related to optimism about personal risks and benefits, and optimism about personal knowledge about risks and benefits. These differences provide insights for the potential of health interventions to influence perceptions of risks and benefits associated with fish consumption, and ultimately fish consumption, for different consumer groups. This study shows that not only optimism regarding perceptions and knowledge of health *risks*, but also optimism regarding perceptions and knowledge of health *benefits* should be taken into account when addressing healthier lifestyles.

6

THE IMPACT OF BALANCED RISK-BENEFIT INFORMATION AND INITIAL ATTITUDES ON POST-INFORMATION ATTITUDES

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ABSTRACT

In a realistic social context people are confronted with *both* positive and negative information, yet research on this topic is relatively scarce. This chapter presents two studies examining the role of initial attitudes on the impact of one-sided *versus* balanced positive (benefit) and negative (risk) information on attitudes towards different food production methods. The first experiment demonstrated that providing one-sided information influenced post-information attitudes congruent to the direction of the message content. The second experiment showed that the effect of balanced information on post-information attitudes may depend on initial attitudes. These results demonstrate that negativity effects are dominant for people with initial positive attitudes, but change into positivity effects for people with initial negative attitudes. Implications for communicating both positive and negative information are discussed.

6.1 Introduction

New and emerging technologies contextualize the social and cultural aspects of people's lives. Consider, for example, the influence of internet and mobile telephone services on interpersonal contact, and the public fear and outrage associated with the introduction of genetically modified organisms in Europe.

Many technologies or practices introduced into society are associated with both positive and negative aspects. For example, the natural science research literature implies that the use of genetic modification in food production may enable food products to retain more micronutrients (for example, vitamins and minerals; a positive aspect), but may also negatively affect human and animal health (for example, because some genetically modified products may reduce the effectiveness of animal and human antibiotics; a negative aspect). Individuals are often confronted with such conflicting information. Human decision making associated with many different situations encountered everyday involves simultaneous evaluation of both its positive and negative properties. As a consequence, it is important to understand how messages that contain *both* positive and negative information influence attitudes.

To date, research on persuasive communication associated with decision-making has mainly focused on the impact of one-sided messages (e.g. the information includes either positive *or* negative elements) on attitude change. Whereas there is some research on the impact of *combined* positive and negative information on attitude change (Crowley & Hoyer, 1994; Darke & Chaiken, 2005; Frewer, Scholderer, & Bredahl, 2003; Lord, Ross, & Lepper, 1979; Miller, McHoskey, Bane, & Dowd, 1993; Pomerantz, Chaiken, & Tordesillas, 1995; Wilson, Evans, Leppard, & Syrette, 2004), there is limited research on the impact of combined *balanced* information provision (i.e., where the extremity of the positive and negative information is matched) on attitude change (see Cacioppo, Gardner, & Berntson, 1997, for an exception). Research into the effects of balanced information provision is particularly suited to provide insights into how people combine positive and negative information in the formation of post-information attitudes. Therefore, in the current paper, the impact of balanced positive and negative information on attitude change will be examined, and compared against the impact of one-sided positive or negative information.

Previous research on how positive and negative information influences attitudes (for example, toward political candidates, products, or brands) has shown that negative information usually has a larger impact on overall evaluations than equally large positive information (Ajzen, 2001; Klein & Ahluwalia, 2005). This effect is commonly referred to as the *negativity bias* (Ajzen, 2001). Skowronski and Carlston (1989) provide a comprehensive review of theoretical explanations for the negativity bias. One assumption underlying some of these explanations of negativity bias is that people have a moderately positive internal standard or reference point (Skowronski & Carlston, 1989). Attitudes or expectations can serve as this reference point. For example, social judgment theory posits that people value negative information more

negatively than if the existing attitude or expectation is neutral, because the negative information is contrasted to the positive initial attitude (Sherif & Sherif, 1967). When positive and negative information is combined in one message, the negative information will have more impact on the overall impression because the positive information is perceived or judged more accurately (Skowronski & Carlston, 1989). In novelty theory, the negativity bias is explained by the higher informational value of unexpected information (Fiske, 1980). Since negative information is more against expectations than positive information for people with moderately positive expectations, negative information will receive relatively more weight in the overall impression formation (Fiske, 1980).

The assumption of moderate positivity implies that a negativity bias would be restricted to situations where people hold moderately positive expectations, and that the dominant impact of negative information over positive information on post-information attitudes may be contingent upon the existence of positive attitudes towards the underlying issue. This hypothesis can be tested by investigating situations where initial attitudes are more negative, in which case a positivity bias would be expected. In sum, research on the negativity bias and its underlying causes suggests that initial attitudes should be considered when examining the relative impact of positive and negative information on post-information attitudes.

To date, research on the negativity bias on post-information attitudes has often been conducted in situations where initial attitudes are of little importance, for example, in the case of impression formation of fictitious people or hypothetical products. In other cases there has been little variance within initial attitudes, making their explanatory value limited. The aim of the current research was to examine the role of initial attitudes on the relative impact of balanced positive and negative information on post-information attitudes. To do this, attitude-objects were selected with initial attitudes that were characterized by sufficient variation (from negative to positive). Based on novelty theory and expectancy contrast theory not only a negativity bias was predicted for people with *positive* initial attitudes, but *also* a positivity bias was predicted in the case of people with *negative* initial attitudes. In other words, an attitude incongruency effect was expected under conditions where a broad spectrum of initial attitudes exists.

Risk and benefit information associated with different food production methods was used as a "context" for investigating the impact of both negative and positive information on attitudes, because food production methods provide realistic examples of situations where both negative and positive aspects play a role. In order

to ensure variation in attitudes and positive and negative contextualization, different agri-food production methods were used as attitude-objects, including ones that previous research has shown individuals tend to be negative about (genetic modification, Bredahl, 2001; Magnusson & Koivisto Hursti, 2002), positive about (organic farming, Saba & Messina, 2003), and assumed to be neutral about (conventional agriculture). In the first experiment the effect of one-sided versus balanced risk and benefit information provision on post-information attitudes was compared. Additionally, the effect of initial attitudes on the impact of information on post-information attitudes was examined. In this experiment, the risk and benefit information associated with the different food production methods was related to a single domain: personal health. In making behavioral decisions, however, consumers often need to trade-off interests in different domains against one another, such as the consequences for their personal health, the environment, and financial aspects. In the second experiment, the risk and benefit information associated with the different production methods was therefore related to both health and the environment. In experiment two the effect of balanced positive and negative information was further examined for the explicit situation when the benefits and risks concerned different domains. Again, the moderating role of initial attitudes on the impact of information on post-information attitudes was examined.

In addition to post-information attitudes, the impact of risk and benefit information and initial attitudes on risk and benefit perceptions were examined in both experiments. Risk and benefit perceptions can be conceptualized as specific evaluations of an attitude object (Eiser, Miles, & Frewer, 2002; Fischer & Frewer, 2009; Frewer, Scholderer, & Bredahl, 2003; Siegrist, 1999, 2000). Given that previous research on the impact of information on risk and benefit perceptions has mainly focused on how providing risk *or* benefit information influences risk and benefit perceptions, it is important to consider the combination of risk and benefit information and its impact on these more specific attitude evaluations. For example, Finucane, Alhakami, Slovic and Johnson (2000) found that providing people with risk information results in increased perceptions of risk *and* reduced perceptions of benefit. Similarly, providing people with benefit information leads to increased perceptions of benefit *and* reduced perceptions of risk. Investigating changes in risk and benefit perceptions as a result of providing balanced risk-benefit information can provide additional insight in the way in which positive and negative information is differentially used in the formation of (more specific) post-information attitudes.

6.2 Experiment 1

An attitude-incongruent effect on post-information attitudes was predicted for both one-sided and balanced information provision. It was hypothesized that the impact of one-sided positive information on post-information attitudes would be more positive for people with negative initial attitudes than for people with positive initial attitudes (and *vice versa* for one-sided negative information). An incongruency effect for *balanced* information provision was predicted, such that balanced information would have a positive impact on post-information attitudes for people with negative initial attitudes and a negative impact for people with positive initial attitudes. In other words, a *positivity effect* was expected for people with a negative initial attitude and a *negativity effect* for people with a positive initial attitude when positive and negative information was provided in one message. These hypotheses were extended to specific evaluations of attitude objects in terms of risk and benefit perceptions, where it is argued that similar effects would occur (see Table 6.1).

Table 6.1 Summary of experimental hypotheses

Information provision	Initial attitude	Post-information attitude	Risk perception	Benefit perception
Risk only	Positive	--	++	--
	Negative	-	+	-
Benefit only	Positive	+	-	+
	Negative	++	--	++
Balanced	Positive	-	+	-
	Negative	+	-	+

Hypothesized impact of one-sided and balanced information provision on post-information attitudes and risk and benefit perceptions for people with positive or negative initial attitudes.

6.2.1 Method

Participants and Design

Data were collected from a nationally representative sample of participants in the United Kingdom by means of an Internet questionnaire during November and December 2007. Participants were recruited from Internet panels by a professional social research agency and were selected to be representative of the national population regarding age, gender and educational level. Of the 368 respondents, 51%

were women, 36% had a low educational level, 42% had a mid-educational level, and 21% had a high educational level. In the total sample, the mean age of participants was 44.17 years (*SD*=14.68).

The experiment had a 3 x 6 design with agri-food production method as the within-participant factor (organic farming, genetic modification, and conventional production methods) and provision of information was the between-participant factor (only benefit information, only risk information, first risk then benefit, first benefit then risk, no information, and no information with no measure of initial attitude). The last condition was added to provide insight in the effect of repeatedly assessing respondents' attitudes toward the different production methods (initial and post information provision), and was used to confirm the internal validity of the experimental results (partial Solomon design).

Materials

Risk and benefit information. Three food production methods were included in the study (organic farming, genetic modification, and conventional production methods) in order to ensure coverage of a broad and realistic spectrum of initial attitudes. All respondents received a short description of each production method (Appendix A). Information about risks and benefits to human health associated with the different food production methods was used to examine the impact of negative and positive information on post-information attitudes (Appendix B). Potatoes were used as the food product for all risk-benefit statements as it was assumed this is a fairly neutral product (i.e. people generally do not have strong attitudes towards potatoes), which most people consume. In addition, a single, relatively trustworthy, information source was used for all statements (i.e. 'scientists have shown...', Frewer, Howard, Hedderley, & Shepherd, 1996). A pretest (*N*=29) showed that the statements were perceived as realistic and understandable and that the risk and benefit information was balanced, i.e. that perceptions of the risks and benefits for the different production methods did not differ from each other (repeated measures ANOVA with perceptions of the risk and benefit information for each of the three production methods as repeated factor (six levels), $F(5, 140)=0.92$, $p=.47$, $\eta^2=0.03$).

Initial and post-information attitude. Initial attitudes towards the different production methods were measured with 4 items, 7-point semantic differential scales (extremely bad - extreme good, extremely unfavorable - extremely favorable, extremely undesirable - extremely desirable, and extremely inappropriate - extremely appropriate; Cronbach $\alpha=0.98$). Post-information attitude was measured with 4 other

items in order to reduce repetition and a reactivity effect (extremely dislikable - extremely likable, extremely disagreeable - extremely agreeable, extremely unsatisfactory - extremely satisfactorily, extremely negative - extremely positive; Cronbach α=0.99). In two pre-tests (N=41 and N=44), it was confirmed that the means on the two scales did not differ, $t(40)=-0.09$, $p=.93$ for initial and post-information attitudes towards the use of organic farming, $t(40)=-1.87$, $p=.07$ for initial and post-information attitudes towards the use of conventional production methods, and $t(43)=-0.45$, $p=.66$ for initial and post-information attitudes towards the use of genetic modification.

Perceived risk and benefit. Perceived risk and perceived benefit were measured with three items each that were rated on 7-point scales with endpoints labeled from 1 'very low' to 7 'very high'. Perceived risk and benefit were measured using the items "The risks [benefits] associated with the use of [production method] to me personally are …", "The risks [benefits] associated with the use of [production method] to the average British person are …", and "The risks [benefits] associated with the use of [production method] to British society are…" (Cronbach α=0.98 for both risk and benefit perception) (Frewer, Shepherd, & Sparks, 1994; Weinstein & Klein, 1995).

Procedure

Participants initially read a general introduction about the purpose of the study, namely to find out what consumers think about important issues surrounding food safety and the way foods are produced. Participants were then randomly allocated to one of the six information conditions (only benefit information, only risk information, first risk then benefit, first benefit then risk, no information, and no information with no measure of initial attitude). Next, all participants received a one-sentence general description of one of the three production methods, after which their attitude towards the production method was measured (with the exception of the control condition where initial attitudes were not assessed). This was repeated in random order for the remaining two production methods. Participants then received information about risks and/or benefits associated with one of the three production methods (except if assigned to one of the two no information conditions), which they were asked to read carefully before answering the questions which followed. After reading the information, participants' risk and benefit perceptions and post-information attitude was measured. This process was again repeated in random order for the remaining two production methods.

A computer-aided survey procedure was used to enable the random assignment of the between-participant information condition, as well as the randomization of the order of presenting the three production methods within participants. At the end of the experiment, respondents were asked to provide some demographic background information. Following their participation in the experiment, participants received a small reward from the social research agency in the form of "credits" that could be saved towards a gift coupon.

Analysis

The impact of *provision of information* and *initial attitudes* on post-information attitudes was analyzed with a mixed linear model[1]. The between-subject factor, i.e. information provision, was included as a fixed factor with four levels (risk only; benefit only; balanced risk and benefit; no information), combining the two balanced conditions and excluding the condition that did not include a measure of initial attitude. Initial attitude was entered as a continuous variable (centered on its grand mean). The within-subject factor, i.e. food production method, was entered as repeated factor. By including food production method as a repeated factor, the model recognizes that measures of initial attitudes toward each production method are correlated within respondents, eliminating the participant effect and leaving only the variance between production methods, which was the focus of this investigation. The model included the main effects and the interaction effect between information provision and initial attitudes (see Aiken & West, 1991 for testing and interpreting interaction effects with continuous variables). In the analyses, the effects of the information conditions in which information was provided to respondents on post-information attitudes were compared against the no information condition to rule out the effect of regression to the mean. Similar analyses were conducted with perceptions of risks and benefits as dependent variables.

6.2.2 Results

Manipulation Checks

To confirm that participants' attitudes towards the selected attitude objects reflected a range of attitudes (negative, neutral, positive), the distribution of initial attitude ratings

[1] A property of the mixed linear analysis is that the amount of degrees of freedom are estimated, as a result of which the amount can deviate from the amount of degrees of freedom that would apply in an ANOVA.

across the three production methods was assessed. The selection of food production methods resulted in a broad range of initial attitudes, with 30% of the initial attitude ratings between 1.00 and 3.00 (very negative to negative), 36% of the initial attitude ratings between 3.00 and 5.00 (neutral), and 34% between 5.00 and 7.00 (positive to very positive).

Initial attitudes significantly differed between the three technologies (repeated measures ANOVA with initial attitude for each production method as repeated factor (three levels), $F(1.97, 601.33)=304.40$, $p<.001$, with Huynh-Feldt correction). As expected, attitudes toward organic farming were relatively positive, attitudes toward genetic engineering were relatively negative, and attitudes toward conventional production methods were relatively neutral (Table 6.2).

Table 6.2 Attitude means and standard errors for the different production technologies (n=307)

Production technology	Attitude	
	M [a]	*SE*
Genetic engineering	2.66	0.09
Conventional production	4.70	0.09
Organic farming	5.58	0.08

[a] All differences are significant at $p<.001$

Regarding the two control conditions, where no information was provided, no significant differences were found between the mean scores of attitude depending on whether initial attitudes were measured or not, $F(1, 361)=0.38$, $p=.54$. This supports the validity of the procedure to the extent that measuring initial attitudes did not have an effect on post-information attitude ratings. From this point in the analysis, the condition in which initial attitudes were not assessed is omitted.

The two balanced information conditions in which risk information was presented, either first or last, were combined in subsequent analyses, since the conditions did not differ significantly on post-information attitude, $F(1, 123)=0.02$, $p=0.88$, risk perception, $F(1, 121)=0.04$, $p=0.84$, and benefit perception, $F(1, 124)=0.61$, $p=0.44$, ruling out possible order effects.

Post-information Attitude

Impact of information. A significant main effect for information provision on post-information attitudes was identified, $F(3, 303)=15.32$, $p<.001$[1]. Compared to the condition in which no information was given, attitudes were more positive after

unbalanced information about benefits (B=0.40, p=.001), and more negative after unbalanced information about risks (B=-0.40, p=.001) had been provided. Post-information attitudes measured after balanced information provision was provided were not different from post-information attitudes after no information provision (B=0.07, p=.49), indicating that risk information did not have a dominant impact over benefit information in the balanced information condition (Table 6.3).

The moderating role of initial attitudes on the impact of information. Although post-information attitudes were positively related to initial attitudes, $F(1, 647)=1152.97$, $p<.001$, no evidence was found for the assumed moderating role of initial attitudes on the impact of information on post-information attitudes, $F(3, 643)=0.80$, $p=.50$. That is, no evidence was found for the hypothesized incongruency effect, in which attitude-incongruent information was expected to have a higher impact on post-information attitudes compared to attitude-congruent information.

Table 6.3 Impact of information provision (*B*) on post-information attitudes and risk and benefit perceptions for different initial attitude levels

Information provision	Initial attitude	Post-information attitude		Risk perception		Benefit perception	
		B	*SE*	*B*	*SE*	*B*	*SE*
Risk only	Mean	-0.40*	0.12	0.55*	0.20	-0.80*	0.16
Benefit only	Mean	0.40*	0.11	-0.26	0.20	0.35*	0.16
	Positive [a, c]			0.04	0.24		
	Negative [b, c]			-0.55*	0.24		
Balanced info	Mean	0.07	0.10	0.46*	0.17	-0.04	0.14
	Positive [a, c]			0.80*	0.20		
	Negative [b, c]			0.11	0.22		

* Significantly different from the no information condition at $p<.05$

[a] 1 *SD* above the overall mean

[b] 1 *SD* below the overall mean

[c] Only reported for significant interaction between information provision condition and initial attitude

Risk and Benefit Perceptions

Impact of information. The results indicate a significant main effect of information provision on perceptions of risk, $F(3, 297)=8.58$, $p<.001$, and benefit, $F(3, 304)=18.79$, $p<.001$. Compared to the condition in which no information was given, risk perceptions were higher after provision of risk information, whether alone

(B=0.55, p<.05) or in combination with benefit information (B=0.46, p<.05), see Table 6.3. Provision of unbalanced benefit information, on the other hand, did not affect risk perceptions, as perceptions of risk did not differ from the condition where no information was given (B=-0.26, p=.19).

In the case of benefit perceptions, it was found that benefit perceptions were lower after unbalanced information about risks (B=-0.80, p<.001), and higher after unbalanced information about benefits (B=0.35, p<.05) had been provided, compared to the condition in which no information was provided (Table 6.3). Benefit perceptions after balanced information provision were not different from benefit perceptions following no information provision (B=-0.04, p=.76).

The moderating role of initial attitudes on the impact of information. The main effects of initial attitude indicate that positive initial attitudes were associated with lower perceived risk, F(1, 592)=384.98, p<.001, and higher perceived benefits, F(1, 602)=491.24, p<.001.

A significant interaction effect between information provision and initial attitude on risk perception was observed, F(3, 589)=2.98, p<.05, indicating that initial attitudes were less predictive of risk perceptions when information was provided. Further probing of this interaction effect showed that initial attitudes did not moderate the incremental effect of provision of unbalanced risk information on risk perceptions (B=0.10, p=.22), but that initial attitudes did moderate the impact of provision of unbalanced benefit information and balanced information provision. Providing unbalanced benefit information decreased risk perceptions for people with a negative (-1 *SD*) initial attitude (B=-0.55, p<.05), whereas providing unbalanced benefit information had no impact on risk perceptions for people with a positive (+1 *SD*) initial attitude (B=0.04, p=.87), see Table 3. In addition, the main effect of balanced information provision on risk perceptions shows that, on average, risk perceptions were higher after *balanced* information provision. However, the interaction effect shows that this was only the case for people who held a positive (+1 *SD*) initial attitude (B=0.80, p<.001), whereas balanced information had no impact on risk perceptions for people with a negative (-1 *SD*) initial attitude (B=0.11, p=.61).

In the case of benefit perceptions, the interaction effect between information provision and initial attitude was not significant, F(3, 598)=0.70, p=.55.

These results provide partial support for the incongruency hypothesis. Unbalanced benefit information reduced risk perceptions only for people with negative initial attitudes (positivity effect), and people's risk perceptions were

influenced more by the risk component of balanced information when their initial attitude was more positive (negativity effect).

6.2.3 Discussion Experiment 1

Whereas providing unbalanced risk or benefit information influenced the formation of post-information attitudes, providing balanced information did not differ from the effect of no information on post-information attitudes. Contrary to what would be predicted by the negativity bias, these results indicate that negative information included in a balanced message did not have a dominant impact on post-information attitudes. In addition, it was found that initial attitudes influenced post-information attitudes but that, contrary to the hypothesized incongruency effect, initial attitudes did not influence the impact of information on post-information attitudes. No evidence was found for negativity or a positivity effect depending on existing attitudes.

Effectively, providing balanced risk-benefit information made no difference to post-information attitudes. Risk perceptions, on the other hand, were affected differentially by balanced risk-benefit information depending on peoples' existing attitudes. Partly in accordance with the attitude incongruency effect, these results suggest that (only) people with more positive attitudes relied on risk information more than on benefit information in the formation of risk perceptions.

The results provide only partial support of the hypothesis that existing attitudes influence the relative impact of risk and benefit information. The balanced information provided in the current study may have been relatively easy to process in terms of risk and benefit comparisons, insomuch as risks and benefits included in the experiment were both related to the domain of human health. Therefore, the information may have been relatively easy to ignore during the formation of post-information attitudes and perceptions. For example, after reading the information about risks and benefits related to the agri-food production method under consideration, respondents may have thought that the production method might be both good and bad for their health, concluded that it does not really matter, and subsequently ignored the information in the formation of their post-information attitudes. However, when the positive and negative information concerns different domains (e.g. health and the environment), it may become more difficult to compare the information directly, and subsequently to discount it as irrelevant, because the positive and negative information is valued on different attribute dimensions. When

information is less easy to compare and to subsequently discount, an incongruency effect may be more likely to occur.

In order to examine whether an incongruency effect occurs when the information is less easily comparable and less likely to be discounted, positive and negative information related to different domains were used in the second experiment.

6.3 Experiment 2

Experiment 2 focused on balanced risk-benefit information that concerned different domains (health and the environment), and did not include unbalanced risk or benefit information conditions. Balanced information related to different domains may be less easily compared and subsequently discounted. For this reason, it was hypothesized that attitude-incongruent information would impact on post-information attitudes and risk and benefit perceptions to a greater extent than attitude-congruent information.

6.3.1 Method

Participants and Design

Participants were again selected to be representative of the national population of the United Kingdom regarding age, gender and educational level. Recruitment of participants was similar to that of experiment 1. Data were collected during January 2008. Participants who took part in experiment 1 were not invited to participate in experiment 2. Of the 311 respondents, 53% were women, 38% had a low educational level, 40 % had a mid-educational level, and 22% had a high educational level. In the total sample, the mean age of participants was 43.24 years (*SD*=13.62).

The experiment had a 3 x 3 design using the same food production methods as in experiment 1(organic farming, genetic modification, and conventional production methods) to ensure the same broad variance in initial attitude. Production method was a within-participant factor, and provision of information (health risk-environmental benefit [H-E+], health benefit-environmental risk [H+E-], and no information) was the between-participant factor.

Materials

Risk and benefit information. The information about the risks and benefits for human health associated with the three production methods was identical to that used in

experiment 1. Statements concerning risks and benefits for the environment associated with each production method were developed (Appendix B), and found to be realistic and understandable. Perceptions of the statements in terms of perceived risk and benefit associated with the information for health and the environment did not differ from each other for each of the production methods (repeated measures ANOVA with perceptions of the risk and benefit information for the statements of each production method as repeated factor (four levels), $F(3, 42)=1.15$, $p=.34$, $\eta^{2}=0.08$ for organic farming; $F(2.27, 29.55)=0.81$, $p=.47$, $\eta^{2}=0.06$, with Huynh-Feldt correction for genetic modification; and $F(1.84, 25.69)=1.27$, $p=.30$, $\eta^{2}=0.08$, with Huynh-Feldt correction for conventional production methods).

Measures. Initial (Cronbach $\alpha=0.96$) and post-information attitudes (Cronbach $\alpha=0.97$) were measured with different 8-item unipolar semantic differential scales (for example: extremely good - not at all good; extremely bad - not at all bad) based on the 4-item bipolar scales of experiment 1. Perceptions of risks (Cronbach $\alpha=0.98$) and benefits (Cronbach $\alpha=0.96$) were measured with the same scales as in experiment 1.

Procedure

Participants were randomly assigned to one of the three information provision conditions; health risk-environmental benefit (H-E+), health benefit-environmental risk (H+E-), or no information. The order of the risk and benefit information in the two information conditions was randomly varied to counter for order effects. The procedure was otherwise identical to experiment 1.

Analysis

Analyses were the same as in experiment 1, with information provision as the between-subject factor and initial attitude as continuous variable. The models included all main effects and the interaction effect between initial attitude and information provision.

6.3.2 Results

Manipulation Check

The food production methods again resulted in a broad range of initial attitudes, with 21% of the initial attitude ratings between 1.00 and 3.00 (very negative to negative), 45% of the initial attitude ratings between 3.00 and 5.00 (neutral), and 34% between 5.00 and 7.00 (positive to very positive).

Post-information Attitude

Impact of information. There was no main effect of information provision on post-information attitudes, $F(2, 306)=0.08$, $p=.93$. Post-information attitudes in both experimental conditions did not differ from the control condition ($B_{H+E-}=-0.03$, $p=.71$ and $B_{H-E+}=-0.03$, $p=.75$). The two balanced information conditions in which the domain of the risk and benefit information differed (i.e. H-E+ and H+E-) did not differentially influence post-information attitudes ($B=0.01$, $p=.95$), ruling out possible domain effects. While these results indicate that, on average, risk and benefit information did not differentially impact the formation of post-information attitudes, this effect was dependent on initial attitudes.

The moderating role of initial attitudes on the impact of information. Although post-information attitudes were positively related to initial attitudes, $F(1, 683)=1561.28$, $p<.001$), the interaction effect between initial attitudes and information provision shows that this relation was less strong for both experimental conditions ($B_{H+E-}=-0.17$, $p<.05$ and $B_{H-E+}=-0.14$, $p<.05$) compared to the control condition, $F(2, 679)=5.61$, $p<.05$. Further probing of this interaction effect indicates that this was due to post-information attitudes becoming more moderate after information provision. That is, compared to the condition where no information was provided, positive attitudes (+1 *SD*) became less positive ($B_{H+E-}=-0.32$, $p<.05$ and $B_{H-E+}=-0.27$, $p<.05$) and negative attitudes (-1 *SD*) became (marginally) less negative ($B_{H+E-}=0.26$, $p<.05$ and $B_{H-E+}=0.22$, $p=.08$) following balanced information provision (Table 6.4). These results are in accordance with the predicted incongruency effect.

The relation between initial and post-information attitudes did not differ between the two experimental conditions ($B=0.03$, $p=.50$), indicating that the moderating role of initial attitudes on the impact of information on post-information attitudes did not depend on the domain of the risk or benefit information.

Table 6.4 Impact of information provision (*B*) on post-information attitudes and risk and benefit perceptions for different initial attitude levels

Information provision	Initial attitude	Post-information attitude		Risk perception		Benefit perception	
		B	*SE*	*B*	*SE*	*B*	*SE*
Health +	Mean	-0.03	0.08	0.29	0.14	-0.04	0.12
Envi -	Positive [a]	-0.32*	0.12	0.63*	0.17	-0.42*	0.16
	Negative [b]	0.26*	0.12	-0.05	0.19	0.34*	0.17
Health -	Mean	-0.03	0.08	0.25	0.14	-0.14	0.12
Envi +	Positive [a]	-0.27*	0.12	0.53*	0.17	-0.64*	0.16
	Negative [b]	0.22*	0.12	-0.02	0.18	0.35*	0.17

* Significantly different from the no information condition at $p<.05$

[a] 1 *SD* above the overall mean

[b] 1 *SD* below the overall mean

Risk and Benefit Perceptions

Impact of information. Provision of balanced risk benefit information did not influence perceptions of risk, $F(2, 309)=2.36$, $p=.10$, and benefit, $F(2, 309)=0.94$, $p=.39$. Risk and benefit perceptions in both experimental conditions did not differ from the control condition, indicating that, on average, providing risk and benefit information did not influence risk and benefit perceptions (Table 6.4). However, as will be discussed below, this again was dependent on initial attitudes. The domain of the risk or benefit information did not differentially influence risk and benefit perceptions (B=-0.04, $p=.75$ for risk perception and B=-0.10, $p=.28$ for benefit perception).

The moderating role of initial attitudes on the impact of information. The main effects of initial attitude indicate that positive attitudes are associated with lower perceived risk, $F(1, 674)=542.96$, $p<.001$, and higher perceived benefits, $F(1, 738)=578.86$, $p<.001$. Significant interaction effects were found between initial attitudes and information provision for both and risk perception, $F(2, 670)=4.80$, $p<.05$, and benefit perception, $F(2, 729)=10.00$, $p<.001$. These results indicate that initial attitudes became less predictive of perceptions of risk ($B_{H+E-}=0.20$, $p<.001$ and $B_{H-E+=}0.16$, $p<.05$) and benefit ($B_{H+E-}=-0.23$, $p=.001$ and $B_{H-E+=}-0.30$, $p<.001$) when balanced information was provided compared to when no information was provided.

Partially in accordance with the incongruency effect, it was found that risk perceptions were *higher* after information provision for people with a positive (+1 *SD*) initial attitude ($B_{H+E-}=0.63$, $p<.001$ and $B_{H-E+=}0.53$, $p<.05$), whereas information had

no impact on risk perceptions for people with a negative (-1 SD) initial attitude ($B_{H+E-=}$-0.05, p=.78 and $B_{H-E+=}$-0.02, p=.92) compared to the condition in which no information was given. Also in accordance with the incongruency effect, benefit perceptions, compared to the condition in which no information was provided, were *lower* after balanced information provision for people with a positive (+1 *SD*) initial attitude (B_{H+E-}=-0.42, p<.05 and $B_{H-E+=}$-0.64, p<.001), and *higher* for people with a negative (-1 *SD*) initial attitude ($B_{H+E-=}$0.34, p<.05 and $B_{H-E+=}$0.35, p<.05), see Table 4.

The relation between initial attitudes and risk and benefit perceptions did not differ between the two experimental conditions (B=-.04, p=.43 and B=-.07, p=.20, respectively), indicating that the moderating role of initial attitudes on the impact of information on risk and benefit perceptions did not depend on the domain of the risk or benefit information.

6.3.3 Discussion Experiment 2

The impact of balanced information related to different impact domains on post-information attitudes was dependent on initial attitudes. Whereas post-information attitudes, on average, did not differ depending on whether information was provided or not, information provision had a negative impact on post-information attitudes for people with positive initial attitudes, and a positive impact on post-information attitudes for people with negative initial attitudes. It is shown that negative information (i.e. the risk component of the information) had a dominant influence on post-information attitudes only for people with positive initial attitudes, whereas positive information (i.e. the benefit component of the information) was dominant for people with negative initial attitudes towards the attitude object. This effect was independent of the domain of the attitude-incongruent information. These results suggest that attitude-incongruent information was used more in the formation of post-information attitudes than attitude-congruent information. Additional support for the differential use of attitude-incongruent information was provided by the effects observed for perceived risk and benefit, where attitude-incongruent information was also generally more influential.

By comparing the impact of information provision for people with more positive or negative attitudes against a no-information control condition, regression to the mean, i.e. a statistical phenomena that makes it likely that extreme scores initial to the intervention will move towards the mean on post intervention measures (De Vaus,

2001), is ruled out. Although results of the current study show a shift to the mean (i.e. positive attitudes become less positive, negative attitudes become less negative), this effect is assessed in comparison to people with extreme scores that received no information. Therefore the effects actually result from the additional effects of information provision and cannot be attributed to regression to the mean as a result of increased error in extreme observations.

Whereas results from the first experiment indicated that balanced positive and negative information related to the same domain had no impact on the formation of post-information attitudes when presented in one message, the results from the second experiment suggest that an incongruency effect may occur when the positive and negative information is related to different domains. Although not measured directly, these results suggest that positive and negative information related to different domains may be less easily compared and subsequently ignored as irrelevant in the formation of post-information attitudes compared to positive and negative information related to the same domain and presented in one message. However, some of the positive findings in experiment 2 could also be attributed to a possible increase in statistical power in experiment 2, due to more participants being exposed to the balanced information compared to experiment 1. Future research should be designed to explore whether the domain difference is fundamental to the impact of balanced information on attitude change.

6.4 General discussion

Relevant interactions between existing attitudes and the provision of balanced positive (benefit) and negative (risk) information on post-information attitudes towards different food production methods were identified. Whereas both unbalanced positive and negative information were used in the formation of post-information attitudes, the impact of balanced information on post-information attitudes appeared to be dependent on initial attitudes (experiment 2).

The results contextualize the negativity bias reported in previous research. In accordance with the negativity bias, people with initial positive attitudes were influenced more by negative information than by positive information. In contrast to this, people with initial negative attitudes showed a positivity effect after balanced information provision. The implication is that communication of balanced positive and negative information may differentially affect people with positive and negative existing attitudes. Further research is needed to examine incongruency effects

after the provision of mixed positive and negative information that is unbalanced (for example, information which suggests that risks are greater than benefits). This could provide insights into whether the incongruency effects found in the current study are a result of the presence of both positive and negative information, or whether the effects are limited to the communication of *balanced* positive and negative information.

Regarding the processes underlying the incongruency effects, the results are open to alternative interpretations that can only be addressed by further research. For example, the findings align with novelty theory, which suggests that attitude-incongruent information may have more impact in the formation of post-information attitudes due to the increased informative value of this information as a result of *expectancy disconfirmation* (Fiske, 1980).

The increased impact of attitude-incongruent information on post-information attitudes may also be due to increased informational value as a result of the *newness* of the information (a view consistent with information integration theory proposed by Anderson, 1971), rather than the unexpectedness of the information. As it can be argued that people are less likely to have been exposed to attitude-incongruent information in the formation of their existing attitudes, attitude-incongruent information is inherently more likely to be new, and therefore more informative, than attitude-congruent information. In addition, new information or arguments may have more impact on post-information attitudes than information which is familiar to people, because this information may receive more attention and more elaborative cognitive processing (see Petty, Wegener, & Fabrigar, 1997), which may result in a higher impact of attitude-incongruent information.

A third explanation for the increased impact of attitude-incongruent information is based on social judgment theory. That is, initial attitudes may have influenced *perceptions* of the positivity or negativity of the information (Sherif & Sherif, 1967). Although the positive and negative information in the current study was balanced in pretests, initial attitudes were not taken into account. As a result, perceptions of the positive and negative information may have been balanced *on average*, but the information may have been perceived differently by people with more positive or negative attitudes due to contrasting the information with existing attitudes. Such differences in perception may have lead to an increased impact of attitude-incongruent information. However, future research might usefully include a manipulation check to ensure balanced information is indeed perceived as balanced.

This study also seems to indicate that one of the elements determining the attitude incongruency effects may be related to the *complexity of the comparison* of information. Where information in a single (health) domain did not result in post-information attitude effects (but showed indications for an effect for risk perception), providing the information about two domains (health and environment) resulted in the effects in all relevant post-information attitudes (attitude, risk perception and benefit perception). It can be speculated that ease of information processing in the case of the single health domain (experiment 1) may have suppressed the effect sizes by allowing the participant to conduct simple comparisons between the positive and negative information and subsequently ignore the information before integrating either part of the information into post-information attitudes. For more complex comparisons (for example, between health and environment), a different strategy of information processing may be triggered.

Further research is needed to provide better insights into how information processing may mediate the different effects of balanced information provision, and whether incongruency effects are due to expectancy disconfirmation, newness of the information, or biased perception initial to cognitive elaboration on the information. Further research could usefully include information processing measures, such as a thought listing task and reading time, in order to provide information relevant to understanding the processes underlying the incongruency effects.

Whereas the current study found an attitude-*incongruent* impact of information on post-information attitudes, previous research has shown that people frequently process information in an attitude-*congruent* way (Ajzen, 2001), which may lead to attitude polarization (e.g. Eagly & Chaiken, 1993; Lord, Ross, & Lepper, 1979; Pomerantz, Chaiken, & Tordesillas, 1995). Research has also shown that this confirmation bias is greatest for strong attitudes (Brannon, Tagler, & Eagly, 2007; Pomerantz, Chaiken, & Tordesillas, 1995). An explanation proposed for the confirmation bias is that individuals are motivated toward reinforcing important self-related beliefs and attitudes, i.e. a defense motivation (Chaiken, Giner-Sorolla, & Chen, 1996). Possible reasons why such confirmation effects are not found in the current study are that existing attitudes may have been less strong than in some of the confirmation bias research, and that an accuracy motivation may have been more dominant in these experiments. Research by Ahluwalia (2002) on the weight given to positive and negative information in evaluating brands has shown that people with a positive attitude showed a negativity effect under conditions of accuracy motivation, but a positivity bias under conditions of defense motivation. In addition, accuracy

motivated people elicited more support arguments for the negative information and more counterarguments for the positive information. These results indicate that accuracy motivation may lead to attitude-incongruent information processing and subsequent increased impact of incongruent information, whereas defense motivation may lead to attitude-congruent information processing and subsequent increased impact of congruent information. Hence, future research is needed to determine whether the attitude-incongruent effects of balanced information shown in this paper are dependent on the motivation of the individual participant.

The current paper amends the established negativity bias literature by showing that this negativity bias is dominant for people with initial positive attitudes, but changes into a positivity effect for people with initial negative attitudes towards the attitude object.

APPENDIX A

Description of production methods

Production method	Description
Organic farming	Organic farming is a way to produce foods using only natural protective agents and fertilizer, and restricted use of additives. [a]
Genetic modification	Genetic modification is a way to change certain properties of a plant by transferring genetic material from one organism to another. [b]
Conventional production methods	Conventional production is a way to produce food products using modern farming methods such as synthetic (i.e., man-made) pesticides and fertilizer, and is currently applied to most agriculture. [c]

[a] Voedingscentrum (2007); [b] Magnusson & Koivisto Hursti (2002); [c] Williams & Hammitt (2001)

APPENDIX B

Statements used for describing risks and benefits to human health and the environment associated with organic farming and genetic modification

Risk / benefit	Health / environment [a]	Statement
		Organic farming
Risk	Health	Scientists have shown that organically grown potatoes have potential health risks in terms of increased levels of natural poisons from moulds.
	Environment	Scientists have shown that organically grown potatoes have potential environmental risks in terms of increased vulnerability to diseases in nearby plant-life due to limited treatment of plant diseases.
Benefit	Health	Scientists have shown that organically grown potatoes have potential health benefits in terms of increased nutritional value.
	Environment	Scientists have shown that organically grown potatoes have potential environmental benefits in terms of reduced CO2 emissions.
		Genetic modification
Risk	Health	Scientists have shown that the use of genetic modification in potatoes has potential health risks in terms of reduced effectiveness of antibiotics.
	Environment	Scientists have shown that the use of genetic modification in potatoes has potential environmental risks in terms of creating multi-resistant plants.
Benefit	Health	Scientists have shown that the use of genetic modification in potatoes has potential health benefits in terms of providing increased levels of certain minerals.
	Environment	Scientists have shown that the use of genetic modification in potatoes has potential environmental benefits in terms of reduced need for herbicides.

[a] Environment items were only used in experiment 2

APPENDIX B (continued)

Statements used for describing risks and benefits to human health and the environment associated with conventional production methods

Risk / benefit	Health / environment [a]	Statement
		Conventional production methods
Risk	Health	Scientists have shown that conventional methods to grow potatoes have potential human health risks in terms of pesticide residues.
	Environment	Scientists have shown that conventional methods to grow potatoes have potential environmental risks in terms of reduced diversity in nature due to mono-culture.
Benefit	Health	Scientists have shown that conventional methods to grow potatoes have potential human health benefits in terms of providing constant quality.
	Environment	Scientists have shown that conventional methods to grow potatoes have potential environmental benefits in terms of strictly controlled and optimized production methods.

[a] Environment items were only used in experiment 2

7

CONSUMER RESPONSES TO COMMUNICATION ABOUT FOOD RISK MANAGEMENT

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ABSTRACT

Recent emphasis within policy circles has been on transparent communication with consumers about food risk management decisions and practices. As a consequence, it is important to develop best practice regarding communication with the public about how food risks are managed. In the current study, the provision of information about regulatory enforcement, proactive risk management, scientific uncertainty and risk variability were manipulated in an experiment designed to examine their impact on consumer perceptions of food risk management quality. In order to compare consumer reactions across different cases, three food hazards were selected (mycotoxins on organically grown food, pesticide residues, and a genetically modified potato). Data were collected from representative samples of consumers in Germany, Greece, Norway and the UK. Scores on the "perceived food risk management quality" scale were subjected to a repeated-measures mixed linear model. Analysis points to a number of important findings, including the existence of cultural variation regarding the impact of risk communication strategies - something which has obvious implications for pan-European risk communication approaches. For example, while communication of uncertainty had a positive impact in Germany, it had a negative impact in the UK and Norway. Results also indicate that food risk managers should inform the public about enforcement of safety laws when communicating scientific uncertainty associated with risks. This has implications for the coordination of risk communication strategies between risk assessment and risk management organizations.

7.1 Introduction

There has been recent emphasis within policy circles regarding the need to implement open and transparent communication with consumers about food safety policy procedures and decision making practices (Byrne, 2002; FSA, 2002; Millstone & Van Zwanenberg, 2002). As a consequence, it has become increasingly important to ascertain the best ways to communicate with the public about how food risks are *managed*, as well as about food safety problems *per se*. The importance of effective communication about food risks for facilitating informed decision making by consumers, as well as for changing consumers' health related behaviors, has been stressed by many authors (Fischer, de Jong, de Jonge, Frewer, & Nauta, 2005; Frewer, 2004b; Verbeke, 2005). However, while most research to date has focused on communicating the risks associated with specific hazards (Frewer, Scholderer, & Bredahl, 2003; Miles & Frewer, 2001; Slovic, 1986), there is a paucity of research on the communication of *risk management practices* (Houghton, Van Kleef, Rowe, & Frewer, 2006; Van Kleef et al., 2006). Communication about what is being done by food risk managers to protect consumers may be extremely relevant to societal responses to existing and emerging food risks, as well as generating trust among consumers in the process and practice of risk analysis.

As a result of increased attention to increase transparency in the risk analysis process, risk management practices and decisions have become open to public scrutiny (Wales, 2004). Previous research has identified circumstances under which the public may approve institutional activities focused on consumer protection. For example, enforcement of safety regulations and efforts directed towards prevention have been shown to be important for consumer perceptions of effective food risk management (Van Kleef et al., 2006; Van Kleef et al., 2007). It might be supposed, therefore, that effective risk communication should not only include information about the risks associated with different food hazards, but also what is being done by risk managers in order to mitigate these risks.

Other important factors that may influence consumers' understanding of risk communication are *scientific uncertainty* and *risk variability* associated with risks and risk assessment procedures (Thompson, 2002), and how these concepts are incorporated in risk management decisions and practices. Scientific uncertainty and risk variability are inherent in risk assessment, but may not have been explicitly communicated to the public. Making risk analysis transparent means that both uncertainty and population level vulnerabilities to the risks of different hazards become open to public scrutiny

(Frewer, 2004a; Millstone & Van Zwanenberg, 2002; Shepherd et al., 2006). As a consequence, it becomes increasingly important to also examine how uncertainty and variability should be communicated to the public, and how targeted communication might most effectively meet the needs of society – and in particular, of vulnerable groups.

The objective of the present study is to examine the impact of information about food risks and risk management practices on consumer perceptions of food risk management quality. More specifically, the effects of communicating about various factors shown in previous research to be related to consumer perceptions of food risk management quality are compared, namely: (1) information about regulatory enforcement, (2) information regarding authorities' efforts directed towards prevention, (3) communication of scientific uncertainty, and (4) communication of population level variability. In addition, different countries and potential food hazards are included in the study in order to assess the potential impacts of these factors across different hazard types and cultures. An investigation of potential differences and similarities in consumer preferences for risk management strategies across hazards and countries can provide useful insights for whether there need to be general or specific guidelines for the communication about food risk management.

In the following sections we present the rationale for selecting the communication factors (regulatory enforcement, preventive measures, scientific uncertainty and risk variability) used in this study. We then provide details of the design of the study and data analysis approach, before documenting the results and discussing the implications of our findings.

7.1.1 Regulatory enforcement

As defined by the FAO/WHO (1997), the primary goal of food risk management is the protection of public health by controlling risks as effectively as possible through the selection and implementation of appropriate measures. This concept is also important for consumers, as it is related to perceptions of effective food risk management. For example, consumer participants in a series of focus groups regarded food risks as well managed when they perceived measures for controlling food risks, such as the strict enforcement of safety laws and regulations, were in place (Houghton, Van Kleef, Rowe, & Frewer, 2006; Van Kleef et al., 2006). Providing information about selected measures for controlling food risks by responsible authorities is likely to increase perceptions of control, which in turn may decrease risk

perceptions (Fischhoff, Slovic, Lichtenstein, Read, & Combs, 1978; Redmond & Griffith, 2004). However, consumers also indicated a degree of uncertainty and skepticism about the conduct of inspections and the enforcement of legislation, and who might be the responsible agents (Houghton, Van Kleef, Rowe, & Frewer, 2006). For example, Worsfold (2006) reported that easily accessible information about hygiene inspections of food premises are highly appreciated by consumers. An example of such easily accessible information is the "Smiley system" in Denmark, where results of public food inspections are displayed in all places where food products are sold. The results of the hygiene inspections are illustrated by smiley figure stickers with different facial expressions (Nielsen, 2006). It appears that information about the enforcement of safety laws and regulations can offer reassurance that food safety is being monitored. Based on the evidence from these previous studies, it is hypothesized that information about strict enforcement of safety laws and regulations will increase perceptions of food risk management quality.

7.1.2 Preventative risk management activities on the part of the authorities

The second factor examined in this study was the impact of information regarding *preventative* risk management activities on the part of the authorities. Whilst strict enforcement of safety laws and regulations *could* be perceived as a preventive risk management activity, for example when safety inspections are frequently conducted, this could also be perceived as a more reactive approach, as when fines are imposed following discovery of a violation. Research has suggested that consumers prefer regulatory authorities with responsibility for consumer protection to direct their efforts towards preventing the occurrence of a food safety incident, as opposed to managing risks through adoption of a reactive approach, and consider this approach more indicative of good management (Van Kleef et al., 2006). For example, consumers expressed the opinion that, whilst a lot can be done by risk managers to prevent exposure to high levels of pesticide residues via food, health risks associated with pesticide residues on food were perceived to be poorly managed by some consumers because they believed that financial interests and powerful lobbies prevent the authorities from making greater efforts to prevent exposure (Houghton, Van Kleef, Rowe, & Frewer, 2006). In a similar vein, after an incident in 2005 in Greece where high levels of carcinogenic paradichlorobenzene (PDB) were found in honey, consumers questioned why the authorities allowed the distribution of this product, which is used to clean honeycomb used in honey production, that is, they were

concerned that the authorities didn't check the safety of the product before consumers were exposed to the risks (Theodoridis, personal communication; data summarized in Van Kleef et al., 2007). These examples illustrate that consumers conceptualize proactive and reactive risk management activities as qualitatively different. Hence, it is predicted that information about authorities' efforts directed towards preventing the occurrence of an incident should increase perceptions of food risk management quality relative to information about efforts directed towards mitigating the risk after an incident has occurred.

7.1.3 Communication of scientific uncertainty

A third factor that was manipulated in this study was the communication of *scientific uncertainty* to the public. Scientific uncertainty refers to the extent the probability of the occurrence of a potentially hazardous event is understood (Hoffman & Hammonds, 1994), and is increasingly identifiable as probabilistic risk assessment techniques are adopted by risk assessors and end-users (Vose, 1996) . Although scientific experts often believe that providing information about scientific uncertainty to the general public will increase distrust in scientific institutions, and will cause panic and confusion regarding the extent and impact of a particular hazard (Frewer et al., 2003), consumers report they prefer information about existing uncertainties to be made available in an understandable way so that they can make an informed choice about different food hazards and food choices (Frewer et al., 2002; Shaw, 2004).

Communicating uncertainty in risk assessment is increasingly seen as highly relevant to ensure consumer confidence in regulatory institutions (Millstone & Van Zwanenberg, 2002; Shepherd et al., 2006). In the case of the BSE crisis in the UK, it has often been suggested that failure to communicate scientific uncertainty associated with the risks resulted in decreased trust in risk management processes and the regulatory institutions that control those processes (Frewer & Salter, 2002; Jensen, 2004; Millstone & Van Zwanenberg, 2002). While increased transparency in risk analysis is likely to increase public awareness of scientific uncertainty in risk assessment, consumer skepticism about food safety assessment and the uncertainties surrounding these issues can have a negative impact on perceptions of food risk management quality (Van Kleef et al., 2007). These results indicate the importance of effective communication of scientific uncertainty, where it exists, if consumer perceptions of food risk management quality are to be positive. However, research on the effect of uncertainty information on trust in risk managers has shown that agency

discussion of scientific uncertainty can increase perceptions of honesty, while simultaneously decreasing perceptions of agency competence or expertise (Johnson & Slovic, 1995). Information about risk uncertainty has also been shown to increase perceived risk in some instances (Johnson & Slovic, 1995; Miles & Frewer, 2003). The impact of communication about uncertainty on food risk management quality has not, to our knowledge, been evaluated. In the current study, the impact of communication of scientific uncertainty associated with food risks on consumer perceptions of food risk management quality is investigated, as well as whether any effects interact with information about additional food risk management practices, such as the enforcement of safety laws and authorities' efforts directed towards prevention. This may provide food risk managers with useful guidelines on how to communicate effectively with the public about scientific uncertainty.

7.1.4 Communication of risk variability

The last factor that was manipulated in this study is the communication of risk variability. In this study, the term risk variability refers to known differences in the population regarding vulnerability of certain groups of people. Communication of variability information to the public should facilitate informed decision making regarding food safety issues (Thompson, 2002). Several authors state that communications that succeed in making information individually relevant and appropriate will be more effective than those that do not (Brinol & Petty, 2006; Fischer, Frewer, & Nauta, 2006; Salaun & Flores, 2001; Verbeke, Vermeir, & Brunsø, 2007). In addition, as a risk for the entire population may be smaller than the risk for certain subgroups, failure to communicate risk variability may be misleading (Thompson, 2002). As a result of increased emphasis on transparency in risk management, it is expected that people will also become more aware of risk variability, and how this is incorporated in risk management decisions and practices (Frewer, 2004b). For example, consumers may become aware of which risk management practices are implemented to protect more vulnerable groups of people. In the current study the impact of communication of risk variability and associated risk management practices on consumer perceptions of food risk management quality is evaluated, together with an investigation of whether this interacts with communications about the factors previously discussed.

7.1.5 Potential variations with hazard type

Finally, consumer responses to communications about food risk management may vary with hazard type. Several studies have shown that different hazard types are related to qualitatively different perceptions of those hazards (Fife-Schaw & Rowe, 1996; Fischhoff, Slovic, Lichtenstein, Read, & Combs, 1978; McCarthy, Brennan, Ritson, & Boer, 2006; Miles & Frewer, 2001; Sparks & Shepherd, 1994). For example, there is substantial evidence in the literature that consumers evaluate risks which they perceive as natural as less threatening than those perceived as technological in origin (Fife-Schaw & Rowe, 1996; Fischhoff et al. , 1978; Slovic, 1987; Williams & Hammitt, 2001). For this reason we may expect that consumers perceive natural hazards as being better managed than technological hazards. In a similar vein, Miles and Frewer (2001) investigated public risk perceptions associated with different food hazards such as pesticide residues in food, BSE, genetic modification of food, Salmonella food poisoning, and high fat diets. They showed that consumers have specific concerns about different food hazards. For example, the primary concern about high fat diets was a health concern, such as weight gain and heart disease. Genetic modification was also related to concerns about health, such as the unknown long term consequences, but also to concerns about animal welfare and the environment, and about a lack of personal control over exposure, involuntary exposure, and profit coming before safety. The risks associated with pesticide residues in food were also associated with concerns about health and long term and unknown effects, but in addition there was increased concern for vulnerable groups. These different concerns related to different hazard types may influence consumer information needs (Miles & Frewer, 2001; Slovic, 1986) and responses to communication. For example, in another study by Miles and Frewer (2003) the authors argue that responses to uncertainty information are dependent on the type of hazard. In this research, uncertainty information tended to increase perceptions of risk for the hazards under societal control (GM food and pesticides), relative to other, personally controllable hazards (BSE, high fat diets and Salmonella). The authors suggest however, that further research is needed to empirically investigate the influence of type of food hazard on the impact of uncertainty information on risk perceptions. Since certain food hazards are inherently more uncertain than others however, communication of uncertainty may also be more important for positive evaluations of food risk management of these hazards, compared to hazards that are inherently less uncertain.

In the current study potential differences and similarities in consumer responses to communication about risk management practices across hazards is examined.

7.2 Method

7.2.1 Participant characteristics

Data were collected from nationally representative samples of consumers in Germany, Greece, Norway and the United Kingdom during the months June and July of 2006. The countries included in the current study were partly selected according to their different Hofstede values (Hofstede, 2001), to be culturally differentiated in terms of uncertainty avoidance and aversion to risk. For example, according to Hofstede values, consumers in the UK might be expected to exhibit low levels of uncertainty avoidance. Consumers in Greece are associated with high levels of uncertainty avoidance, whereas Germany and Norway are relatively undifferentiated in terms of uncertainty avoidance. All participants were recruited from Internet panels by a professional market research agency and were selected to be representative of the national population as a whole regarding age, gender and educational level (Table 7.1). Of the total of 7952 respondents, 51% were women, 49 % had a middle educational level, 28 % had a high educational level, and 24% had a low educational level. In the total sample, the mean age of participants was 43 years (SD=14).

7.2.2 Materials

Respondents read information scenarios consisting of general information about a food hazard followed by information about food risk management practices. Three potential food hazards were included in the study. These were mycotoxins found on organically grown food (a natural, emerging hazard), combined exposure to pesticide residues (a technological hazard), and a genetically modified potato (a technological hazard with an explicit health benefit). The general descriptions of the three food hazards represent ongoing research[1], and were developed in collaboration with experts in risk assessment in order to reflect "realistic" hazards being examined in the context of food safety.

[1] See Safefoods, www.safefoods.nl, accessed on 6th February 2006

Table 7.1 Characteristics of study participants

Characteristic	Germany (*n*=1796)	Greece (*n*=1604)	Norway (*n*=2273)	UK (*n*=2279)	Total sample (*n*=7952)
Gender					
Male	49.9 %	49.6 %	52.5 %	44.0 %	48.9 %
Female	50.1 %	50.4 %	47.5 %	56.0 %	51.1 %
Age (years)					
mean	45.2	39.9	43.5	43.6	43.2
SD	12.3	13.1	15.4	14.3	14.1
Educational level [a]					
Low	49.2 %	18.8 %	12.1 %	17.7 %	23.5 %
Middle	25.9 %	59.9 %	47.6 %	59.1 %	48.5 %
High	24.8 %	21.3 %	40.3 %	23.2 %	28.1 %

[a] Lower education level: Primary school and vocational education; middle education level: lower or higher secondary education, pre-university education, and intermediate vocational education; higher education level: university

Mycotoxins on organically grown food

Participants read the following information when presented with the risks associated with mycotoxins found on organically grown food;

Exposure to poisonous moulds on organically grown food

> The following text is about a food hazard which was under control, but has recently re-emerged as a result of new production systems. This food hazard is called mycotoxin contamination. Mycotoxins are poisonous substances that come from moulds that grow on vegetables and fruit. These moulds seem especially likely to be found on organically grown vegetables and fruit, because these products are not treated with pesticides. Food products can become infected with these moulds both on the field, and during storage. When levels of these poisonous moulds on organically grown food are high, this can decrease resistance of the immune system against common infectious diseases, like colds. In addition, the risk of cancer can increase.

Combined exposure to pesticide residues

The risks associated with exposure to a combination of pesticide residues were presented to participants as follows;

Exposure to a combination of pesticide residues

The following text is about a food hazard associated with exposure to a combination of pesticide residues *via* food. Pesticides are substances used for protecting fruits and vegetables from insects, weeds and moulds. They can have a poisonous effect in humans as well. Pesticide residues are found, for example, on cereals, vegetables and fruits. The different pesticides that are used in agriculture have been examined separately regarding their negative effects on human health. This research has shown that chronic exposure to pesticide residues *via* food can increase the risk of getting cancer. Therefore, safety standards have been determined regarding the amount of pesticide residues allowed on food. However, due to the wide variety of pesticides used in agriculture, the average consumer is simultaneously exposed to a combination of different pesticides. This can change the poisonous effects of the different pesticides inside the mixture. Simultaneous exposure to different pesticide residues could, for example, have an extra toxic effect on human health.

Risks associated with a genetically modified potato

And finally, participants read the following information about the risks associated with a genetically modified potato;

Vitamin A potato

The following text is about possible risks and benefits associated with a new genetically modified potato. This new potato has been genetically modified to contain higher levels of vitamin A. This has been achieved by transferring parts of the genetic material from a bacterium into the new potato. This high level of vitamin A can help decrease the risk of blindness, heart diseases and cancer. The health benefits of the vitamin A potato are especially relevant for people with a vitamin A deficiency, such as people with poor diets or people in developing countries who are malnourished. However, there is a risk that the amount of natural poisons, found in all potatoes, changes in the vitamin A potato as a result of the genetic modification. This could form a new risk for the environment and human health. When people eat too much of the vitamin A potato, the changed amount of natural poisons can cause headaches, nausea, vomiting or diarrhea. In addition, there is a risk that the vitamin A potato becomes more susceptible to plant diseases.

All respondents received the same general descriptions of the three food hazards. Each hazard description was followed by four statements manipulating factors related

to the provision of information about food risk management practices and food risks. The factors include (1) regulatory enforcement, (2) authorities' efforts directed towards prevention, (3) communication of scientific uncertainty, and (4) communication of risk variability. Each factor was manipulated with two statements (high and low), representing hypothetical communication efforts of food risk managers to the public (see Table 7.2).

7.2.3 Design and procedure

Consumers were asked to participate in completing an Internet based questionnaire. A computer-aided survey procedure was used to enable a random assignment of information scenarios for each participant. Each participant was presented with three information scenarios in total, one for each food hazard. It was decided not to expose participants to more than one scenario per hazard, because this might result in lower credibility of the information given that opposing messages could be potentially presented in the different scenarios, as well as inducing respondent fatigue. In addition, respondents received a different combination of randomly selected statements for each of the three hazards. The information scenarios were presented to participants in random order. The experimental design consisted of an incomplete blocks design with four within-subject factors with two levels each (high or low regulatory enforcement; high or low efforts directed towards prevention; high or low scientific uncertainty; high or low risk variability), one within-subject factor with three levels (hazard type: mycotoxins; pesticides; GM potato), and one between-subject factor with four levels (country: Germany; Greece; Norway; UK). After reading the information, participants were asked to answer a set of questions about their overall evaluation of food risk management quality for each case. Finally, respondents were asked to provide demographic information. At the end of the questionnaire, respondents were informed that the information they had read about the three food hazards had been hypothetical, and were given a link to a national governmental website with accurate information about the hazards described in the experiments. Following their participation in the experiment, participants received a small reward from the research agency in the form of points that respondents can save up for a gift coupon.

Table 7.2 Statements used for manipulating factors related to communication of food risk management practices and food risks

Factor	Level	Statement
Scientific uncertainty	Low	Scientists are certain that levels of pesticide residues on food *[organically grown food/ the vitamin A potato]* are safe for consumption, and that further research is not needed.
	High	Scientists believe that levels of pesticide residues on food *[organically grown food/ the vitamin A potato]* are safe for consumption, but they admit that they do not know everything and that further research is needed.
Risk variability	Low	Scientists believe that any risks associated with combined exposure to pesticide residues via food *[poisonous moulds on organically grown food/ the vitamin A potato]* are unlikely to affect some groups of people more than others. Consequently they are not focusing their research and communication efforts on any particular group of people.
	High	Scientists are aware that any risks associated with combined exposure to pesticide residues via food *[poisonous moulds on organically grown food/ the vitamin A potato]* are likely to affect some groups of people more than others. Consequently they are focusing their research and communication efforts on these groups of people.
Regulatory enforcement	Low	Safety laws to control levels of pesticide residues on food *[poisonous moulds on organically grown food/ Safety laws for the development of genetically modified food, like the vitamin A potato]* exist.
	High	Safety laws to control levels of pesticide residues on food *[poisonous moulds on organically grown food/ Safety laws for the development of genetically modified food, like the vitamin A potato]* are stringently enforced by the authorities.
Preventive risk management	Low	Authorities have considerable resources available to ensure that they are able to respond to any food safety *[or environmental]* incident that occurs from pesticide residues on food *[poisonous moulds on organically grown food/ the vitamin A potato]*.
	High	Authorities spend considerable resources in monitoring and researching pesticide residues on food *[poisonous moulds on organically grown food/ the vitamin A potato]* to ensure they will not lead to a food safety *[or environmental]* incident.

7.2.4 Measures

A multi-item measure was employed to assess participants' evaluation of food risk management quality (FRMQ), which was measured with three items taken from Van Kleef et al. (2007) and adapted to the specific hazards of interest in the present study. The items included "In this case, the risks associated with the vitamin A potato [combined exposure to pesticide residues via food/ poisonous moulds on organically grown food] are very well managed", "In this case, if I bought the vitamin A potato [organically grown food/ food that has been treated with pesticides], I would be certain that it is safe to eat", and "In this case, I trust the regulatory system to protect me from the risks associated with the vitamin A potato [combined exposure to pesticide residues via food/ poisonous moulds on organically grown food]". All items were answered by respondents on seven point rating scales, labelled from 1 "strongly disagree" to 7 "strongly agree".

The questionnaire, including the descriptions of the different hazards and the manipulations of FRM practices, was translated and back translated into the appropriate national language.

7.2.5 Pre-test

The general descriptions of the three food hazards and the statements for the factor levels were checked with a pre-test regarding their understandability, credibility, and whether they were perceived as being realistic (n=157). Respondents rated the hazard descriptions and statements on 5-point scales, ranging from 1 'not at all understandable/realistic/credible', to 5 'very understandable/realistic/credible'. Additionally, within the pre-test, the statements were checked for their impact on the factor they intended to manipulate. For example, people were asked to rate the extent to which they thought the two statements about scientific uncertainty made clear that scientists were uncertain about the size of the risks. The statements and hazard descriptions that did not perform well on the first pre-test were adapted and tested again (n=88). The adapted hazard descriptions and factor statements performed satisfactorily on the second manipulation check, and were used in the main experiment. The results of the manipulation checks for the hazard descriptions and statements are presented in Tables 7.3 and 7.4.

Table 7.3 Mean scores with associated standard deviations (*SD*) of the hazard descriptions on the manipulation checks

Hazard	Manipulation check	*n*	Mean	*SD*
Pesticides	Understandable	87	4.32*	0.77
	Realistic	87	3.95*	0.73
	Credible	87	3.84*	0.79
GM potato	Understandable	87	4.14*	0.70
	Realistic	87	3.44*	0.86
	Credible	87	3.47*	0.86
Mycotoxines [a]	Understandable	148	4.36*	0.72
	Realistic	148	3.70*	0.87
	Credible	148	3.59*	0.90

* Means differ significantly from the midpoint of the scale at $p<0.001$

[a] Results from the first pre-test

7.2.6 Data analysis

To assess the impact of the six factors *regulatory enforcement, efforts directed towards prevention, scientific uncertainty, risk variability, hazard type and country,* on perceptions of FRMQ, mean scores on the FRMQ-scale (Germany: Cronbach α=0.89; Greece: Cronbach α=0.89; Norway: Cronbach α=0.82; UK: Cronbach α=0.89; combined: Cronbach α=0.87) were subjected to a repeated-measures mixed linear model using SPSS 12.01 (SPSS Inc., Chicago, IL, USA). An advantage of the mixed linear model procedure is that it recognizes the repeated character of the measures (e.g. observations nested within respondents) and can be applied to the analysis of data from an incomplete block design (participants rated 3 of the 48 possible information scenarios; Maas & Snijders, 2003). The within-subject factors (regulatory enforcement, efforts directed towards prevention, scientific uncertainty, risk variability and hazard type) were entered as repeated factors in the model, with a compound symmetry structure for the variance-covariance matrix.

A model was estimated with all main effects and two-way interactions. Higher order interactions were not included in the model because of the increased complexity of interpretation. Pair-wise comparisons were conducted to explore significant interaction effects.

Table 7.4 Mean scores and associated standard deviations (*SD*) of the statements used for factor manipulations on the manipulation checks

Factor	Manipulation check	Level	*n*	Mean	*SD*
Scientific uncertainty	Uncertainty	low	75	1.97 [a]	1.04
		high	80	3.59 [b]	1.00
	Understandable	low	75	4.36*	0.71
		high	80	4.10*	0.82
	Realistic	low	75	2.83	1.22
		high	79	3.81*	0.79
	Credible	low	75	2.61*	1.11
		high	79	3.61*	0.81
Risk variability	Variability	low	88	1.94 [a]	0.84
		high	88	4.07 [b]	0.66
	Understandable	low	88	3.69*	0.96
		high	88	3.91*	0.91
	Realistic	low	88	3.27*	0.92
		high	88	3.68*	0.74
	Credible	low	88	3.10	0.97
		high	88	3.64*	0.66
Regulatory enforcement	Amount of systems of control	low	76	3.14 [a]	0.83
		high	80	3.98 [b]	0.89
	Understandable	low	76	3.95*	0.88
		high	81	4.04*	0.99
	Realistic	low	76	3.74*	0.90
		high	81	3.93*	0.88
	Credible	low	76	3.59*	1.05
		high	81	3.80*	0.93

Note: Means for the high and low levels of a factor with the same superscript character do not differ significantly ($p>0.05$).

* Means differ significantly from midpoint of scale at $p<0.01$

Table 7.4 (continued) Mean scores and associated standard deviations (*SD*) of the statements used for factor manipulations on the manipulation checks

Factor	Manipulation check	Level	*n*	Mean	*SD*
Preventive risk management	Concern for consumer welfare	low	88	3.63 [a]	0.84
		high	88	4.18 [b]	0.67
	Understandable	low	88	3.91*	0.75
		high	88	4.07*	0.86
	Realistic	low	88	3.64*	0.79
		high	88	3.81*	0.79
	Credible	low	88	3.43*	0.89
		high	87	3.64*	0.92

Note: Means for the high and low levels of a factor with the same superscript character do not differ significantly (p>0.05).

* Means differ significantly from midpoint of scale at p<0.01

7.3 Results

Table 7.5 presents the results of the mixed linear model for the main and two way interaction effects.

7.3.1 Regulatory enforcement

The results indicate that there was no significant main effect of including information about regulatory enforcement on FRMQ perceptions. However, significant interaction effects with hazard and with country were observed (see Table 7.5).

Table 7.6 shows the estimated marginal means of FRMQ perceptions for high and low regulatory enforcement for each hazard, over all countries. The estimated marginal means are the means predicted by the model. The results indicate that there was a positive impact of information about regulatory enforcement when it concerned food risk management of mycotoxins (p=0.009), but no significant impact when it concerned food risk management of pesticides or the GM potato (p>0.05).

Table 7.5 *F*-Values of the main and two-way interaction effects with associated *p*-values

	Nominator *df*	Denominator *df*	*F*-test	*P* value
Main effects				
Regulatory enforcement	1	22296	1.09	0.297
Preventive FRM	1	22064	0.56	0.454
Scientific uncertainty	1	22774	1.17	0.279
Risk variability	1	22359	0.01	0.904
Hazard	2	15895	907.33	<0.001
Country	3	7944	125.87	<0.001
Two-way interaction effects				
Regulatory enforcement * Hazard	2	22146	3.84	0.022
Regulatory enforcement * Country	3	22305	3.10	0.026
Preventive FRM * Hazard	2	22276	2.21	0.110
Preventive FRM * Country	3	22057	1.68	0.169
Scientific uncertainty * Hazard	2	21857	0.63	0.532
Scientific uncertainty * Country	3	22780	15.55	<0.001
Scientific uncertainty * Preventive FRM	1	22177	0.28	0.599
Scientific uncertainty * Regulatory enforcement	1	22284	4.83	0.028
Risk variability * Hazard	2	22092	0.25	0.782
Risk variability * Country	3	22373	2.85	0.036
Hazard* Country	6	15896	39.76	<0.001
Scientific uncertainty * Risk variability	1	22405	1.11	0.292
Risk variability * Regulatory enforcement	1	22227	0.16	0.685
Risk variability * Preventive FRM	1	22373	0.07	0.794
Regulatory enforcement * Preventive FRM	1	22323	0.34	0.560

Table 7.6 Estimated marginal means (*M*) of FRMQ perceptions for high and low regulatory enforcement per hazard with associated standard errors (*SE*)

Hazard	Low regulatory enforcement		High regulatory enforcement	
	M	*SE*	*M*	*SE*
Mycotoxins	4.14 [a]	0.02	4.22 [b]	0.02
Pesticides	3.43 [a]	0.02	3.44 [a]	0.02
GM potato	3.48 [a]	0.02	3.44 [a]	0.02

Note: Means within hazard with the same superscript character do not differ significantly (p>0.05).

Table 7.7 shows the estimated marginal means of FRMQ perceptions for high and low regulatory enforcement for each country, over all hazards. The results show that there was a positive impact of regulatory enforcement in the UK (p=0.012), and no significant impact in the remaining three countries on perceptions of FRMQ (p>0.05).

Table 7.7 Estimated marginal means (*M*) of FRMQ perceptions for high and low regulatory enforcement per country with associated standard errors (*SE*)

Country	Low regulatory enforcement		High regulatory enforcement	
	M	*SE*	*M*	*SE*
Norway	4.00 [a]	0.03	4.05 [a]	0.03
UK	3.64 [a]	0.03	3.72 [b]	0.03
Greece	3.63 [a]	0.03	3.62 [a]	0.03
Germany	3.47 [a]	0.03	3.41 [a]	0.03

Note: Means within country with the same superscript character do not differ significantly (p>0.05).

7.3.2 Efforts directed towards prevention

No significant main effect of information about efforts directed towards prevention on perceptions of FRMQ was observed, nor were there significant interaction effects (see Table 7.5).

7.3.3 Scientific uncertainty

A significant interaction between *scientific uncertainty* and *country* was observed (see Table 7.5). Table 7.8 shows the estimated marginal means of FRMQ perceptions for

each country under both conditions regarding the communication of scientific uncertainty. Communication of scientific uncertainty had a negative impact on perceptions of FRMQ in the UK ($p<0.001$) and Norway ($p=0.001$). However, there was a significant positive effect of communication of uncertainty on perceptions of FRMQ in Germany ($p<0.001$). No significant effects were observed in Greece ($p>0.05$).

Table 7.8 Estimated marginal means (*M*) of FRMQ perceptions per country for both levels of uncertainty communication, with associated standard errors (*SE*)

Country	Low communication of scientific uncertainty		High communication of scientific uncertainty	
	M	*SE*	*M*	*SE*
UK	3.74 [b]	0.03	3.62 [a]	0.03
Norway	4.08 [b]	0.03	3.97 [a]	0.03
Germany	3.35 [a]	0.03	3.53 [b]	0.03
Greece	3.64 [a]	0.03	3.61 [a]	0.03

Note: Means within country with the same superscript character do not differ significantly ($p>0.05$).

A significant interaction was also found between communication of scientific uncertainty and information about regulatory enforcement (see Table 5). When scientific uncertainty was not communicated, people did not exhibit a preference for information about regulatory enforcement ($p>0.05$). When information about scientific uncertainty was communicated, however, information about high regulatory enforcement improved perceptions of FRMQ ($p<0.05$; see Table 7.9).

Table 7.9 Estimated marginal means (*M*) of FRMQ perceptions for scientific uncertainty by regulatory enforcement interaction with associated standard errors (*SE*)

Communication of scientific uncertainty	Low regulatory enforcement		High regulatory enforcement	
	M	*SE*	*M*	*SE*
Low	3.71 [a]	0.02	3.69 [a]	0.02
High	3.65 [a]	0.02	3.71 [b]	0.02

Note: Means within a level of scientific uncertainty with the same superscript character do not differ significantly ($p>0.05$).

7.3.4 Risk variability

A significant interaction between provision of risk variability information with country was observed (see Table 7.5). While there was a significant negative impact of communicating risk variability information in Greece ($p<0.05$), this was not the case in the other three countries ($p>0.05$; see Table 7.10).

Table 7.10 Estimated marginal means (*M*) of FRMQ perceptions per country for both levels of risk variability communication, with associated standard errors (*SE*)

Country	No communication of risk variability		Communication of risk variability	
	M	*SE*	*M*	*SE*
Norway	4.04 [a]	0.03	4.02 [a]	0.03
UK	3.65 [a]	0.03	3.71 [a]	0.03
Greece	3.67 [b]	0.03	3.58 [a]	0.03
Germany	3.42 [a]	0.03	3.46 [a]	0.03

Note: Means within country with the same superscript character do not differ significantly ($p>0.05$).

7.3.5 Effects of hazard type and country

While there were significant differences in mean FRMQ between countries and hazards, there was also a significant interaction between these two factors (see Table 7.5). This means that the differences in mean FRMQ between hazards were moderated by country.

Table 7.11 shows the estimated marginal means of FRMQ perceptions for the different hazards per country. In the *UK*, FRMQ of mycotoxins was evaluated significantly higher than FRMQ of pesticides ($p<0.001$) and the GM potato ($p<0.001$). FRMQ of pesticides was also evaluated significantly higher than FRMQ of the GM potato ($p<0.001$). The same pattern emerged in *Norway*. FRMQ of mycotoxins was evaluated significantly higher than FRMQ of pesticides ($p<0.001$) and the GM potato ($p<0.001$). FRMQ of pesticides were also evaluated significantly higher than FRMQ of the GM potato ($p<0.001$). In *Germany* no significant differences between the evaluation of FRMQ of the GM potato and pesticides were observed ($p>0.05$), although both were evaluated significantly lower than mycotoxins ($p<0.001$). In *Greece* a different pattern emerged. Here the GM potato was evaluated

higher on FRMQ than pesticides (p<0.001), though both the GM potato and pesticides were evaluated lower than FRMQ of mycotoxins (p<0.001).

Table 7.11 Estimated marginal means (*M*) of FRMQ perceptions for each hazard per country, with associated standard errors (*SE*)

Country	Mycotoxins		Pesticides		GM potato	
	M	*SE*	*M*	*SE*	*M*	*SE*
UK	4.20 [c]	0.03	3.52 [b]	0.03	3.32 [a]	0.03
Norway	4.44 [c]	0.03	3.92 [b]	0.03	3.72 [a]	0.03
Germany	4.03 [b]	0.03	3.14 [a]	0.03	3.15 [a]	0.03
Greece	4.06 [c]	0.04	3.15 [a]	0.04	3.66 [b]	0.04

Note: Means within country with the same superscript character do not differ significantly (p>0.05).

7.4 Discussion

In the study reported here, we have examined the impact of information about food risks and associated risk management practices on consumer perceptions of food risk management quality (FRMQ). In addition, we have examined whether the particular hazard and the particular cultural context plays a role in FRMQ perceptions.

The research highlights the importance of cultural variation regarding the impact of potential risk communication strategies, as well the importance of hazard characteristics for risk management quality perceptions. In addition, communication factors may have relevance for consumer perceptions of FRMQ, but their impact may be subtle, and most clearly revealed in interaction effects.

The cultural differences identified have implications for the standardization of risk communication. In current times, for example with the formation of the European Food Safety Authority (EFSA), there seems an impetus towards risk communication approaches that cross borders. Our results suggest, however, that specific cultural characteristics may need to be taken into account, with communications specifically tailored to each. For example, in terms of communicating about scientific uncertainty, consumer demands for information may vary cross-culturally, perhaps as a consequence of historical differences in national experiences of food safety incidents. For example, the study showed that, while communication of uncertainty had a positive impact in Germany, the same information had a negative impact in the UK and Norway. A possible reason for this different impact of uncertainty information is that consumers in the UK have been shown to be more skeptical about the efficacy

of risk assessment practices, together with the associated uncertainties, compared to Germany and Greece (Van Kleef et al., 2007). Communication about scientific uncertainty may have fuelled this skepticism and as a consequence, reduced confidence in expertise of food risk managers, which subsequently led to decreased perceptions of food risk management quality in the UK. Against this, it is also possible that communication of uncertainty may have increased perceived risks in the UK and Norway. In Germany, it is possible that communication of scientific uncertainty may have increased perceived honesty of food risk managers, which subsequently resulted in increased perceptions of food risk management quality. Thus public responses to uncertainty information may depend on past experience with how scientific uncertainty has been communicated by risk managers in the past. Further research is needed to understand how to communicate scientific uncertainty more effectively. While in some countries communication of uncertainty may increase consumer perceptions of food risk management quality - perhaps as a result of increased perceived honesty of food risk managers - in other countries consumers may need additional information about scientific uncertainty, for example a more explicit acknowledgement of the strength and limitations of the choices food risk managers make as a result of uncertainty in risk assessment (Millstone & Van Zwanenberg, 2000). This may be particularly relevant under circumstances where consumers are skeptical about food safety assessment practices. A very interesting result from the current study is the interaction between information about scientific uncertainty and regulatory enforcement, which suggests that food risk managers might usefully inform the public about enforcement of safety laws and regulations when communicating scientific uncertainty associated with risks if consumer perceptions of FRMQ are to be enhanced. This also has implications for the coordination of risk communication activities between risk assessment and risk management organizations like EFSA and DG Sanco. While EFSA is responsible for risk communication arising from risk assessments, it seems that in some situations it is important for consumers also to receive information about risk management actions, i.e. what is being done about the risk and the scientific uncertainty.

An issue which needs to be raised is that, in the discussion presented here, it is assumed that positive consumer evaluation of FRMQ is, in itself, positive, whereas, of course, consumer negativity may spur risk managers to increased efforts to optimize consumer protection. In the paper presented here, we have endeavored to demonstrate the impact of different communication strategies on consumer perceptions of efficacious risk management. However, at a time when risk analysis

practices are becoming more transparent internationally, it is difficult to see how information such as population level variability and uncertainty associated with the risk can not be communicated, and thus not communicating this information where it exists is not an option.

The importance of cultural context is also highlighted by the observation of differences between countries in the perceived quality of food risk management associated with the different hazards. While quality of food risk management of the risks associated with mycotoxins was evaluated highest of the three hazards in all countries, the evaluation of risk management of pesticide residues and the GM potato differed between countries. When compared to Norway and the UK, the quality of food risk management associated with the GM potato was evaluated in Greece as higher than, and in Germany as equal to, food risk management of the risks associated with pesticide residues. This is in concordance with results from the Eurobarometer (2006), where it was found that, when different food hazards were compared, pesticide residues in fruit, vegetables or cereals are the top concern for German and Greek consumers. It may be that Greek consumers feel that GM food, on the other hand, is an "imported" hazard that is relatively easy to deal with because, for instance, the government bans the import of GM food products into Greece (Smith, 2006).

These results indicate that more research would seem to be needed, for example within the EU, to see whether there are a limited number of national perspectives on FRMQ and risk perception that might be addressed by a limited number of communication approaches, or whether each nation is so different as to require a unique approach. The countries included in the current study were partly selected according to their different Hofstede values (Hofstede, 2001), to be culturally differentiated in terms of uncertainty avoidance and aversion to risk. However, the results from the current study suggest that the degree of uncertainty avoidance may be distributed differentially across countries.

Our results also highlight the importance of hazard type for risk management quality perceptions. Participants thought that organically produced products, with risks related to mycotoxins, were best managed, irrespective of information about management activities. This finding was consistent and significant across all countries. This confirms the expectation formulated in the introduction that consumers may perceive natural risks as being easier to manage because they are perceived as less threatening than risks perceived as technological in origin. In addition, various authors have suggested that consumers may apply the affect heuristic to evaluate

multiple judgments associated with a potentially risky activity or technology based not only on what they *think* about it, but also on what they *feel* about it (Alhakami & Slovic, 1994; Finucane, Alhakami, Slovic, & Johnson, 2000; Slovic, Finucane, Peters, & MacGregor, 2004). In the current study, participants may have simply registered a positive affect or general attitude for organically grown products (e.g. Saba & Messina, 2003), and a relatively negative affect associated with pesticides and genetically modified foods. These different affective evaluations may have subsequently influenced consumer judgments of the quality of food risk management to a much greater degree than any other information that was provided (see also Poortinga & Pidgeon, 2005).

One implication is that increasing consumer perceptions of FRMQ may be difficult when public attitudes towards the particular product or technology about which is communicated are already well established. It may be that fundamental attitudes towards the target issue need to be addressed in order to increase consumer perceptions of the quality of food risk management, and that this approach, rather than the provision of information on actual risk management practices, may be the most effective strategy if perceptions of FRMQ are to be increased. Research certainly needs to address this issue.

Finally, it is worth noting that there are several limitations to this study. First, some of the effects found in our model were rather small. Although this is in concordance with a meta-analysis on effect sizes in consumer behaviour experiments - which has shown that, in general, only a minimum amount of variance in response variables is explained (Peterson, Albaum, & Beltramini, 1985) - it also indicates that other factors are important for explaining perceptions of FRMQ. One of these possible factors we have already mentioned, which is peoples' prior attitude or general affective evaluation towards the hazards or technologies that are the focus of the communications. Further research may also usefully look at the impact of trust in food risk managers. Research has shown that trust in the expertise of food risk managers is seen as a prerequisite for successful food safety management. That is, consumers see the expertise of food risk managers as a key factor in their evaluations of food risk management quality (Van Kleef et al., 2006).

Second, while the communication factors have relevance for perception of FRMQ, their impact is subtle, and most clearly revealed in interaction effects. Although this is understandable since for example, cultural differences influence consumer reactions to information, there is always a concern with information experiments that it may be demanding on participants to read a piece of text and be

significantly impacted by fairly subtle differences in words between different conditions. Further evidence on the importance of the communication factors could be sought by ensuring that participants are more cognitively involved when reading the information scenarios, which may facilitate awareness of differences between conditions. This may provide further understanding of how and when these communication factors interact.

In conclusion, this study has raised a number of important issues for risk communicators, and identified a number of priorities for future research. The current study showed that the impact of communication efforts on consumer perceptions of the quality of food risk management is influenced by cultural variation, perhaps rooted in historical precedents and learning. This implies that a unitary pan-European risk management communication policy is not practical. Future research needs to focus on a possible limited number of communication approaches regarding food risk management within the EU. In addition, the current study showed the importance of hazard type for risk management quality perceptions. This implies that fundamental attitudes towards the target issue need to be addressed if consumer perceptions of FRMQ are to be enhanced. Future research may further explore different communication strategies regarding effective FRMQ according to the types of potential hazards under consideration.

8

GENERAL DISCUSSION

As a result of increased attention to the assessment of both food-related risks and benefits as part of the food risk analysis process (EFSA, 2006; Renwick et al., 2004), combined communication of risks and benefits associated with food consumption to consumers is likely to become an increasingly important topic in years to come. The aim of this thesis was therefore to examine consumer responses to the simultaneous communication of risks and benefits associated with food, in order to provide insights into effective ways to communicate this information. Three lines of research were applied to this purpose, the first of which focused on consumer perceptions and responses to *integrated risk-benefit metrics* describing the combined impact of risks and benefits associated with food consumption. The second line of research focused on *potential barriers* to the effective communication of risks and benefits. The third line of research examined consumer responses to communication about *risk management* practices associated with food hazards.

In this final chapter of the thesis, the main results and conclusions from the research are summarized. In addition, theoretical and policy implications will be discussed. The chapter concludes with a discussion of some limitations of the research and issues for future research.

8.1 Summary and conclusions

8.1.1 Communication of integrated risk-benefit information: Integrated risk-benefit metrics

Chapter 2 of the thesis provided a first qualitative exploration of consumer preferences and information needs regarding the simultaneous communication of risks and benefits associated with food consumption, including preferences regarding several integrated risk-benefit metrics describing the combined impact of risks and benefits associated with food consumption on health. The focus was on information about the net health impact of risks and benefits on life expectancy, quality of life, and Disability Adjusted Life Years (DALYs). The results provided insights into potential

issues related to the communication of risk and benefit information. Current risk-benefit communication was perceived as either 'asymmetrical' or confusing, and often associated with consumer distrust in the information provided. A need for more balanced and scientifically derived information with consumers about both risks and benefits associated with food consumption was identified. Consumer preferences regarding the communication of risk-benefit assessment outputs indicated that information about the net health impact of consuming particular foods may be useful to consumers, in particular information about the net impact on *both* life expectancy and quality of life. However, DALYs may not to be the best way for communicating the combined impact on life expectancy and quality of life to consumers, as DALYs were considered counterintuitive and difficult to understand.

Chapter 3 examined consumer perceptions of quality-adjusted-life-years (QALYs) as an alternative tool for describing the combined impact of risks and benefits associated with food consumption. The results indicated that integrated risk-benefit information in terms of QALYs can enhance the transparency of regulatory decision-making by providing *useful* information about health risks and benefits related to food consumption in terms *understandable* to consumers. However, it is important that the *credibility* of the information is ensured, for example by attributing the information to a highly credible source, as the credibility of information about the impact of food consumption on QALYs was limited. In addition, QALYs were perceived as less useful by specific groups (younger, unhealthier, and more highly educated people), implying the need to examine alternative strategies to communicate risk-benefit information to these groups of individuals.

Chapter 4 examined whether integrated risk-benefit information in terms of QALYs can facilitate informed decision making for consumers, including how this information can best be presented. The research highlighted the importance of information format for consumer perceptions of the *usefulness* of QALYs as a communication tool for describing health effects associated with food consumption. QALYs communicated as a net health effect were preferred if the food product which was the focus of the communication was associated with negative net effects on health, while separate communication of both risks and benefits may be preferred for food products associated with positive or zero net health effects. Information about the impact of food consumption on QALYs may also facilitate informed decision making by consumers, as indicated by the impact on *risk* and *benefits perceptions* as intended by the information. The actual impact of QALY information on subsequent food consumption choices may be limited, however, as indicated by the

absence of an effect of information on *attitudes* and *behavioral intentions* to consume the product under consideration, and merits further investigation.

8.1.2 Potential barriers to effective risk-benefit communication

Chapter 5 developed insights into the existence of *optimism* in terms of perceptions and knowledge about risks and benefits associated with the consumption of fish across consumers. Distinct patterns of risk-benefit perceptions across groups of consumers were related to optimism about personal risks and benefits, and optimism about personal knowledge about risks and benefits. The identification of consumer groups that differed in terms of perceptions of personal risks and benefits, and which could be described in terms of potential barriers to influence those perceptions, provided information relevant to understanding the potential effectiveness of health interventions directed towards increasing the perceived healthiness of fish consumption and subsequent consumption behavior for different consumer groups. This study showed that both optimism regarding perceptions and knowledge of health *risks*, and optimism regarding perceptions and knowledge of health *benefits* should be taken into account when developing interventions aimed at consumer health.

Chapter 6 focused on the role of initial attitudes on the existence of *negativity effects* after the provision of balanced risk-benefit information about different food production methods. Whereas both one-sided positive and negative information were used in the formation of post-information attitudes (experiment 1), the impact of balanced information on post-information attitudes may depend on initial attitudes (experiment 2). In accordance with the negativity bias, people with initial positive attitudes were influenced more by the risk information than by the benefit information. In contrast to this, people with initial negative attitudes showed a positivity effect after balanced information provision. In other words, information had an attitude-incongruent impact on post-information attitudes. These results demonstrated that negativity effects were dominant for people with initial positive attitudes, but changed into positivity effects for people with initial negative attitudes. The implication is that communication of balanced positive and negative information may differentially affect people with positive and negative existing attitudes.

8.1.3 Communication of food risk management practices

Chapter 7 examined the impact of information about food risks and associated risk management practices on consumer perceptions of food risk management quality (FRMQ). In addition, the research examined whether the particular hazard and particular cultural or socio-political contexts play a role in FRMQ perceptions. The study showed the importance of hazard type for risk management quality perceptions, implying that fundamental attitudes towards the target issue need to be addressed if consumer perceptions of FRMQ are to be enhanced. The results also indicated that the impact of communication efforts on consumer perceptions of the quality of food risk management is influenced by cultural variation, which implies that a unitary pan-European risk management communication policy is not practical. For example, while communication of uncertainty had a positive impact in Germany, it had a negative impact in the UK and Norway. Finally, the study showed that food risk managers should inform the public about enforcement of safety laws when communicating scientific uncertainty associated with food safety. This has implications for the coordination of risk communication strategies between risk assessment and risk management organizations.

8.2 Implications

8.2.1 Theoretical implications

The theoretical contribution of this thesis is the extension of existing research that has largely focused on consumer responses to food-related risk (*or* benefit) information to consumer responses to food-related risk-benefit information. Specifically, this thesis has extended scientific literature on consumer responses to information about risk assessment outputs to consumer responses to information about integrated risk-benefit assessment outputs. An interesting finding in this regard is that people may prefer information about the *net* impact on QALYs when consumption of a food product is associated with a negative net health impact, whereas people may prefer *separate* QALY information for the associated health risk and benefits when the net effect is zero or positive. This implies that future research on effective ways to communicate risk-benefit assessment outputs needs to consider the direction of the net effect that is being communicated.

In addition, this thesis has confirmed and extended existing scientific findings regarding potential barriers to effective risk communication to the effective communication of both risks and benefits. For example, research presented in this thesis demonstrates that optimism in the area of dietary choice may not only be related to risks, but also to *benefits* associated with the consumption of a food product, and that people who are optimistic about their risks associated with the consumption of a specific food product are not necessarily optimistic about their benefits associated with the same food product. Furthermore, consumers who differ in terms of perceptions of personal risks and benefits can be described in terms of potential barriers to influence those perceptions, such as optimism regarding perceptions and knowledge of risks and benefits associated with food. These results imply that research on effective ways to communicate food-related risk-benefit information needs to consider both optimism regarding risks and benefits, as well as individual differences in optimism regarding perceptions and knowledge of risks and benefits. The thesis has also extended scientific literature on the negativity bias by showing that existing attitudes can be important for the occurrence of such negativity bias effects. This suggests that future research on incongruency effects needs to consider existing attitudes towards the target object.

Finally, this thesis has extended research on the communication about food safety to the communication about risk management practices associated with food hazards. Research presented in this thesis demonstrates the importance of cultural variation regarding the impact of potential communication strategies, as well the importance of hazard characteristics for risk management quality perceptions. Future research therefore needs to consider cultural variation and the type of hazard under consideration when examining communication strategies that may enhance consumer perceptions of food risk management quality.

8.2.2 Policy implications

This thesis has provided useful insights into consumer responses to the simultaneous communication of risks and benefits associated with food, which has provided insights for the development of effective ways to communicate this information, including the communication of information about integrated risk-benefit assessments. In addition, this thesis has provided insights for the development of effective ways to communicate about risk management practices associated with food hazards.

Communication about integrated risk-benefit assessments may usefully provide information on both life expectancy and quality of life. QALYs can be a useful tool for this purpose, as it can provide useful information about health risks and benefits related to food consumption using terminology which is understandable to consumers. Information about the impact of food consumption on QALYs may also facilitate informed decision making, as it is likely to influence risk and benefit perceptions congruent to the net health effect communicated in the information. When the aim of the communication is to influence food consumption decisions, however, integrated risk-benefit information in terms of QALYs may not be very effective, although this issue merits further investigation. Specific groups of people, for example, younger, unhealthier, and more highly educated people, may require alternative ways to communicate about integrated risk-benefit assessments. One approach that might increase the perceived usefulness of integrated risk-benefit information may be the provision of personalized risk-benefit information, for example based on actual food intake levels and vulnerabilities to certain health effects, although future research is needed to examine this. In addition, further advances in the development of integrated risk-benefit assessment methodology may be required before this can be practically introduced. Alternatively, the usefulness of integrated risk-benefit information may be increased by providing information about how changes in consumption may influence similar others, as this may increase the personal relevance of the information. When communicating about the impact of food consumption on QALYs, it is important that credibility of the information is ensured, for example by attributing the information to a highly credible source. In addition, the way of communicating QALY information may need to differ for different net effects on health. For example, when food products are associated with negative net effects on health, consumers may prefer the information about QALYs to be communicated as a net effect, while separate communication about risks and benefits may be preferred for food products associated with positive or zero net health effects. Further research into how this may be operationalized is needed before effective and efficient policy translation can occur.

This thesis also shows that communication of risk-benefit information does not take place in a vacuum and that psychological phenomena of the recipient of the information need to be taken into account. There is a need to consider existing attitudes about the target issue under consideration when communicating about risks and benefits associated with food, whether people are optimistic about their personal risks and benefits from a particular hazard, and the extent to which they are optimistic

about their personal knowledge about risks and benefits associated with food. Health interventions directed towards influencing perceptions of personal risks and benefits associated with food consumption may be targeted to specific population groups which differ in terms of optimism effects.

Finally, when developing effective ways to communicate about risk management practices associated with food hazards, fundamental attitudes towards the type of food hazard involved may need to be addressed if consumer perceptions of food risk management quality are to be enhanced. For example, people tend to evaluate risks which they perceive as natural as less threatening than those perceived as technological in origin (Fife-Schaw & Rowe, 1996; Fischhoff et al. , 1978; Slovic, 1987; Williams & Hammitt, 2001), and may incorporate this into their evaluation of how effectively the risks are managed. In other words, the greater the (perceived) risk, the more critical people may be of how the risks are managed. In addition, it is important that cultural and socio-political variation in the impact of communication efforts on perceptions of food risk management quality is taken into account, which implies that a unitary pan-European risk management communication policy is not always practical. When communicating scientific uncertainty associated with food safety, managers may usefully inform the public about enforcement of safety laws, which has implications for the coordination of risk communication strategies between risk assessment and risk management organizations. For example, at a pan-European level, this would imply more effective liaison between assessment, management and communication activities involving institutions such as the European Food safety Authority (EFSA) and DG Sanco. At the national level, national institutes for the assessment of the safety and healthiness of food products (e.g. RIKILT and RIVM in the Netherlands) may need to coordinate their communication strategies with the ministries of the national government.

8.3 Limitations and future research

In this section some overall limitations and suggestions for future research are discussed. The discussion is intended to compliment the specific limitations and suggestions for future research already discussed in the empirical chapters.

One limitation of this thesis is that consumer responses to QALY information have not been related to the potential barriers to the effective communication of risks and benefits identified in Chapters 5 and 6. Future research may therefore usefully examine how optimism regarding perceptions and knowledge of risks and benefits

associated with the target object influences the impact of risk-benefit information in terms of QALYs on perceptions of personal risks and benefits. In addition, the research presented in Chapter 6 demonstrated the importance of existing attitudes for the occurrence of negativity effects. No evidence for a negativity effect was found after the provision of QALY information. However, the results did suggest that increased importance was attributed to risk information compared to benefit information when the net health effect was negative. More specifically, participants perceived information about the net impact on QALYs as being more useful (compared to separate QALY information for the associated health risk and benefits) under circumstances when consumption of a food product is associated with a negative net health effect. The reverse was true when the consumption of a food product was associated with a zero net effect. It could be interesting, therefore, to examine whether a preference for information about the net impact on QALYs when consumption of a food product is associated with a negative net health impact is moderated by existing attitudes towards the target object.

The results presented in this thesis have provided insights into the existence of *unrealistic optimism* regarding both risks and benefits associated with food consumption, as well as the importance of existing attitude for the occurrence of *negativity effects*. However, additional psychological phenomena have been identified in the literature which may influence the impact of risk-benefit information. Although outside the scope of this thesis, future research should provide a comprehensive overview on how additional psychological phenomena may influence consumer responses to risk-benefit information. For example, research has found evidence for a confirmation bias (Ajzen, 2001) whereby people process information in an attitude-congruent way which may lead to an increased impact of attitude-congruent information. In addition, people may use an affect heuristic (Alhakami & Slovic, 1994; Finucane, Alhakami, Slovic, & Johnson, 2000; Slovic, Finucane, Peters, & MacGregor, 2004) where they base specific judgments such as perceptions of risks and benefits on a general affective evaluation of the target object, rather than on specific cognitive evaluations. Framing effects (Kahneman & Tversky, 1979; Kuhberger, 1998) may also be important to consider when communicating risk-benefit information, as these have shown that the impact of information depends on how the information is formulated. Although framing effects were explored in Chapter 3, further research is needed to systematically examine potential framing effects when communicating risk-benefit information.

The results have indicated that consumers find DALYs counterintuitive and difficult to understand, whereas QALYs described in more simplified terminology were considered understandable and useful. Future research could therefore examine whether DALYs described in more simplified terminology, such as used for QALYs in this thesis, could increase the usefulness of DALYs as a communication tool for describing positive and negative health effects associated with food consumption.

With regards to the generalisability of the findings across different cultures and contexts, a limitation of the quantitative studies examining consumer perceptions and responses to integrated risk-benefit information in terms of QALYs is that they were conducted using Dutch consumers. Integrated risk-benefit assessment outputs are likely to be valid for people in many nations. As information about the impact of risks and benefits associated with food consumption in terms of life expectancy and quality of life is likely to be useful for people across different cultures and socio-political contexts, QALYs may also be a useful communication tool for describing positive and negative health effects associated with food consumption in a cross-cultural context. Nevertheless, future research is needed to confirm this. In addition, differences across consumers in optimism regarding perceptions and knowledge of risks and benefits have been examined in Russia, and in relation to fish consumption only, in the present thesis. The generalisability of results to other areas of food choice merits further investigation. For example, unrealistic optimism has been shown to increase with increased perceptions of controllability of the positive or negative event (Sparks & Shepherd, 1994; Weinstein, 1980). Compared to food-related life-style hazards, more technological food hazards are often perceived as less controllable (Sparks & Shepherd, 1994). As a consequence, optimism about personal risks and benefits may be less relevant when the risks and benefits are associated with more technological food hazards (see also Frewer, Shepherd, & Sparks, 1994), such as the application of genetic modification or nanotechnology for the production of food products. In addition, future research may examine the generalisability of results to other cultures. Cultural differences may exist between Western and Eastern cultures in the extent to which people are optimistic or pessimistic about their personal risks and benefits (Chang & Asakawa, 2003; Chang, Asakawa, & Sanna, 2001; Chang, Sanna, Kim, & Srivastava, 2010; Heine & Lehman, 1995). Future research is therefore needed to examine whether cultural variation exists in the extent to which food consumption is related to optimism or pessimism regarding personal risks and benefits. In addition, research may examine whether distinct patterns of risk-benefit perceptions are differentially related to optimism or pessimism regarding perceptions

and knowledge about risks and benefits in Eastern cultures. Such differences may have implications for the development of health interventions directed towards influencing perceptions of risks and benefits targeted to people of Eastern culture. Regarding the finding that existing attitudes may be important for the occurrence of a negativity effect after the provision of balanced risk-benefit information, further research is needed to examine the generalisability of this effect to other contexts. For example, research might examine whether the attitude-incongruent effect is related to the complexity of the comparison between the risk and benefit information, the motivational goal of the individual, and the communication of *balanced* risk-benefit information.

Research on consumer responses to communication about food risk management practices (Chapter 7), has not fully addressed the communication issues which may be relevant as a result of increased attention to risks and benefits in the food risk analysis process. The antecedents of this research were grounded in food risk perception, and, from this, consumer perceptions of effective food risk management (Van Kleef et al., 2006; Van Kleef et al., 2007). As a consequence, the focus of these studies was mainly on food *risks*, and the *protection* of human health against food safety incidents. With increased attention to risks *and* benefits in the food risk analysis process, *promotion* of consumer health may also become important for consumer perceptions of effective food risk management, and it may also become important to communicate about how food risk management practices are directed towards the promotion of consumer health. Future research certainly needs to address this. In a similar vein, Chapter 7 examined the impact of communication of risk variability and associated risk management practices on consumer perceptions of food risk management quality. Further research is needed to examine the impact of communication of variability of risk and benefits (for example, when the population at risk differs from the population that benefits), and how this is incorporated in risk management practices. For example, in addition to communication about which risk management practices are implemented to protect more vulnerable groups of people, it may be important to communicate which management practices are implemented to promote the health of other (potentially different) groups. In addition, this thesis has provided some useful insights for the communication of scientific uncertainty associated with food risks that may enhance consumer perceptions of food risk management quality. However, uncertainties associated with integrated risk-benefit assessments may pose new

challenges for communication, as these may not only be about the *magnitude*, but also about the *direction* of the net effect[1].

In real world situations, attitudes towards food are determined or influenced by other aspects in addition to health, such as habit, cultural traditions, taste, preparation skills, availability and price. Although outside the scope of this thesis, these other determinants of food consumption decisions need to be taken into account when trying to influence food consumption patterns. In addition, the ethics of communicating health information needs to be considered. For example, communication needs to avoid being overtly persuasive in a particular direction when there is uncertainty about the exact health impact for individuals. Furthermore, the use of persuasive communication techniques to increase acceptance of controversial agro-food technologies, such as genetically modified food products, should be avoided.

8.4 Final conclusion

This thesis has provided insights into consumer responses to the simultaneous communication of risks and benefits associated with food. The results help the development of effective ways to communicate information about integrated risk-benefit assessments. Integrated risk-benefit measures are a way forward to communicate information about integrated risk-benefit assessments to consumers. However, the direction of the net health impact and individual characteristics of consumers moderate the potential usefulness of QALYs as a communication tool. The research also contributes to the development of effective ways to communicate food-related risk-benefit information. When communicating about risks and benefits associated with food, there is a need to consider existing attitudes towards a target issue, and whether people are optimistic about their personal risks and benefits, and optimistic about their personal knowledge about risks and benefits associated with food. Optimism in the area of dietary choice may not only be related to risks, but also to *benefits* associated with the consumption of a food product. In addition, the impact of balanced risk-benefit information on perceptions of risks and benefits is moderated by existing attitudes. Finally, the research has provided insights for the development of effective ways to communicate about risk management practices associated with food hazards. Consumer evaluations of the quality of food risk

[1] See QALIBRA, http://www.qalibra.eu/tool/support/page30.cfm (accessed June 2010).

management are dependent on the specific context, such as the culture and the type of hazard under consideration.

Combined communication of risks and benefits is likely to become an increasingly important topic in years to come. While the field of combined risk-benefit communication in relation to foods is still in its infancy and requires further attention, this thesis has provided some initial insights for the development of effective risk-benefit communication and hopefully stimulates further research in this interesting area.

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SUMMARY

Communication about the healthiness of consuming different food products has frequently involved *either* health messages about the associated risks *or* benefits. In reality, consumption decisions often involve consumers "trading-off" the risks and benefits associated with the consumption of a particular food product. If consumers are to make informed choices about food consumption, they may need to simultaneously understand both risk and benefit information associated with consuming different foods. However, it is not known how this potentially conflicting information can best be communicated. Effective risk-benefit communication is also important because, increasingly, risk assessment and regulatory decision-making is focused on risk *and* benefit associated with a specific food issue, which will also need to be communicated to consumers. This thesis therefore examines consumer responses to information about both risks and benefits associated with food, in order to provide insights into effective ways to communicate this information. For this purpose, three lines of research are explored: (1) consumer perceptions and responses to *integrated risk-benefit metrics*, (2) *potential barriers* to effective risk-benefit communication, and (3) consumer responses to communication about *risk management practices* associated with food hazards.

As risk assessment and regulatory decision-making is increasingly focused on risk and benefit associated with a specific food issue, and this will need to be communicated to consumer, the first part of the thesis (chapters 2, 3 and 4) reports on research examining consumer perceptions and responses to *integrated risk-benefit metrics* describing the combined impact of risks and benefits associated with food consumption. *Chapter* 2 provides a first qualitative exploration of consumer preferences and information needs regarding the simultaneous communication of risks and benefits associated with food consumption, including preferences regarding several integrated risk-benefit metrics describing the combined impact of risks and benefits associated with food consumption on health. The focus is on information about the net health impact of risks and benefits on life expectancy, quality of life, and Disability Adjusted Life Years (DALYs). Current risk-benefit communication is perceived as either 'asymmetrical' or confusing, and often associated with consumer distrust in the information provided. A need for more balanced and scientifically derived information with consumers about both risks and benefits associated with

food consumption is identified. Consumer preferences regarding the communication of risk-benefit assessment outputs indicate that information about the net health impact of consuming particular foods may be useful to consumers, in particular information about the net impact on *both* life expectancy and quality of life. However, DALYs may not to be the best way for communicating the combined impact on life expectancy and quality of life to consumers, as DALYs are considered counterintuitive and difficult to understand.

Chapter 3 examines consumer perceptions of quality-adjusted-life-years (QALYs) as an alternative tool for describing the combined impact of risks and benefits associated with food consumption. The results indicate that integrated risk-benefit information in terms of QALYs can enhance the transparency of regulatory decision-making by providing *useful* information about health risks and benefits related to food consumption in terms that are *understandable* to consumers. However, it is important that the *credibility* of the information is ensured, for example by attributing the information to a highly credible source, as the credibility of information about the impact of food consumption on QALYs was limited. In addition, QALYs are perceived as less useful by specific groups (younger, unhealthier, and more highly educated people), implying the need to examine alternative strategies to communicate risk-benefit information to these groups of individuals.

Chapter 4 examines whether integrated risk-benefit information in terms of QALYs can facilitate informed decision making for consumers, including how this information can best be presented. The research highlights the importance of information *format* for consumer perceptions of the *usefulness* of QALYs as a communication tool for describing health effects associated with food consumption. QALYs communicated as a net health effect are preferred if the food product which is the focus of the communication is associated with negative net effects on health, while separate communication of both risks and benefits are preferred for food products associated with zero net health effects. Information about the impact of food consumption on QALYs may also facilitate informed decision making by consumers, as indicated by the impact on *risk* and *benefits perceptions* as intended by the information. The actual impact of QALY information on subsequent food consumption choices may be limited, however, as indicated by the absence of an effect of information on *attitudes* and *behavioral intentions* to consume the product under consideration, and merits further investigation.

The second part of the thesis (chapters 5 and 6) focuses on *potential barriers* to the effective communication of risks and benefits. Optimistic biases may influence the

impact of risk-benefit information, but have only been examined in relation to risks in the area of food consumption. *Chapter 5* therefore focuses on consumer perceptions of health risks *and benefits* associated with the consumption of fish, and looks at how differences across consumers in these perceptions relate to optimism in terms of perceptions and knowledge about the risks and benefits. Distinct patterns of risk-benefit perceptions across groups of consumers are related to optimism about personal risks and benefits, and optimism about personal knowledge about risks and benefits. The identification of consumer groups that differ in terms of perceptions of personal risks and benefits, and which can be described in terms of potential barriers to influence those perceptions, provides information relevant to understanding the potential effectiveness of health interventions directed towards increasing the perceived healthiness of fish consumption and subsequent consumption behavior for different consumer groups. This study shows that both optimism regarding perceptions and knowledge of health *risks*, and optimism regarding perceptions and knowledge of health *benefits* should be taken into account when developing interventions aimed at consumer health.

As a negativity bias may undermine potential beneficial effects associated with a food issue, but may also depend on existing attitudes towards the target issue, *Chapter 6* examines the occurrence of negativity effects after the provision of balanced risk-benefit information across a range of existing attitudes associated with different food production methods. Whereas both one-sided positive and negative information are used in the formation of post-information attitudes (experiment 1), the impact of balanced information on post-information attitudes may depend on initial attitudes (experiment 2). In accordance with the negativity bias, people with initial positive attitudes are influenced more by the risk information than by the benefit information. In contrast to this, people with initial negative attitudes show a positivity effect after balanced information provision. In other words, information has an attitude-incongruent impact on post-information attitudes. These results demonstrate that negativity effects are dominant for people with initial positive attitudes, but change into positivity effects for people with initial negative attitudes. The implication is that communication of balanced positive and negative information may differentially affect people with positive and negative existing attitudes.

The third part of the thesis examines consumer responses to communication about risk *management practices* associated with food hazards. As communication about food risk management practices may be extremely relevant to societal responses to existing and emerging food risks, as well as generating trust among consumers in the

process and practice of risk analysis, *Chapter 7* examines the impact of information about food risks and associated risk management practices on consumer perceptions of food risk management quality (FRMQ). In addition, the research examines whether the particular hazard and particular cultural or socio-political contexts play a role in FRMQ perceptions. The study shows the importance of hazard type for risk management quality perceptions, implying that fundamental attitudes towards the target issue need to be addressed if consumer perceptions of FRMQ are to be enhanced. The results also indicate that the impact of communication efforts on consumer perceptions of the quality of food risk management is influenced by cultural variation, which implies that a unitary pan-European risk management communication policy is not practical. Finally, the study shows that food risk managers should inform the public about enforcement of safety laws when communicating scientific uncertainty associated with food safety, which has implications for the coordination of risk communication strategies between risk assessment and risk management organizations.

In conclusion, this thesis has extended existing research that has largely focused on consumer responses to food-related risk (*or* benefit) information to consumer responses to the simultaneous communication of risks and benefits associated with food. The results help the development of effective ways to communicate information about integrated risk-benefit assessments. Integrated risk-benefit measures are a way forward to communicate information about integrated risk-benefit assessments to consumers. However, the direction of the net health impact and individual characteristics of consumers moderate the potential usefulness of QALYs as a communication tool. The research also contributes to the development of effective ways to communicate food-related risk-benefit information. When communicating about risks and benefits associated with food, there is a need to consider existing attitudes towards a target issue, and whether people are optimistic about their personal risks and benefits, and optimistic about their personal knowledge about risks and benefits associated with food. Optimism in the area of dietary choice may not only be related to risks, but also to *benefits* associated with the consumption of a food product. In addition, the impact of balanced risk-benefit information on perceptions of risks and benefits is moderated by existing attitudes. Finally, the research has provided insights for the development of effective ways to communicate about risk management practices associated with food hazards. Consumer evaluations

of the quality of food risk management are dependent on the specific context, such as the culture and the type of hazard under consideration.

As a result of increased attention to the assessment of both food-related risks and benefits as part of the food risk analysis process, combined communication of risks and benefits associated with food consumption to consumers is likely to become an increasingly important topic in years to come. While the field of combined risk-benefit communication in relation to foods is still in its infancy and requires further attention, this thesis has provided some initial insights for the development of effective risk-benefit communication and hopefully stimulates further research in this interesting area.

SAMENVATTING
(DUTCH SUMMARY)

Communicatie over de gezondheid van verschillende voedingsmiddelen richt zich vaak eenzijdig op de verbonden risico's van consumptie *ofwel* de verbonden voordelen voor de gezondheid. In werkelijkheid maken consumenten in hun voedselkeuze beslissingen meestal een afweging tussen de risico's en voordelen verbonden aan de consumptie van een bepaald voedingsmiddel. Consumenten dienen daarom inzicht te hebben in zowel de eventuele risico's als de voordelen van consumptie als zij goed geïnformeerde keuzes willen maken. Er is echter weinig bekend over hoe deze mogelijk tegenstrijdige informatie het beste kan worden gecommuniceerd. Effectieve gelijktijdige communicatie van risico's en voordelen is bovendien belangrijk omdat in toenemende mate risicobeoordelingen en besluitvorming over regelgeving gebaseerd is op de gezamenlijke analyses van risico's *en* voordelen verbonden aan voedingsmiddelen. Deze analyses van voordelen en risico's moet tevens aan de consument worden gecommuniceerd. Om inzicht te krijgen in de meest effectieve manieren om dit te communiceren, worden in dit proefschrift consumentenreacties op informatie over zowel risico's als voordelen verbonden aan voedsel onderzocht. Voor dit doel zijn drie onderzoekslijnen gevolgd leidend tot een groter begrip van (1) percepties en reacties van consumenten op *geïntegreerde risico-voordeel maten*, (2) *potentiële belemmeringen* voor effectieve risico-voordeel communicatie, en (3) reacties van consumenten op communicatie over *risico management* van voedselveiligheids-vraagstukken.

In het eerste deel van het proefschrift (hoofdstukken 2, 3 en 4) wordt het onderzoek naar de percepties en reacties van consumenten op geïntegreerde risico-voordeel maten gerapporteerd. Deze geïntegreerde risico-voordeel maten beschrijven de gecombineerde invloed van risico's en voordelen verbonden aan voeding op de gezondheid. In *Hoofdstuk 2* worden informatiebehoeftes van consumenten voor de gelijktijdige communicatie van risico's en voordelen verbonden aan voedselconsumptie kwalitatief verkend in groepsdiscussies met consumenten in vier EU landen. Daarnaast worden consumentenvoorkeuren voor verschillende geïntegreerde risico-voordeel maten voor het beschrijven van de gecombineerde impact van gezondheidsrisico's en -voordelen verbonden aan voedselconsumptie onderzocht. Specifiek wordt hierbij gekeken naar informatie over het netto effect van

gezondheidsrisico's en -voordelen op de levensverwachting, de kwaliteit van leven, en 'ziekte gecorrigeerde levensjaren' (Disability Adjusted Life Years of DALYs). Uit de resultaten blijkt ondermeer dat de huidige communicatie over risico's en voordelen wordt gezien als 'asymmetrisch' of verwarrend. Het onderzoek laat zien dat er onder consumenten behoefte is aan meer evenwichtige en wetenschappelijk gebaseerde informatievoorziening over de risico's en voordelen geassocieerd met voeding. De reacties van consumenten op geïntegreerde risico-voordeel informatie tonen tevens aan dat informatie over de netto invloed van het eten van een specifiek voedselproduct op de gezondheid als nuttig wordt ervaren, in het bijzonder informatie over de netto invloed op *zowel* de levensverwachting *als* kwaliteit van leven. Samenvattend kan gesteld worden dat de 'DALYs maat' niet de meest optimale maat is om het gecombineerde effect op levensverwachting en kwaliteit van leven te communiceren, aangezien deze maat als contra-intuïtief en ingewikkeld wordt gezien.

In *Hoofdstuk 3* wordt gekeken naar consumentenpercepties van 'kwaliteit gecorrigeerde levensjaren' (Quality Adjusted Life Years of QALYs) als een alternatieve maat voor het beschrijven van het gecombineerde effect van risico's en voordelen verbonden aan voedingsmiddelen. De resultaten van deze studie onder Nederlandse consumenten tonen aan dat geïntegreerde risico-voordeel informatie in termen van QALYs de transparantie van de besluitvorming over regelgeving kan verbeteren door het verstrekken van *nuttige* informatie over de gezondheidsrisico's en -voordelen verbonden aan voedselconsumptie, in termen die *begrijpelijk* zijn voor de consument. Het is echter belangrijk dat de *geloofwaardigheid* van de informatie beter wordt gewaarborgd, bijvoorbeeld door het toeschrijven van de informatie aan een betrouwbare bron, omdat consumenten aangeven dat de geloofwaardigheid van de informatie over de invloed van voedselconsumptie op QALYs beperkt is. Daarnaast worden QALYs als minder bruikbaar ervaren door jongeren, mensen met een slechtere gezondheid en meer hoog opgeleide mensen, hetgeen impliceert dat onderzoek nodig is naar alternatieve strategieën om informatie over risico's en voordelen te communiceren naar deze specifieke groepen consumenten.

In *Hoofdstuk 4* wordt aandacht besteed aan QALYs als communicatiemiddel voor het beschrijven van gezondheidseffecten verbonden aan voeding. Onderzocht is of risico-voordeel informatie in termen van QALYs geïnformeerde besluitvorming van consumenten kan vergemakkelijken. Daarnaast wordt in een experimentele studie onder Nederlandse deelnemers onderzocht hoe deze informatie het best kan worden gepresenteerd. De resultaten benadrukken het belang van de *manier* waarop de informatie wordt gepresenteerd voor de waargenomen *bruikbaarheid*. QALYs die

gecommuniceerd worden als een *netto* effect op de gezondheid hebben de voorkeur wanneer het voedselproduct wordt geassocieerd met *negatieve* netto effecten op de gezondheid. QALYs gecommuniceerd *afzonderlijk* voor de risico's en voordelen (in één boodschap maar uitgesplitst) hebben de voorkeur voor voedingsmiddelen die geassocieerd worden met *nul* (netto) effecten op de gezondheid. Informatie over de invloed van voedselconsumptie op QALYs kan een geïnformeerde besluitvorming van de consument vergemakkelijken, zoals blijkt uit het effect op *waargenomen risico's* en *voordelen* zoals bedoeld door de informatie. De feitelijke invloed van QALY informatie op voedselconsumptie keuzes kan echter beperkt zijn, blijkend uit de afwezigheid van een effect van informatie op *attitudes* en *intenties* om het betreffende product te consumeren. De invloed van QALY informatie op voedselconsumptie keuzes verdient nader onderzoek.

Het tweede deel van het proefschrift (hoofdstukken 5 en 6) richt zich op *potentiële belemmeringen* voor de effectieve communicatie van risico's en voordelen. Onrealistisch optimisme kan gevolgen hebben voor de invloed van informatie over risico's en voordelen, maar is in voorgaand onderzoek alleen onderzocht in relatie tot *risico's* op het gebied van voedselconsumptie. *Hoofdstuk 5* concentreert zich daarom op waargenomen risico's *en voordelen* geassocieerd met de consumptie van vis. Een vragenlijst onder 1081 Russische consumenten toont aan dat verschillende patronen van waargenomen risico's en voordelen tussen groepen consumenten gerelateerd zijn aan optimisme over de persoonlijke risico's en voordelen, en optimisme over de persoonlijke kennis over risico's en voordelen. Deze resultaten zijn nuttig bij het ontwikkelen van effectieve interventies en geven inzicht in de potentiële effectiviteit van gezondheidsinterventies die gericht zijn op het verhogen van de waargenomen gezondheid van visconsumptie voor verschillende groepen consumenten. Bijvoorbeeld, inzicht in verschillen tussen groepen consumenten in hun waargenomen persoonlijke risico's en voordelen, en hoe deze groepen verschillen in termen van potentiële belemmeringen voor het beïnvloeden van deze percepties, geeft sturing aan meer gerichte communicatieboodschappen. Deze studie laat zien dat rekening gehouden dient te worden met zowel optimisme ten aanzien van percepties en kennis van de gezondheids*risico*'s, als optimisme ten aanzien van percepties en kennis van de gezondheids*voordelen* bij het ontwikkelen van interventies gericht op de gezondheid van de consument.

Een negativiteits-bias kan potentiële gunstige effecten geassocieerd met een levensmiddel ondermijnen. Of deze bias wel of niet optreedt zou echter af kunnen hangen van bestaande attitudes ten aanzien van een levensmiddel. In *Hoofdstuk 6*

wordt onderzocht of deze negativiteitseffecten optreden na het lezen van gebalanceerd risico-voordeel informatie over verschillende voedselproductie-methodes. Terwijl zowel eenzijdige positieve als negatieve informatie van invloed is op de vorming van post-informatie attitudes (experiment 1), kan de invloed van gebalanceerde informatie op post-informatie attitudes afhangen van initiële attitudes (experiment 2). In overeenstemming met de negativiteits-bias worden mensen met een initiële positieve attitude meer beïnvloed door de risico informatie dan door de informatie over de voordelen. Daarentegen tonen mensen met een initiële negatieve attitude een positiviteits-effect na gebalanceerde informatie voorziening. Met andere woorden, informatie heeft een attitude-incongruent effect op post-informatie attitudes. Deze resultaten tonen aan dat negativiteitseffecten dominant zijn voor mensen met een bestaande positieve attitude, maar veranderen in positiviteitseffecten voor mensen met bestaande negatieve attitudes. De implicatie is dat de communicatie van gebalanceerde positieve en negatieve informatie verschillend invloed kan hebben op mensen met positieve en negatieve bestaande attitudes.

Het derde deel van het proefschrift onderzoekt hoe consumenten reageren op communicatie over *risico management* van voedselveiligheidsvraagstukken. Communicatie over hoe er wordt omgegaan met voedselrisico's door verschillende belanghebbenden is van cruciaal belang voor het genereren van consumentenvertrouwen in het besturen en identificeren van voedselrisico's. In *Hoofdstuk 7* wordt daarom de invloed van informatie over voedselrisico's en daaraan verbonden risico management op consumenten percepties van de kwaliteit van voedsel risico management (Food Risk Management Quality of FRMQ) onderzocht. Daarnaast wordt in het onderzoek nagegaan of het specifieke voedselrisico en de specifieke culturele of sociaal-politieke context een rol spelen in FRMQ percepties. De studie laat zien dat de waargenomen kwaliteit van management afhangt van het type voedselrisico. Dit impliceert dat de fundamentele attitude ten opzichte van het voedselrisico besproken moet worden als consumenten percepties van de kwaliteit van voedsel risico management verbeterd dienen te worden. De resultaten tonen tevens aan dat het effect van communicatie op consumenten percepties verschilt tussen landen, hetgeen impliceert dat een unitair pan-Europees communicatiebeleid over risico management niet praktisch is. Ten slotte blijkt uit het onderzoek dat wanneer voedsel risicomanagers communiceren over wetenschappelijke onzekerheid omtrent voedselveiligheid, zij consumenten dienen te informeren over de handhaving van de wetgeving voor voedselveiligheid. Dit heeft gevolgen voor de coördinatie van

risico communicatie strategieën tussen risicobeoordeling en risico management organisaties (zoals het RIKILT en RIVM in Nederland en nationale ministeries).

Dit proefschrift bouwt voort op bestaand onderzoek dat vooral toegespitst was op reacties van consumenten op informatie over voedselgerelateerde risico's (*of* voordelen), door te kijken naar consumentenreacties op de gelijktijdige communicatie van voedselgerelateerde risico's en voordelen. De resultaten helpen de ontwikkeling van effectieve communicatie van informatie over geïntegreerde beoordelingen van risico's en voordelen. Geïntegreerde risico-voordeel maten kunnen de communicatie van deze informatie aan de consument bevorderen. De potentiële bruikbaarheid van QALYs als communicatie middel is echter afhankelijk van de richting van het netto gezondheidseffect en individuele kenmerken van consumenten. Het onderzoek draagt bovendien bij aan de ontwikkeling van effectieve manieren om informatie over voedselgerelateerde risico's en voordelen te communiceren. Het is hierbij belangrijk om rekening te houden met bestaande attitudes ten opzichte van het voedselproduct, en of mensen optimistisch zijn over hun persoonlijke risico's en voordelen en hun persoonlijke kennis over geassocieerde risico's en voordelen. Optimisme op het gebied van voedingskeuze kan niet alleen gerelateerd zijn aan risico's, maar ook aan voordelen die verbonden zijn met de consumptie van een voedingsmiddel. Daarnaast modereren bestaande attitudes de invloed van gebalanceerde risico-voordeel informatie op waargenomen risico's en voordelen. Tenslotte levert het onderzoek inzichten voor de ontwikkeling van effectieve manieren om te communiceren over voedsel risico management. De evaluaties van de kwaliteit van voedsel risico management van consumenten zijn afhankelijk van de specifieke context, zoals de cultuur en het type voedselrisico in kwestie.

Als gevolg van een toegenomen aandacht voor de beoordeling van zowel risico's als voordelen in het proces van voedsel risico analyse, wordt gecombineerde communicatie van voedselgerelateerde risico's en voordelen naar de consument in de komende jaren waarschijnlijk een steeds belangrijker onderwerp. Terwijl het gebied van gecombineerde risico-voordeel communicatie met betrekking tot levensmiddelen nog in de kinderschoenen staat en nadere aandacht vereist, levert dit proefschrift enkele eerste inzichten voor de ontwikkeling van effectieve gecombineerde risico-voordeel communicatie en stimuleert hopelijk verder onderzoek op dit interessante gebied.

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ABOUT THE AUTHOR

Heleen van Dijk was born in Bennekom, The Netherlands, on December 3, 1975. She finished her secondary education at the Christelijk Streeklyceum, Ede, in 1994. After one year of backpacking through Australia, she started the study of Social Psychology at the University of Amsterdam. In 2002 she obtained her Master of Science degree in Social Psychology (*cum laude*), with a specialization in consumer decision making. After living in Israel with her boyfriend, whom she married in 2007, she started her PhD research in 2005 examining consumer responses to risk-benefit information about food within the Marketing and Consumer Behaviour Group of Wageningen University. The results of this research are described in the present thesis. As of September 2010 she is working as a postdoctoral researcher within the Marketing and Consumer Behaviour Group of Wageningen University on the embedding of nanotechnology in society.

COMPLETED TRAINING AND SUPERVISION PLAN

Heleen van Dijk
Wageningen School of Social Sciences (WASS)

Name of the activity	Institute	Year	ECTS*
Project related competences			
Food risk analysis	WASS	2009	3
Quantitative data analysis: Multivariate techniques	WUR	2008	6
Advanced social theory	WUR	2008	6
Series of international workshops at SafeFoods and QALIBRA, Paris (France), Athens (Greece), Riga (Latvia), Pretoria (South Africa), Warsaw (Poland), Lisbon (Portugal), York (UK), Patras (Greece), Reykjavik (Iceland), Wageningen (Netherlands), Budapest (Hungary)		2005-09	3
SRA Europe annual meeting, The Hague, the Netherlands		2007	1
ASPO, Amsterdam, the Netherlands		2008	1
Mansholt multidisciplinary seminar	WASS	2009	1
Mansholt multidisciplinary seminar, peer review subcommittee	WASS		1
General research related competences			
Introduction course	WASS	2005	1.5
Scientific writing	CENTA	2008	1.8
Techniques for writing and presenting a scientific paper	WASS	2008	1.2
Writing PhD research proposal		2008	4
Career related competences/personal development			
Career perspectives	WASS	2009	1.8
Sensory perception and consumer preference, supervision students	WUR	2009	2
Supervising MSc student thesis	WUR	2006	1
Total (minimum 30 ECTS)			35.3

*One ECTS on average is equivalent to 28 hours of course work

Abbreviations

WASS stands for Wageningen School of Social Sciences
WUR stands for Wageningen University and Research centre
CENTA stands for Languages Services Wageningen

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