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Review

Are risk or benefit perceptions more important for public acceptance of innovative food technologies: A meta-analysis

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ABSTRACT

Research goal: This paper pursued two goals: first, to investigate the much disputed question of whether risk or benefit perceptions are more influential in people's acceptance of food technologies and second, to shed light on the relationship between the two perceptions.

Scope and approach: In total, 26 studies were selected for a random-effects meta-analysis.

Key findings and conclusions: The results suggest a high degree of variability in correlation coefficients for all three investigated relationships. This paper presents the insights gained into the perception and acceptance of food technologies, the relationships between these three factors and discusses potential moderators of the relationship strengths. Furthermore, this paper's discussion offers insights for future risk communication research by highlighting important research gaps and possibilities.

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1. Introduction

The list of technological advancements that are shaping today's food supply or that might shape it in the future is long. Prominent examples are gene technology (i.e., genetically modified organisms), nanotechnology, substances that serve technological or sensory purposes (e.g., food additives, pesticides) or decontamination of foods with irradiation. Past experience of the emergence of innovative food technologies shows that these technologies are sometimes associated with consumer uncertainty and anxiety about the safety of the food supply (Frewer et al., 2011; MacFie, 2007). The implementation and retention of a new food technology depends, among other factors, on consumers' acceptance of the technology (Bonfadelli, Dahinden, & Leonarz, 2002; Bonfadelli et al., 1996; MacFie, 2007). The role that the public's acceptance plays in the implementation of food technology gives rise to a number of important research questions for social scientists, such as "which factors determine whether a particular food technology will be accepted or rejected"? The literature on this topic is extensive with several review papers published (e.g., Bredahl, Grunert, & Frewer, 1998; Frewer et al., 2011; Gupta, Fischer, &

Frewer, 2012; Rollin, Kennedy, & Wills, 2011; Ronteltap, van Trijp, Renes, & Frewer, 2007; Siegrist, 2008). The literature has linked a variety of intra-personal, inter-personal and technology aspects to public acceptance (or rejection) of a new technology. Examples are socio-demographics, knowledge about the food technology, trust in the regulators of the food technology and the perceived naturalness of the food technology. Among the most frequently found predictors, risk and benefit perceptions appear to be vital drivers of consumer acceptance of different food technologies (e.g., Alhakami & Slovic, 1994; Frewer, Scholderer, & Lambert, 2003; Gupta et al., 2012; Siegrist, 2008). Knowledge of potentially changeable, predictive factors, such as perceptions, enables policy-makers to develop communication material that indirectly targets people's acceptance of innovative food technologies by targeting those predictive factors (e.g., highlight benefits of a technology). Thus, the main aim of this meta-analysis is to deepen the scientific understanding of the relationships between risk and benefit perceptions and the acceptance of food technologies.

1.1. Risk and benefit perceptions as predictors of acceptance

Studies have frequently discovered that experts' and laypeople's risk and benefit perceptions of food technologies do not match, with resulting conclusions for the implementation of the technology (Hansen, Holm, Frewer, Robinson, & Sandøe, 2003; Krystallis

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et al., 2007; Savadori et al., 2004). Experts mostly embrace the use of innovative food technologies, despite the small uncertainties related to potentially detrimental effects of the technology, due to the many benefits these innovations promise, either by improving food quality, safety, security or variety or by simplifying food production processes. Among other reasons for the disparity between experts and laypeople, the latter utilise different appraisal strategies (e.g., heuristics, mental shortcuts), and the resources available to them are different than those available to experts (Hansen et al., 2003; Kahneman & Tversky, 1979; Krystallis et al., 2007; Tversky & Kahneman, 1992). For a society to evolve and benefit from innovative technologies it is important to enable apprehensive consumers to understand experts' risk-benefit-appraisals and to reduce non-facts based rejection of food technologies. This requires evidence-based communication strategies on how to raise the acceptance of beneficial food technologies.

Hansen et al. (2003) suggests three interlinked tasks of risk communication: educating the public, avoiding unnecessary food scares and encouraging the acceptance of innovative, food technologies, which for example offer important societal or economic benefits. Prerequisites for achieving those goals are not only an understanding of laypeople's perceptions, but also an understanding of the impact those perceptions have on the acceptance of an innovative food technology and which contextual factors moderate this impact. Thus, a central research question is which perception weighs in more heavily on laypeople's acceptance of an innovative food technology and under which contextual circumstances. Knowledge of this will enable risk communication to focus on the more influential or salient information about either potential risks (or absence thereof) or benefits for the consumer and food production; thus, informing and changing people's perceptions and in turn their acceptance of innovative food technologies.

Most articles and reviews on the topic have concluded that benefit perceptions are generally more influential than risk perceptions (e.g., Bredahl et al., 1998; Frewer et al., 2011; Olsen, Grunert, & Sonne, 2010; Siegrist, 2000, 2008; Siegrist, Cousin, Kastenholz, & Wiek, 2007; Siegrist, Cvetkovich, & Roth, 2000), while some authors focused more intensely on risk perceptions (e.g., Cardello, Schutz, & Leshner, 2007; Eiser, Miles, & Frewer, 2002). Despite the large literature base on the public perception of food technologies, the question of which perception is more influential for acceptance has not been addressed in a systematic way. A meta-analytic investigation of the relationships between risk and benefit perceptions and acceptance could clarify this issue and provide additional insights related to important contextual factors. Thus, the primary goal of this paper was to conduct a meta-analysis of the relationships between risk perception and acceptance of new food technologies and between benefit perception and acceptance. This allows for a direct comparison of strength and variability of the two relationships.

1.2. Relationship between risk and benefit perceptions

One important aspect related to people's acceptance, risk and benefit perception was not mentioned thus far, but should not be disregarded and is this meta-analysis' secondary goal. Contemporary research suggests that risk and benefit perceptions are not independent, but rather inversely related (e.g., Alhakami & Slovic, 1994; Finucane, Alhakami, Slovic, & Johnson, 2000). Alhakami and Slovic (1994) found that people are willing to tolerate a larger amount of risk, when in turn a hazard is associated with a certain degree of benefits and vice versa. This suggests that people do not judge risks and benefits independently, as is done in scientific risk-benefit-appraisals, but rather intuitively weigh risks and benefits up against each other. An alternative, explanation for

this phenomenon is offered by Finucane et al. (2000) with the affect heuristic, which suggests that people consult an overall affective impression as a shortcut, in order to preserve mental or time resources when faced with complex decisions. Thus, a certain hazard (in this case an innovative food technology) is judged based on the affective tags associated with the technology. The authors (Finucane et al., 2000) conclude that judgments and decisions related to risks and benefits are based on both cognitive and affective processes, in dependence of contextual factors (e.g., time-pressure, mental resources).

To sum up, in an examination of the relationships between acceptance, risk and benefit perceptions, the inverse relationship between risks and benefits should not be disregarded. Thus, the secondary goal of this meta-analysis was to deepen the understanding of how these two perceptions are interlinked by systematically investigating the relationship between these two perceptions.

2. Method

2.1. Selection of relevant studies

A literature search of Web of Science and Scopus was conducted in autumn 2014. The following search terms were used: ('Food' or 'Technology') and 'Risk' and 'Benefit' and 'Perception' and 'Acceptance.' The search was restricted to English research articles. Additional articles were uncovered by looking through the

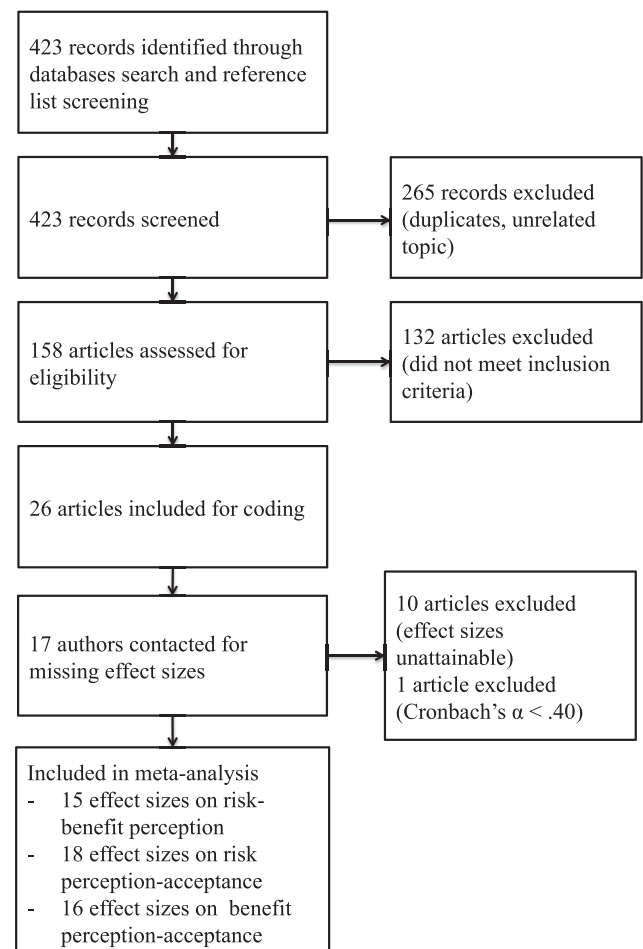


Fig. 1. Flowchart of the search and inclusion strategy.

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