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A scale for consumer confidence in the safety of food

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A scale for consumer confidence in the safety of food

Abstract

The aim of this study was to develop and validate a scale to measure general consumer confidence in the safety of food. Results from exploratory and confirmatory analyses indicate that general consumer confidence in the safety of food consists of two distinct dimensions, optimism and pessimism, which can co-exist. Since optimism and pessimism may not be activated by the same events, or at the same time, these dimensions should be assessed and evaluated separately, in order to increase understanding of consumer confidence in the safety of food, and to develop effective food risk communication.

Introduction

In response to a number of food safety scares over the past decades, food safety issues have become increasingly important within society. In order to better protect consumers, a range of new regulations have been developed and implemented (see O'Rourke, 2001). For example, food producers are obliged to incorporate quality management systems (such as Hazard Analysis Critical Control Points) into the food production process. Also, tracking and tracing systems have been introduced to be able to efficiently trace the origin of contaminated, or otherwise harmful food products or ingredients. One of the key challenges of regulatory institutions is to strengthen consumer confidence in the safety of food (Houghton et al., 2006; Regulation (EC) 178/2002), as it has been recognised that failure to incorporate public perceptions into policy development has had extremely negative effects on public confidence in the past (Frewer & Salter, 2002).

Despite the increased interest into the concept of consumer confidence in the safety of food, it has to our knowledge not been adequately defined and operationalized in the existing literature. In previous research, the extent to which consumers are confident about the safety of food in general has been assessed using single-item measures (De Jonge et al., 2004; Henson & Northen, 2000; Miles et al., 2004), which do not allow for a critical test of the reliability and validity of the measure (Churchill, 1979). Therefore, following psychometric best practice (see, for example, Baumgartner & Homburg, 1996; Churchill, 1979; Steenkamp & Van Trijp, 1991), the aim of this study is to develop a reliable and valid measure of general consumer confidence in the safety of food.

Scale development

First, the concept of general consumer confidence is defined. Then item generation and purification are discussed. In a confirmatory assessment, the convergent and discriminant validity of the scale are investigated, and in the last step the scale of consumer confidence is cross validated in another sample.

Conceptual definition

Judgments of confidence have relevance for many areas of life (Siegrist, Earle, & Gutscher, 2003). For example, people can have confidence in future economic developments (Katona, 1974), personal abilities (Brug, Lechner, & De Vries, 1995), and (as we propose) in the safety of food. Confidence can be regarded as a taken-for-granted attitude towards particular aspects of daily life (see, for example, Berg et al., 2005; Hansen et al., 2003). Confidence is based on familiarity, and may be reduced or lost when a consumer's automatic expectations are disappointed (Kjærnes and Dulsrud, 1998, as cited in Hansen et al. 2003). Although several studies have examined consumer confidence in the safety of food, their main focus was not on developing a measure for it. Previous research has focused on specific food-related hazards and issues of concern (e.g., Miles & Frewer, 2001; Setbon et al., 2005; Verbeke, 2001), how different hazards are perceived by consumers in terms of various risk characteristics, such as the extent to which hazards are known and dreaded (e.g., Fife-Schaw & Rowe, 1996; Fischhoff et al., 1978; Kirk et al., 2002; Sparks & Shepherd, 1994), and how food safety incidents influence consumer risk perceptions and purchase intentions with respect to particular foods (e.g., Pennings, Wansink, & Meulenberg, 2002). However, successive food scares, as well as more general consumer concerns about contemporary food production practices, might have long term consequences for consumer confidence in the safety of food *in general*, besides effects associated with particular product groups (Smith, Young, &

Gibson, 1999). The accumulation of incidents, no matter how different in character and in terms of risk for public health, might put pressure on consumer confidence in food safety in general. In this study, general consumer confidence in the safety of food is defined as the extent to which consumers perceive that food is generally safe, and does not cause any harm to their health or to the environment.

Item generation and purification

Based on a review of the literature, a set of 26 items designed to measure general consumer confidence in the safety of food was constructed. Some items were developed and adapted from previous research on consumer perceptions of food safety (De Jonge et al., 2004; Henson & Northen, 2000; Miles et al., 2004; Sapp & Bird, 2003). In addition, based on several studies conducted on emotions, or affective factors, in relation to consumption (Chaudhuri, 1998), various emotions (both positive and negative) were selected taking into account their applicability in the context of food safety (Laros & Steenkamp, 2004, 2005).

In a pilot study, the 26 items were tested in order to select a subset for measuring general consumer confidence in the safety of food. Data were collected by a professional market research agency in September 2003 from 106 Dutch respondents. Half of the respondents were male and half of the respondents were female. The respondents' age ranged between 18 and 60, and different levels of education were represented. The items were rated on 5-point Likert scales ranging from 'disagree strongly' (1) to 'agree strongly' (5), and are shown in Table 1. Three respondents (3%), who answered 3 or more of the 26 items (i.e., > 10%) with 'don't know', were not included in the analysis. The remaining cases contained few missing values, and data from these respondents were included in the analysis.

To examine the interrelationships between the items and the dimensional structure underlying them, principal components analysis with varimax rotation was performed in

SPSS 12.0.1 (see Table 1). The underlying structure of the data was represented by two components, which together explained 51.1% of the variance. The two components reflected a split between positive (optimism) and negative (pessimism) beliefs about the safety of food. Five items that had communalities below 0.4 were not included in the scale. In addition, four items that extremely departed from a symmetric distribution, i.e., where the most observed answer (between 31 and 46% of the responses) was one extreme of the scale, were excluded from further analysis. Two items, of which one generated relatively many missing values (i.e., 'don't know' answers) and the other was too broadly defined, were excluded as well. When two items were highly similar, e.g. 'I do not have faith in the safety of food' and 'I am confident that food products are safe', one of the items was removed. Eventually, 12 items were selected for the final scale, 6 to measure 'optimism' and 6 to measure 'pessimism' (see Table 1). The reliability of the subscales and the internal consistency of the items was high (Cronbach's alpha > 0.86 for both 'optimism' and 'pessimism').

- Table 1 about here -

Assessing convergent and discriminant validity

To formally test the dimensional structure of the two scales as well as their discriminant and convergent validity, confirmatory factor analysis was applied to a larger sample.

Data collection and sample

Surveys were administered in November and December 2003, and in total 525 respondents filled out the survey. Data were collected by a professional market research agency (GfK Panelservices Benelux B.V.), with geographical sampling by region throughout the Netherlands. The sample consisted of persons of a 'household' panel (n = 200), i.e. people

who were responsible for the daily shopping for their household, and persons from an 'individuals' panel (n = 325), i.e. people who did not have the responsibility for the daily grocery shopping. The survey consisted of the 12 items about general consumer confidence in the safety of food that were selected from the pilot study (see Table 1), next to other items dealing with consumer perceptions of the safety of food. Answers to the 12 items were rated on 5-point Likert scales ranging from 'disagree strongly' (1) to 'agree strongly' (5).

Respondents with missing values on the 12 items measuring consumer confidence in the safety of food were excluded from the analysis, leaving 458 observations suitable for analysis (87%). The remaining sample was compared with official population statistics on gender and age, and found to be representative for the Dutch population for these characteristics.

Data analysis

Confirmatory factor analysis in LISREL 8.50 was used to assess the validity of the scale of general consumer confidence in the safety of food. Maximum Likelihood was used for estimation. Assessment of model fit was based on the Satorra-Bentler (S.-B.) scaled χ^2 statistic[1] and conventional fit statistics, such as the Root Mean Square Error of Approximation (RMSEA), the Comparative Fit Index (CFI), and the Non-Normed Fit Index (NNFI), see Schermelleh-Engel, Moosbrugger, and Müller (2003) for the interpretation of these statistics. For convergent validity to be confirmed, the Average Variance Extracted (AVE) should exceed 0.50 for each subscale (Fornell & Larcker, 1981). For discriminant validity to be confirmed, the AVE for each subscale should exceed the squared correlation between the two subscales (Fornell & Larcker, 1981), and the correlation between the two subscales should be significantly smaller than 1 (Anderson & Gerbing, 1988).

Results

The two-dimensional structure underlying the 12 items fits the data well in terms of fit statistics (Table 2, Model 1). The RMSEA is below 0.05, and the CFI and NNFI are larger than 0.90. However, for three items the variance accounted for (VAF) is (far) below the minimum level of 50%. Therefore, in the first modification step, these items are removed from the scale. Two items deal with consumer perceptions of the safety of food over time (i.e., 'I believe food products are becoming increasingly safe', VAF = 0.43, and 'In recent months my confidence in food products has decreased', VAF = 0.29). The poor performance of these items on the confidence scale indicates that the extent to which consumers perceive that food is becoming increasingly safe does not necessarily indicate that they perceive it *is* safe. The third item that does not fit to the scale is 'Generally there are few risks involved with food', VAF = 0.34. The level of perceived risk associated with food and the extent to which consumers are optimistic or pessimistic about the safety of food appear to be two different things (also, see Sjöberg, 1998). General consumer confidence in the safety of food may not be based on a cognitive judgment of the perceived riskiness of food, but may rather be represented by general emotions or feelings (see also Loewenstein et al., 2001; Slovic et al., 2004). The fit statistics of the adjusted model (Model 2) are shown in Table 2.

- Table 2 about here -

The S.-B. scaled χ^2 decreases considerably, and fit indices improve, except for the RMSEA, which remains zero. However, the correlations of the two items 'Food scares increase my concern about food safety' and 'It scares me that there are problems with managing the safety of food' with other items of the scale, depart from what might be expected on the basis of the item loadings (as indicated by large residual correlations).

Therefore, these two items are excluded from the scale. Model 3, which consists of seven items, shows a further improvement of the model's fit to the data in comparison with the second model (see Table 2), and this model is chosen as the final measurement scale of general consumer confidence in the safety of food. In Table 3, the standardized factor loadings, the composite reliability and the AVE of the final scale of general consumer confidence in the safety of food are displayed. For 'optimism' the AVE is 0.55, and for 'pessimism' the AVE is 0.62, which indicates that the scale shows convergent validity. The AVE's also exceed the squared correlation (.52) between the two dimensions, which is one of the requirements for discriminant validity. The other requirement is that the correlation between the dimensions 'optimism' and 'pessimism' should be smaller than 1. This is tested by assessing the difference in fit between the uni-dimensional and the two-dimensional version of the scale. All goodness of fit indices deteriorated for the uni-dimensional scale (S.-B. scaled $\chi^2 = 48.5$ ($p = 0.0$); RMSEA = 0.07; CFI = 0.85; NNFI = 0.77), which indicates that the correlation between 'optimism' and 'pessimism' is smaller than 1, and that they are therefore distinct dimensions of the confidence scale. On the basis of these tests, it was concluded that the psychometric properties of the scale in terms of convergent and discriminant validity (see Anderson & Gerbing, 1988; Fornell & Larcker, 1981) are satisfactory.

- Table 3 about here -

Cross-validation

The two-dimensional structure of the 7-item scale is cross-validated by a separate sample. An Internet survey was filled out by 563 respondents that were recruited by means of quota sampling on the basis of gender, age, household size, education level, and area of residence.

Again, respondents with any missing values on the confidence items are excluded, leaving 520 (92%) observations for the analysis. The two-dimensional structure of the confidence scale fits the data well (S.-B. scaled χ^2 (13 *df*) = 9.8, p = 0.7; RMSEA = 0.0; CFI = 0.99; NNFI = 0.98). Both convergent and discriminant validity are confirmed. Multigroup confirmatory factor analysis is applied to assess the equivalence of the scale across the two samples (i.e., the sample used to assess convergent and discriminant validity and the Internet sample to cross-validate the scale), using the approach as suggested by Steenkamp and Baumgartner (1998). The sequential constraints imposed on the item loadings, the item intercepts, the factor covariance, the factor variances, and the error variances of the items do not result in a deterioration of the model fit (see Table 4), which indicates that the scale of general consumer confidence in the safety of food is invariant for the two samples. It can be concluded that the scale is robust for the Dutch population.

- Table 4 about here -

Conclusion and discussion

The concept of general consumer confidence in the safety of food can be conceptualized along two dimensions, i.e., optimism and pessimism. Positive (optimistic) and negative (pessimistic) perceptions about the safety of food are not two end poles of a uni-dimensional scale. This indicates that optimism and pessimism are conceptually distinct, and can to some extent co-exist, as evidenced by the finding that 52% of the variance of the two dimensions is common variance, and the other half is unique variance. This confirms similar findings in other domains of consumer behaviour such as the distinction between positive and negative attitudes (Cacioppo, Gardner, & Berntson, 1997; Conner & Sparks, 2002), dispositional optimism and pessimism in the context of health (Kubzansky, Kubzansky, & Maselko, 2004),

and trust and distrust (Lewicki, McAllister, & Bies, 1998; Poortinga & Pidgeon, 2003). Also in those domains it has been suggested that positively and negatively oriented perceptions constitute distinct dimensions that can be relatively independent from each other.

Optimism and pessimism may not be activated by the same events, or at the same time. A study by Frewer et al. (2002) in a related field, indicated that food related risk communication differentially influenced perceptions of risk and benefit. That is, during a high level of media coverage about genetically modified food, both perceived risk, which increased, as well as perceived benefit associated with the technology, which decreased, were affected. However, when media coverage of genetic modification of food subsequently diminished, risk perception dropped to the level prior to increased media attention, but perceived benefits with regard to genetically modified food remained depressed (Frewer et al., 2002). This example shows that a single event can have different consequences for perceived risk and benefit. Similar effects might be found for optimism and pessimism in the context of a food safety incident or risk communication aimed at restoring consumer confidence in the safety of food. Focusing on either optimism or pessimism, or integrating these two dimensions into one measure, may result in a biased view of reality. For example, communication activities might result in increased optimism, but when worries are not taken away by the communication, focusing solely on the degree of optimism leads to an underestimation of the existence of concerns with consumers. Similarly, if only pessimism is being assessed, the situation might be evaluated as alarming when many people show feelings of pessimism, whereas the existence of concerns with consumers does not necessarily indicate that people do not see any positive aspects. Therefore, when optimism and pessimism are not assessed as distinct concepts, important information may be lost.

In future research, the concept of consumer confidence in the safety of food can be embedded in a theoretical framework to investigate consumer perceptions of food safety,

where its relationships with other relevant constructs can be assessed. For example, the extent to which optimism and pessimism are differentially influenced by food safety events, as well as the extent to which optimism and pessimism relate to behavioral measures, such as food purchases, can be investigated. Further, the optimism and pessimism dimensions of general consumer confidence in the safety of food can in future applications be used as indices to investigate developments in consumer confidence over time. That is, the measures of optimism and pessimism can function as benchmarks to compare subsequent assessments against, and to examine whether there are any trends in the level of consumer confidence in the safety of food.

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Footnote

[1]A check of the multivariate normality of the data indicated that the data departed from normality. Hence we applied a Satorra Bentler (S.-B.) χ^2 correction to account for this (see, Chou & Bentler, 1995).

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Table 1. Means, standard deviations, communalities, and rotated factor loadings for the consumer confidence in the safety of food items

Statements	Mean (std)	Communality	Rotated factor loadings	
			Pessimism (VAF=42%)	Optimism (VAF=9%)
Food products have never been as safe as nowadays [a]	3.14 (1.14)	0.351	-0.071	0.588
I believe food products are becoming increasingly safe [f]	3.49 (1.11)	0.673	-0.102	**0.814**
Food scares increase my concern about food safety [f]	2.58 (1.29)	0.669	**0.814**	-0.072
In recent months my confidence in food products has decreased [f]	2.18 (1.06)	0.678	**0.663**	-0.489
Generally there are few risks involved with food [f]	3.43 (1.05)	0.503	-0.240	**0.667**
Too often it happens that food products are sold in the Netherlands that are dangerous to consume [d]	2.52 (1.16)	0.552	0.701	-0.247
I worry about the safety of food	2.72 (1.20)	0.568	**0.688**	-0.308
I do not have faith in the safety of food [c]	2.33 (1.14)	0.512	0.575	-0.426
I am afraid to become ill as a consequence of the products I eat [a]	2.05 (1.00)	0.259	0.354	-0.366
I am confident that food products are safe	3.87 (1.02)	0.519	-0.490	**0.528**
I get very stressed when I think about food safety [b]	1.96 (0.98)	0.415	0.513	-0.390
I think the quality of food will increase [e]	3.61 (1.04)	0.629	-0.070	0.790
I feel uncomfortable regarding the safety of food	2.35 (1.15)	0.65	**0.788**	-0.170
Generally food products are safe	3.83 (0.89)	0.554	-0.334	**0.666**
As a result of the occurrence of food safety incidents I am suspicious about certain food products	2.90 (1.29)	0.498	**0.678**	-0.195
I feel frustrated about the problems that come up in the area of the safety of food [b]	2.47 (1.31)	0.569	0.715	-0.240
I believe few risks are involved in the consumption of food products [c]	3.33 (1.12)	0.443	-0.258	0.613
It scares me that there are problems with managing the safety of food [f]	2.90 (1.22)	0.588	**0.745**	-0.183
I am calm about all discussions about the safety of food [a]	3.75 (1.12)	0.345	-0.414	0.417
Problems that occur in the area of food safety make me angry [a]	3.11 (1.24)	0.249	0.485	-0.119
I feel hopefull about the developments in the area of food safety [c]	3.51 (1.06)	0.486	-0.145	0.682
I feel nervous when I think about the safety of food products [b]	2.00 (1.03)	0.563	0.661	-0.356

Table 1. Means, standard deviations, communalities, and rotated factor loadings for the consumer confidence in the safety of food items (continued)

Statements	Mean (std)	Communality	Rotated factor loadings	
			Pessimism (VAF=42%)	Optimism (VAF=9%)
I am optimistic about the safety of food products	3.51 (1.01)	0.671	-0.365	**0.733**
I panic as a result of food safety incidents that occur [b]	1.89 (1.01)	0.468	0.683	-0.048
I feel helpless as a consumer, with regard to the safety of food [a]	3.03 (1.34)	0.305	0.490	-0.256
I am satisfied with the safety of food products	3.38 (1.12)	0.562	-0.424	**0.618**

Note: Statements in bold indicate that the item has been selected for the confirmatory test of the subscales.
[a] Excluded on the basis of low communality (<0.40)
[b] Excluded on the basis of asymmetric distribution
[c] Excluded on the basis of overlap in content
[d] Excluded on the basis of a high number of "don't know" answers
[e] Excluded on the basis of a too broad item content
[f] Excluded on the basis of Confirmatory Factor Analysis

Table 2. Model fit statistics

	χ^2	S.-B. scaled χ^2	df	RMSEA	CFI	NNFI
Model 1	205.7	47.2	53	0.00	0.94	0.93
Model 2	94.3	21.5	26	0.00	0.97	0.95
Model 3	47.6	8.8	13	0.00	0.98	0.96

Note that χ^2 difference tests cannot be performed, as the estimated models are not nested and S.-B. scaled χ^2 values cannot be used for χ^2 difference testing (see, Schermelleh-Engel, Moosbrugger, & Müller, 2003).

Table 3. Standardized factor loadings, reliability and average variance extracted for the final measurement scale of consumer confidence in the safety of food

Optimism	
I am optimistic about the safety of food products	0.70
I am confident that food products are safe	0.70
I am satisfied with the safety of food products	0.82
Generally food products are safe	0.74
Reliability	*0.83*
Average variance extracted	*0.55*
Pessimism	
I worry about the safety of food	0.87
I feel uncomfortable regarding the safety of food	0.81
As a result of the occurrence of food safety incidents I am suspicious about certain food products	0.68
Reliability	*0.83*
Average variance extracted	*0.62*

Table 4. Assessment of measurement invariance across samples

	χ^2	S-B scaled χ^2	df	RMSEA	CFI	NNFI
Configural invariance	80.4	17.3	26	0.00	0.98	0.97
Metric Invariance	82.7	18.1	31	0.00	0.98	0.98
Scalar invariance	95.8	24.6	38	0.00	0.98	0.98
Factor covariance invariance	99.6	26.1	39	0.00	0.98	0.98
Factor variance invariance	120.0	32.0	41	0.00	0.98	0.98
Error variance invariance	137.3	26.6	48	0.00	0.97	0.98