

An Instrument for Measuring Take-out Food Safety Perception

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테이크아웃 음식의 안전에 대한 고객인식도 측정을 위한 척도에 관한 연구

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Abstract

This study was conducted to evaluate a take-out food safety perception instrument that could be used by foodservice establishments. A total of 324 responses was collected via online survey, and 299 responses (92.3%) were used for the statistical analysis. Data was randomly split into two groups. Exploratory Factor Analysis (EFA) was performed on the first split-half sample (n=150) to identify a factor structure using standard principal component analysis. EFA revealed three dimensions, titled “Consumer food safety perception,” “Take-out food handling,” and “Elements impacting on purchase decisions.” Confirmatory Factor Analysis (CFA) was performed on the remaining half sample (n=149) using Structural Equation Modeling (SEM). CFA revealed acceptable absolute model fits for three dimensions and excellent comparative model fits for the instrument. These findings propose standardized measures that can be useful in assessing the take-out food safety perception.

Key words: Take-out food safety perception, Measurement, Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA)

I. INTRODUCTION

Currently, consumer can find competitively priced food products from everywhere. In the meantime, each food item must be safe, aesthetically pleasing, good tasting, and consistent with the product’s image. Food safety standards require proper handling from production through consumption. Although standards in the United States are the highest in the world and consumer guidance on proper food handling is available through magazines,

newspapers, food labels, and other sources, mistakes still occur (Christine M & Bruhn HGS 1999; USDA 2001).

Foodborne disease remains a significant public health problem in the 21st century. Therefore, it became one of the top priorities in the Healthy People 2010 initiative (Health and Human Services 2006). The Centers for Disease Control and Prevention (CDC) and the Food and Drug Administration (FDA) estimate that, based on reported outbreaks and other epidemiologic data, between 6.5 and 33

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million people in the United States become ill from microbial pathogens in their food each year (Food Institute Report 2007).

As take-out food consumption increases annually, concerns are also increasing about the public's perception of safe food handling practices. This increase in take-out food consumption is accompanied by increasing risk of foodborne illnesses (Binkley M & Ghiselli R 2005). Unlike commercial food production units, take-out foods are needed to take many precautions to minimize pathogen contamination of take-out foods and food containers because they are the final line of defense against foodborne illnesses. In spite of proper sanitary practices by foodservice personnel, when take-out food has left an establishment, consumers must rely on their own food safety perceptions and the integrity of the packaging to avoid eating a contaminated product. Take-out products comprise up to 10% of total sales of some establishments.

However, few studies regarding comprehensive criterion-referenced measures assessing a full range of consumer take-out food safety perception have been conducted. Without appropriate, valid, and reliable measures and baseline data, it is difficult to develop and implement effective conclusions. Therefore, this study was designed to test reliable and valid instrument to assess consumers' perception of take-out food safety. Rigorous measurement development methodologies, including splitting database, exploratory (EFA) and confirmatory factor analysis (CFA) procedures, were used.

II. LITERATURE REVIEW

1. Increased consumption of take-out food

Over the last three years, curbside take-out has doubled the annual take-out sales of chain concepts

such as Outback Steakhouse, Applebee's, and Chili's (Warner M 2006). This increase in sales indicates a huge profit for the chains, especially considering that 57% of the U.S. population takes out food at least once a week (Klara R 2004). Especially, coffee shop has many choices of take-out food and beverage. Kim Y (2003) evaluated the choice attribute and customer satisfaction of a take-out coffee shop. With increased consumption of take-out food, risks to the consumer associated with a general lack of food safety knowledge and practices are increased (Binkley M & Ghiselli R 2005). Although the federal government regulates the manufacture of single use packaging items with regard to health issues and environmental safety concerns, there is no governmental regulation on the packaging or labeling of take-out food (Food Institute Report 2007). All food safety standards are self-regulated, leaving the responsibility to the restaurant operators to ensure the safety of products and services they provide (Binkley M & Ghiselli R 2005).

2. Studies related to Food Safety Issue

A number of research issues related to food safety have been raised in recent literatures (Binkley M & Ghiselli R 2005; Eo GH & Hahm MH 2009); Food Institute Report 2007; Lando A & Fein S 2007; Lee YE 2008; Silayoi P & Speece M 2004). These studies have noted that delayed consumption of the take-out food after improper food storage is a food safety risk. Lack of knowledge about the handling of take-out foods once the foods leave the foodservice operations is a particular concern related to time and temperature control. However, few perception questionnaires and no comprehensive criterion-referenced measures assessing a full range of consumer take-out food safety perception have

been implemented. For example, Silayoi P and Speece M (2004) evaluated customer's decision regarding packaging and the quality of take-out service without reporting reliability index. Without appropriate, valid, and reliable measures and baseline data, it is difficult to develop and implement effective conclusions. Therefore this study was aimed to evaluate a take-out food safety perception instrument using EFA and CFA respectively.

III. METHODS

1. Study Design

This study followed the scale development paradigm described by Churchill GA (1979), using the theoretical frameworks, questionnaire items were created based on previous studies of consumers' behavior with take-out food (Binkley M & Ghiselli R 2005; Food Institute Report 2007; Lando A & Fein S 2007; Silayoi P & Speece M 2004). The first steps in developing better measures are to define the construct conceptually and then to specify its domain. Configuration of the instrument was based on a survey designed to measure elements regarding food safety issues and training methods for ready-to-eat foods in the grocery industry (Binkley M & Ghiselli R 2005). A panel of experts reviewed and evaluated the original item pool for content validity and clarity of expression. They also reviewed and evaluated the items for applicability and comprehension. Also, ethical approval was obtained from the Advisory Committee on Institutional Review Board (IRB) to protect the rights and welfare of research subjects. In the survey, participants were asked to respond to each statements to elicit the most important aspects driving the consumer's decision to purchase take-out food as well as to understand the level of food

safety knowledge of the average consumer on a 7-point Likert-type scale; response choices ranged from 1 (totally agree) to 7 (totally disagree). Respondents were presented with a number of items, some positively phrased and some negatively phrased, which have been found to discriminate most clearly between extreme views on the subject of study. The next section of the survey included seven demographic questions.

2. Sampling

Snowball sampling was used to conduct the survey. Snowball sampling is a term used for sampling procedures that allow the sampled units to provide information not only about themselves but also about other units. This might be advantageous when rare properties are of interest (Frank O & Snijder T 1994). Respondents were randomly selected, and invitations to participate in the survey were sent via e-mail. The e-mails included the domain address link where they could find the questionnaire. Respondents were directed to answer the questionnaire online, and the responses were linked to the researcher's database. At the last part of the questionnaire, respondent could recommend the survey by providing other people's e-mail addresses. In addition, five hundred cards printed with the URL of the survey were placed in to-go containers of selected restaurants representing high volume fast food, quick service restaurants with pick up counters, and casual dining featuring curbside service. The survey was administered via surveymonkey.com.

3. Data Analysis

Descriptive statistics were used to summarize demographic and baseline characteristics. ANOVA and *t*-tests were used to compare group differences.

Three food safety experts and graduate students in the foodservice field at a major university assessed the face validity of the instrument. The total sample ($n = 299$) was randomly divided into two split-half samples ($n_1 = 150$, $n_2 = 149$). Research has suggested that the sizes of these split-half samples are sufficient to confirm the reliability and 'goodness of fit' of measures using Structural Equation Modeling (SEM)(Marsh HW, Balla JR & McDonald RP 1988). With the first split-half sample ($n_1 = 150$), standard procedures of principle component factor analysis were used to determine a factor structure for each scale (DeVellis RF 1991) using SPSS 15.0. The scree test, eigenvalues, the interpretability of the factors, theoretical considerations were used to define all factor structures. Construct validity was evaluated by conducting Exploratory Factor Analysis (EFA). Cronbach's coefficient alpha values were used to determine the reliability of each construct. When the required dimension reliability level was reached, coefficient alpha for the total-item was calculated. Further validity of the measurement model was assessed by Confirmatory Factor Analysis (CFA). The hypothesized measurement and structural models were tested by performing latent variable Structural Equation Modeling (SEM) with moment structure

analysis software (AMOS 7.0). SEM is a statistical approach that has the capacity to comprehensively and simultaneously test hypotheses among observed and latent variables.

IV. RESULTS

1. Demographics

Out of the 324 surveys collected, 299 surveys were analyzed in this study. Twenty five surveys were unusable for data analysis because the participants failed to complete all portions of the survey. Eighty-six percent of the sample reported purchasing take-out food at least once per week, for an average monthly purchase of 7.09 times. This behavior resulted in an average of \$80.04 spent on take-out food per month, per person. The average age of respondents was 45.30 years, and the most of respondents were female (80.27%), white (87.63%), and married (63.88%). The sample reflected a wide education level from high school diploma to graduate degree, with the majority holding a undergraduate degree (Table 1).

2. Analysis of Validity and Reliability

To the first split-half sample ($n = 150$), EFA with a VARIMAX rotation procedure and Cronbach's

<Table 1> Demographic characteristics of the respondents

($n = 299$)

Gender	Frequency	%	Marital Status	Frequency	%
Female	240	80.27	Married	191	63.88
Male	59	19.73	Single	71	23.75
			Divorced	28	9.36
			Widowed	9	3.01
Educational Level			Ethnicity		
High School Diploma	19	6.35	White, Non-Hispanic	262	87.63
Undergraduate Degree	141	47.16	Hispanic	17	5.69
Graduate Degree	134	44.82	African-American	2	0.67
Others	5	1.67	Asian	11	3.68
			Others	7	1.67

alpha test were conducted. A sample size of 150 suggested factor loading of .30 for significance (Fornell C & Larcker DF 1981). All attributes had factor loadings of .55 or greater in the analysis. The factors identified were titled “Consumer food safety perception,” “Take-out food handling,” and “Elements impacting on purchase decisions” (Table 2). The final questionnaire comprised eight statements relating to these three factors cumulatively, the three factors accounted for 67.31% of total variance. The final scale showed a Cronbach’s coefficient of .62, with 10 items having internal consistency (Peterson RA 1994). Moss S et al. (1998) suggest that an alpha score of .60 is generally acceptable, although this criterion is not as stringent as the more widely recognized .70 threshold (Nunnally JC & Bernstein IH 1994).

For construct validity, the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy (MSA) and the Bartlett Test of Sphericity were used to determine the appropriateness of applying factor

analysis to customers’ take-out food safety perceptions. Based on the criteria .60 for the MSA index, the value of MSA found in the study was .69 and thus verified that the use of factor analysis was appropriate. Bartlett’s Test of Sphericity value (χ^2) was 455.80 ($df = 45, p < .001$), with overall significance of the correlation matrix ($p < .001$). This test explained that the data used did not produce an identity matrix and thus was multivariate normal and acceptable for applying factor analysis.

3. Result of Confirmatory Factor Analysis

In addition, structure coefficients were computed using maximum likelihood estimation. The results of the CFA are also presented in <Table 2>, including factor loadings, mean scores, and standard deviations based on the second split-half sample ($n_2 = 149$). All factor loadings ranged from .33 to .93 and the take-out food safety perception model was conceptualized with three dimensions, also called constructs, and each dimension in-

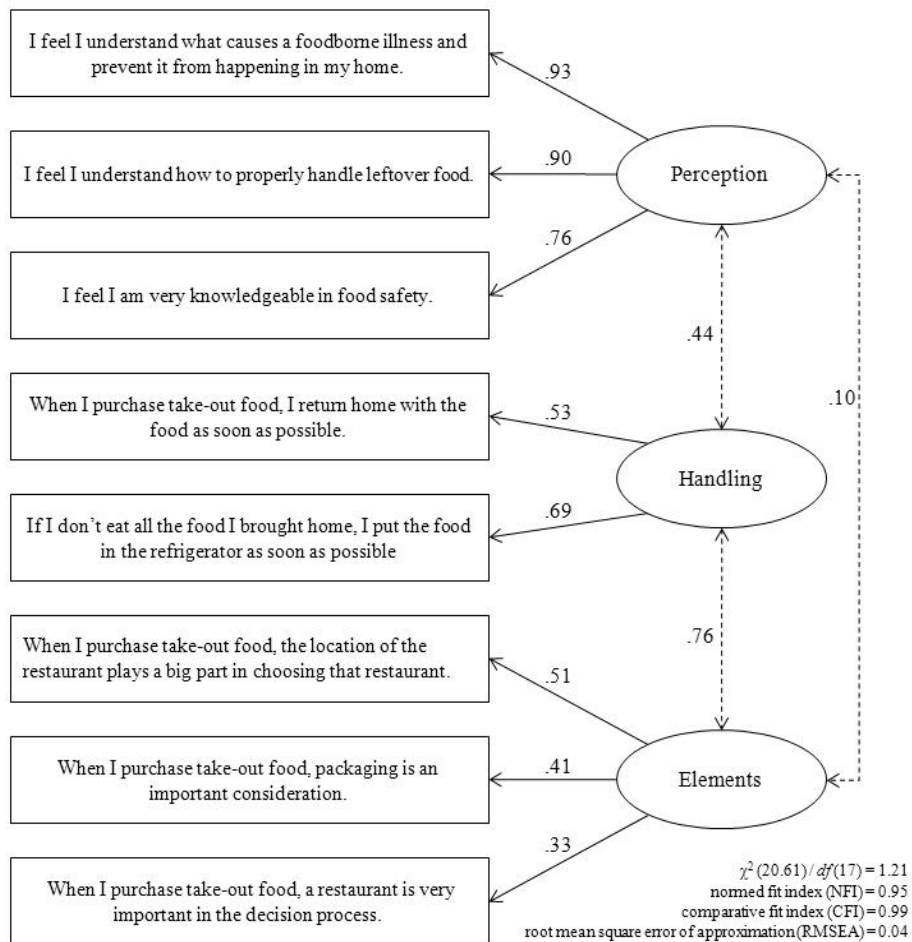
<Table 2> Exploratory factor analysis and confirmatory factor analysis of the mean scores, standard deviations, and factor loadings of a take-out food safety perception instrument

Factors and Statements	EFA (n=150)			CFA (n=149)		
	Loading	Mean	SD	Loading	Mean	SD
Consumer food safety perception						
I feel I understand how to properly handle leftover food.	0.94	4.04	0.83	0.93	4.07	0.77
I feel I understand what causes a foodborne illness and prevent it from happening in my home.	0.94	4.01	0.87	0.90	4.03	0.85
I feel I am very knowledgeable in food safety.	0.90	3.85	0.91	0.76	3.85	0.83
Handling of take-out food						
When I purchase take-out food, I return home with the food as soon as possible.	0.83	4.39	0.83	0.53	4.32	0.88
If I don't eat all the food I brought home, I put the food in the refrigerator as soon as possible.	0.83	4.23	1.06	0.69	4.34	0.83
Elements impacting on purchase						
When I purchase take-out food, the location of the restaurant plays a big part in choosing that restaurant.	0.70	3.28	0.88	0.51	3.11	0.88
When I purchase take-out food, packaging is an important consideration.	0.63	4.19	0.75	0.41	4.32	0.67
When I purchase take-out food, a restaurant is very important in the decision process.	0.55	4.45	0.62	0.33	4.44	0.64

cluded more than two items (Figure 1). Three constructs were intercorrelated, and coefficients of the error terms over the endogenous variables were fixed to 1. A number of fit index measures were used to determine whether dimensions based on EFA fit the data. CFA revealed that the normed fit index (NFI), comparative fit index (CFI), root mean square error of approximation (RMSEA), and $\chi^2(20.61) / df(17)$ were .95, .99, .04, and 1.21, respectively (Figure 1). The indices showed the model was fit, and the results explained that all

standardized factor loadings identified, meaning that all items reflected the constructs. Covariance among the three factors identified by EFA was supported by a significant positive value. A significant value for measuring take-out food safety perceptions of restaurants suggested that the relationships among the four dimensions were statistically significant.

To conclude, the results showed a good fit of the measurement model and presented convergent validity to the defined scale in order to measure



Notes: All coefficient values are standardized and appear above the associated path. Dotted lines represent correlations.

<Fig. 1> Confirmatory Factor Analysis: The Three-Factor Model

consumers' take-out food safety perception of foodservice operations. Given that the model showed a good fit, the internal consistency was analyzed by Cronbach's coefficient alpha, the construct reliability and the variance extracted for each of the latent variables. The measurement model, when assessed as a whole, showed the good fit, and the indicators showed convergent validity and reliability in the respective latent concepts.

V. DISSCUSSION

Overall, the instrument for measuring the take-out food safety perception of foodservice establishments developed in this study met or exceeded the standards of reliability and validity. This study is the first research to report the evaluation of a take-out food safety perception scales that has been tested for reliability and validity. Thus, foodservice operations could evaluate consumers' take-out food safety perceptions using multiple methods, including this instrument. Foodservice operators can use this instrument to assess the food safety perceptions and knowledge of their consumers. Systematic assessment over time will allow foodservice not only to identify the impact of food safety initiatives but also to promote these efforts to consumers. Systematic assessment can reduce the misallocation of societal resources by identifying data gaps, prioritizing food safety problems, and estimating the marginal costs and benefits of alternative public and private control strategies. The take-out food safety perception instrument was also designed to provide educators with a tool that will be used to document knowledge of recommended practices and attitude regarding take-out food safety issues.

However, a limitation in sampling method may

have impacted the results of this study. The subjects recruited for the study were a random sample of U.S. Internet users limiting the generalizability of the study results. Although the scale was designed for a wide variety of audiences, it has not been tested with individuals who speak a language other than English. In addition, when conducting the reliability and validity testing, this study made an assumption that U.S. Internet users were representative of the general public. Future studies could include a more representative database since take-out food is expanding around the world and also examine factors not addressed in this study, for example, satisfaction level of take-out food products among respondents in different locations and of different age groups, education, and income.

한글 초록

외식산업에서 테이크아웃 음식이 대중화 되고 있으며 이에 대한 다양한 전략이 꾸준히 수립되어야 하며 이에 대한 고객의 인식을 살펴보는 연구가 필요하다. 따라서 본 연구는 테이크아웃 음식의 위생에 대한 고객의 인식도를 측정하기 위한 척도의 타당도와 신뢰도를 평가하고자 수행되었다. 온라인 서베이를 통해 324개의 응답을 확보하였고 이중 불성실하게 기입된 응답을 제외하고 299개의 데이터를 분석에 사용하였다. 데이터는 랜덤하게 2개의 세트 ($n_1=150$, $n_2=149$)로 분할되었고, 1차 데이터는 탐색적 요인분석에 2차 데이터는 확인적요인 분석에 사용되었다. 탐색적 요인분석을 실시한 결과 세 개의 요인이 추출되었으며, 이를 “Consumer food safety perception,” “Take-out food handling,” and “Elements impacting on purchase decisions.” 라고 명명하였다. 이어 실시된 확인적 요인분석의 결과는 본 연구에서 제시된 척도가 신뢰도와 타당도가 높으며 고

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2012년 01월 13일 1차 논문수정
2012년 03월 08일 2차 논문수정
2012년 03월 17일 게재 확정