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journal homepage: www.elsevier.com/locate/ijgfsMental representation of domestic cooking operations among Japanese consumers[☆]Yuko Minami^{a,b,1}, Yasushi Kyutoku^{b,1}, Masako Okamoto^c, Yuko Kusakabe^d, Takeshi Koizumi^a, Ippeita Dan^{b,*}^a Nichirei Corporation, Chuo-ku, 104-8042 Tokyo, Japan^b Research and Development Initiatives, Chuo University, 1-13-27 Kasuga, Bunkyo-ku, Tokyo 112-8551, Japan^c Department of Applied Biological Chemistry, Graduate School of Agricultural and Life Sciences, The University of Tokyo, Tokyo 113-8657, Japan^d Food Research Institute, NARO, Tsukuba, Ibaraki 305-8642, Japan

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ABSTRACT

Cooking is a daily undertaking that ensures the proper ingestion of food. However, mental representations of home cooking have yet to be quantitatively elucidated. The primary purpose of the series of three studies presented here was to quantitatively describe the conceptualization of cooking among Japanese consumers by employing Internet surveys. The first study extracted superordinate categories of cooking-related operations, (1) core cooking, (2) subsidiary cooking and (3) convenience food preparation, for 100 Japanese consumers by utilizing an exploratory factor analysis of 30 presumably cooking-related operations. The second study made further sub-categorizations within each superordinate category by utilizing hierarchical cluster analyses in 500 newly recruited Japanese consumers. Core cooking was sub-categorized into “to pickle”, “to cut and heat”, “to season”, and “to mix”. Subsidiary cooking was sub-categorized into “to preserve”, “to acquire”, and “to arrange”. Convenience food preparation was not further sub-categorized. In Study 3, based on the fit indices obtained from structural equation modeling, the appropriateness of the categorizations and sub-categorizations of Studies 1 and 2 was confirmed using 500 newly recruited Japanese consumers. Thus, the current study is the first to quantitatively examine the conceptualization of cooking by elucidating the relationships among a variety of cooking-related operations.

Introduction

The proper ingestion of food is indispensable to the maintenance and promotion of health, or more fundamentally, to life. In order to secure proper food ingestion, mankind has learned to use tools and techniques that have enabled a variety of cooking operations (Wrangham and Conklin-Brittain, 2003). Cooking serves to provide safe and efficient food through (1) elimination of toxic substances, (2) prevention of hygienic hazards, and (3) enhancement of preservability (Collie et al., 1913; Sofos, 1993). Besides increased safety and efficiency, cooking augments the facility and pleasantness of eating. For instance, heating foods induces chemical and physical changes in them, leading to the elimination of unpleasant substances, changes in size and shape, and enhanced texture (Fryer and Robbins, 2005), and, further, to easier and more pleasant food ingestion (Guo et al., 1999). Thus, cooking plays wide variety of indispensable roles in preparing foods in

daily life.

Cooking is not defined by a single facet because it encompasses a wide variety of operations (Lavelle et al., 2017). For instance, cooking-related operations include food preparation, cooking practices, recipe use and food management in addition to cooking (McGowan et al., 2017). In addition to the diversity of cooking operations, individual differences in the categorization of cooking add to the complexity (Wolfson et al., 2016a, 2016b). For instance, the development of processed foods in developed countries (McGowan et al., 2017; Short, 2003a) and an increased number of double-income families has resulted in an increased consumption of convenience foods to save time in many families while other families adhere to traditional home cooking (Ministry of Agriculture, Forestry and Fisheries of Japan, 1993; Cabinet Office, Government of Japan, 2006). As a result, conceptualization of food preparation would be rather diversified among people (Byrd-Brendbenner, Abbot, and Cussler, 2008). Further, home cooking and

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professional cooking operations are contextually different, and require different skills and utensils (Short, 2003b). Thus, it has become unclear (1) the way cooking is conceptualized, and (2) whether the conceptualization of cooking differs among people. By examining these, we aimed to provide a conceptual framework of cooking among Japanese consumers, which will primarily serve as a steppingstone for further conceptualization of cooking in different cultures, and secondarily provide a strategic reference for food industries in designing food products or services targeting specific aspects of cooking.

Overview of the current study series

We conducted three studies to unveil the conceptualization of home cooking among Japanese people. Study 1 examined superordinate cooking categories by employing an exploratory factor analysis based on ratings of the degree of cooking of certain operations. In Study 2, the factor structure of cooking-related operations from Study 1 was replicated and further sub-categorization within each factor was performed by employing a hierarchical cluster analysis. Finally, in Study 3, a hypothesized model of the relationships between a cooking category and its subcategories based on Study 2 results was examined by utilizing structural equation modeling (SEM). Through these analyses, we will present, for the first time, a quantitative description of the concept of home cooking among Japanese consumers.

Study 1

Study 1 was designed to explore the categorization of cooking-related operations. Further, associations between demographic factors (age, gender, and years of cooking experience) and extracted factors were explored.

Methods

Participants

An online survey company (Rakuten Research Co., Tokyo, Japan) was contracted to collect the responses ($n = 100$, mean age = 43.22 years old and SD for age = 15.2). Quotas were set to be equal for females ($n = 50$) and males ($n = 50$) in order to equally reflect demographic distribution in Japan. To fill the quota, participants were randomly selected from each gender from the participant pool of the online survey company ($N > 1.7$ million), and those who voluntarily agreed to participate responded to the online survey. Table 1 presents the descriptive statistics for Study 1.

Measures

Three researchers from the National Food Research Institute of Japan, who had been involved in food research or had worked for the food industry for at least 3 years, sampled representative operations that were presumably regarded as cooking (Table 2). Conventional operations across cultures were sampled referring to the cooking-related operations described in the Cooking Terms Dictionary (Wellman, 1917). For a more modern and culture-based reference, responses to free-answer questions in consumer surveys on cooking-related procedures routinely performed by Nichirei Foods Ltd. were examined.

Table 1
Descriptive statistics for Study 1 ($n = 100$).

Variable	Mean	s.d.
Years of cooking experience	19.98	14.69
Cooking factors		
Core cooking	4.31	.66
Subsidiary cooking	3.01	.89
Convenience food preparation	2.64	.94

Notes. s.d. stands for standard deviation.

Additional surveys were performed on authentic modern American and Japanese culinary textbooks: Culinary Institute of America (CIA, 2001), McGee (1984), All Japan Culinary School Association (2005) and Yamazaki et al. (2011). Finally, a Japanese research article that sampled cooking-related items was referred to (Hamada et al., 2000). Of those sampled operations, all three researchers agreed about the use of 30 items that cover wide range of cooking operations. Then, to unveil the conceptualization of cooking, a typicality judgment of category membership task was used in the current study (Malt and Smith, 1984; Rosch, 1975). This task was used because it has been reported to reflect real-life categorization better than other tasks such as word generation or lexical decision tasks (Malt and Smith, 1984; Rosch, 1975). In the typicality judgment of category membership task, participants are explicitly asked to “judge the typicality of category membership” of sampled items (Reisberg, 2006). Here participants were asked to rate the 30 operations based on their perception of the operations’ typicality as “cooking” based on a 5-point scale from 1 (‘Do not regard it as cooking at all’) to 5 (‘Completely regard it as cooking’).

Procedure

After agreeing to the survey with informed consent, participants started by responding to demographic questions such as age, gender, marital status, and years of cooking experience. They then rated the typicality as “cooking” of cooking-related operations. Items were presented randomly within each scale. After responding to the questions, the participants were discharged. The entire procedure took approximately 25 min to complete.

Data analyses

SPSS 17.0 was used for the following statistical analyses throughout the current series of studies. An exploratory factor analysis based on a least square method with a promax rotation was performed to categorize items regarding cooking-related operations based on the rated degrees of “cooking”. Criteria for extracting factors were based on (a) Kaiser’s rule (Kaiser, 1960), (b) the Scree Test (Cattell, 1966), and (c) interpretability of extracted factors (Tabachnik and Fidell, 2007; Mertler and Vannatta, 2005). Stringent criteria for factor loadings at .55 were used based on criteria by Comrey and Lee (1992). After the extraction of factors, correlations among extracted factors were explored. Direction of correlation among factors was expected to be positive. Finally, correlation among demographic variables and extracted factors were explored. Only associations that were larger than moderate ($r = .30$) were interpreted.

Results

Exploratory factor analysis of direct “cooking” question items

Thirty cooking-related operations were summarized into categories by an exploratory factor analysis with a promax rotation. Based on the criteria, only the first three factors were used to categorize the operations because of the poor interpretability and relatively low eigenvalue of the fourth factor. The factors (Table 2) were interpreted and labeled as *core cooking* (Cronbach’s $\alpha = .95$, $n_{items} = 16$), *subsidiary cooking*, (Cronbach’s $\alpha = .85$, $n_{items} = 6$), and *convenience food preparation* (Cronbach’s $\alpha = .86$, $n_{items} = 5$), which respectively accounted for 45.1%, 11.6%, and 6.7% of variance in cooking-related operations. The factors were named based on the cooking operations most typically associated with each factor (Tables 2, 4) as well as on the rated typicality of each factor itself (Tables 1, 3, 5). For example, *core cooking* is associated with basic cooking operations such as deep-frying and boiling, and it also had a higher typicality rating than did subsidiary cooking and convenience food preparation. *Core cooking* was highly associated with *subsidiary cooking*, $r(100) = .53$, $p < .001$. *Core cooking* was moderately associated with *convenience food preparation*, $r(100) = .38$, $p < .001$. *Subsidiary cooking* was moderately associated with *convenience food preparation*, $r(100) = .46$, $p < .001$. Descriptive

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