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Food Education for Whom?: Perceptions of Food Education and Literacy among Dietitians and Laypeople in Urban Japan

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Abstract: Despite the growing popularity of food education and food literacy, the diversity and complexity of ideas about food education among people from different backgrounds have not yet been examined. To explore people's understandings about food education and examine patterns among people of different occupation, gender, age, and household structure, we conducted in-depth interviews with 120 laypeople (divided equally by gender and six decadal age groups from twenties to seventies) and sixty dietitians in two urban areas in Japan. Participants were asked to freelist responses to the question, "What do you associate with the word 'Shokuiku' (food education)?" Responses were analyzed by principal component analysis. Dietitians and lay females tended to associate food education with several interconnected aspects including food knowledge, habits, and food system, while lay males tended to view it as school education targeting children only. The results suggest that the current food education framework may lead some lay males in urban Japan to believe food education and food literacy are only for children and not relevant for them. To improve effectiveness of programs for diverse populations, it is necessary to reconsider the current framework which focuses excessively on children as well as food consumption.

Keywords: Food Education, Food Literacy, Japan

Introduction

Food and nutrition are indispensable to human health and healthy diets with balanced nutrition prevent malnutrition as well as noncommunicable chronic diseases (World Health Organization 2015). As a result, there is growing recognition of the necessity of food and nutrition education. However, factors contributing to poor eating practices are complex. Food and nutrition education needs to be more than just information dissemination (Contento 2007). Recently, the term "food literacy" emerged as a goal of food and nutrition education (Benn 2014). Initially, the term lacked agreement among scholars and practitioners (Vidgen and Gallegos 2010), but in recent literature a consensus has emerged emphasizing the totality of food and eating as well as a range of knowledge, skills, and behaviors at the individual level (Begley and Vidgen 2016). Yet, these experts' food literacy definitions have not been examined by empirical studies among populations and have not yet been examined cross-culturally, especially in non-English speaking societies (Begley and Vidgen 2016). One empirical study showed that what constitutes food literacy is driven by contexts in which people live (Vidgen and Gallegos 2014). Thus, an examination in a range of cultural contexts is required for a full understanding of food literacy.

For more than a decade, the Japanese government has promoted food and nutrition education as a center of its public health promotion through the establishment of the *Shokuiku* Basic Law in 2005. The term *Shokuiku* literally translates as "nurturing through eating" or "food education" and was a neologism for most Japanese when the law was enacted (Mah 2010). Before *Shokuiku*, most of the food-related programs in Japan focused on macronutrients required for physical health and paid little attention to the interrelations with quality of life, environment, and local

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culture (Adachi 2008). Policy implementation of this more holistic view has been mainly administered by three ministries which are responsible for different domains of food-related issues: Ministry of Agriculture, Forestry, Fisheries (MAFF), Ministry of Education, Culture, Sports, Science and Technology (MEXT), and Ministry of Health, Labor, and Welfare (MHLW). A working group under MAFF and MHLW developed a new food guideline called the Japanese Food Guide Spinning Top, which focuses on the balance and quantity of food and dishes together with physical activity (Yoshiike et al. 2007). Simultaneously, nutrition education in Japan has gradually expanded beyond the simple provision of nutrition knowledge. *Shokuiku* has been portrayed as a solution for a range of food-related public health and societal problems including the nation's food insecurity and the decline of domestic agriculture as well as that of "traditional family" structure and values (Kimura 2011b).

Because of the decade-long nationwide campaign, the term *Shokuiku* is more common in Japan than the Japanese term for food literacy (*fūdo riterashī*). Despite the popularity of food literacy throughout the world, especially in English-speaking countries (Begley and Vidgen 2016), no peer-reviewed Japanese literature about food literacy was found in CiNii and J-STAGE, the most popular academic search engines in Japan. In contrast, the term *Shokuiku* is widely used to discuss food education in Japan in both academic and non-academic literature. According to the latest national survey, about 80 percent of respondents from a national representative sample were familiar with the term *Shokuiku* (MAFF 2016).

Despite the use of different terms, both food literacy and *Shokuiku* share a similar aim: to empower individuals to be healthy by employing comprehensive approaches to food and eating. The attention to individual knowledge and skill discussed in the food literacy framework also exists in some *Shokuiku*-related programs (Kimura 2011a). Opportunities to participate in these programs exist nationwide. However, especially for laypeople not employed in health- or food-related occupations, participation in these programs is voluntary (Cabinet Office 2006). Most studies on *Shokuiku* in Japan focus on populations that engage with certain *Shokuiku* programs; those populations are predominantly women (Kimura 2011a), school-aged children (Tanaka and Miyoshi 2012), and their parents, mostly mothers (Kojima 2011). There is no study examining the general lay population's understanding of *Shokuiku* and how it varies across different sociodemographic groups as well as between laypeople and health professionals such as registered dietitians (RDs) who are actively engaged with *Shokuiku* programs (Miyoshi, Tsuboyama-Kasaoka, and Nishi 2012; MEXT 2005).

This study employed an open-ended research technique to explore ideas about *Shokuiku* among urban Japanese people and to examine how understandings differed by occupation (RD vs lay), gender (male vs female), age (younger vs older), and household structure (those living with young children vs those not living with young children). The original aim of the Japanese *Shokuiku* and food literacy programs was to promote health of the entire population, including children and adults, and not just target those who were interested in health and food (Government of Japan 2005). Many public health scholars and professionals are interested in mobilizing and empowering people of diverse backgrounds rather than excluding them (Wilkinson and Marmot 2003). Therefore, this study aimed to explore the diversity and complexity of people's understanding of food education in order to contribute to the current literature on food education as well as food literacy.

Methods

Data Collection

The analysis of lay and dietitians' understandings was based on freelist responses obtained through face-to-face interviews conducted in Tokyo and Kyoto metropolitan regions of Japan between 2009 and 2013. Freelisting is a technique used to characterize "cultural domains," a set of words and concepts related to a particular topic shared among a cultural group (Quinlan 2005).

Freelisting has been widely used in public health research (Trotter 1981; Chavez et al. 1995; Weller et al. 2012). Items which are frequently listed and shared among a group of participants demonstrate cultural domains or culture shared among the group (Weller 2007). In this study, participants were asked to exhaustively list responses to the question, "What do you associate with the word '*Shokuiku* (food education)'?" This entire question took two to five minutes of the total interview. In addition to freelisting questions, participants responded to questions about demographics and lifestyles; these questions took approximately forty-five minutes on average.

Stratified quota sampling (Bernard 1994) was employed to recruit equal numbers of lay males, lay females, and RDs in two regions. The lay population was divided into gender and decadal age groups. The RDs were divided into three groups by their workplace (school, public administration, and hospital/workplace exams and counseling). Participants were recruited through community centers, corporations, daycare centers, schools, local businesses, collaborators at universities, and dietitian organizations.

In Tokyo and Kyoto, 242 interviews were conducted by four interviewers in Japanese. After the interview protocol was tested by the principal investigator (MM), all interviewers were trained by MM in interview techniques and use of the interview script to ensure consistency among interviewers. Interviews took between forty-five and 180 minutes per interview (105 minutes average). The study was approved by the Research Ethics Committee of the National Institute of Health and Nutrition (Tokyo) and the Institutional Review Board of the University of Delaware. Informed consent was obtained in writing before each interview.

All freelist responses were coded by two coders (WT and MM) independently following guidelines for grounded theory (Charmaz 2006). WT is a Japanese researcher who trained overseas, and MM is an American researcher who has worked in Japan for more than years. Therefore, the coders likely had different cultural biases about the data, and agreement between two coders suggests high reliability of codes. After the initial coding, each coder produced a codebook independently. These codebooks were then compared and merged, and all responses were recoded using the new codebook.

Data Analysis

All gender, age, and occupational categories identified for recruitment were oversampled initially. To achieve a balanced design for analysis, we excluded people with nutrition-related certification who were not currently working as dietitians. We also randomly excluded laypeople in age and region categories that were oversampled. The final analysis sample consisted of a balanced block design of ninety people each in Tokyo and Kyoto: sixty laypeople (divided equally by gender and six decadal age groups from twenties to seventies) and thirty dietitians (divided equally by three occupational subtypes).

Mean response frequency per code was analyzed by occupation (lay vs RD), gender (male vs female), age group (younger vs older), and those who were living with/without children or grandchildren aged eighteen or younger, using the nonparametric Mann-Whitney test. Significance was set at $p < 0.05$, with $p < 0.1$ denoting a statistical trend. Age group was divided by the median age of the sample (49 years old): those who were forty-nine years old or younger were considered "younger," and those above forty-five were considered "older."

Principal component analysis (PCA) was performed to characterize the standardized conceptual groupings and associations of participants' ideas about food education and to compare the component structure between groups. PCA is a data-reduction technique that allows researchers to classify high-dimensional data based on statistical, rather than *a priori* conceptual or arbitrary, parameters (Jackson 1991). PCA of the correlation matrix was conducted using SPSS version 22 to extract components with eigenvalues greater than 1.0. Varimax rotation with Kaiser Normalization was employed to extract interpretable components. The results of PCA were expressed as a linear combination of latent or hidden "components," which cannot be measured directly but are associated with observable variables (i.e., codes). The first component

explains the largest variance in the data, followed by components explaining a decreasing proportion of the variance in the data. Component scores, or component loadings, indicate magnitude of associations (correlation coefficients) between a component and a code. For example, in the case of a hidden component that contains five variables with component scores of 0.878, 0.077, 0.305, -0.67, and 0.724, the first and fifth component scores (i.e., 0.878 and 0.724) indicate that variables 1 and 5 can be used to describe the hidden component. In other words, the hidden component has similar characteristics to variables 1 and 5. The second and third scores are considered too weak to describe the hidden component. The fourth score (-0.67) indicates a variable which has opposite characteristics of the hidden component. To identify significant component loadings, a component score of > 0.4 (or < -0.4) has been recommended as the cut-off point (Stevens 2009).

Results

The full data set contained 242 cases with 512 total responses. Interrater reliability between the two coders was 91.8 percent. Discrepancies were discussed until consensus was reached, resulting in 100 percent interrater agreement. After exclusion to achieve the final block design, the data set used in the present analysis contained 180 cases (60 lay males, 60 lay females, and 60 RDs) shown in Table 1 with 364 freelist responses about participants' understandings of food education. The RDs were predominantly (55/60) female.

Table 1: Demographic Characteristics of the Sample (N = 180)

		Lay	Lay Males	Lay Females	RD	RD Male	RD Female
		N = 120	N = 60	N = 60	N = 60	N = 5	N = 55
Age group (10 years)	20–29	20	10	10	19	2	17
	30–39	20	10	10	8	1	7
	40–49	20	10	10	9	1	8
	50–59	20	10	10	19	1	18
	60–69	20	10	10	5	0	5
	70–79	20	10	10	0	0	0
Age group (divided by median)*	Younger	58	28	30	30	4	26
	Older	62	32	30	30	1	29
Living with young children (under 18)	No	93	48	45	53	5	48
	Yes	27	12	15	7	0	7

* For lay group, > 50 (median) was categorized as older. For RD group, > 45 (median) was categorized as older.

The responses were coded into twenty-four codes, which could be grouped into four general categories (Objective, Method, Target of Food Education, and Others), and are shown in Table 2. The category "Objective" includes a range of codes related to the *Shokuiku* aims or objectives of attaining individual knowledge, skills, and behaviors. The category "Method" comprises approaches to *Shokuiku* such as education at school, home, and community and promotion by government and private enterprises. The category "Target for Food Education" contains populations that are targeted. The category "Others" includes critiques of current food education as well as responses of those who were not familiar with food education. Mean responses and standard deviations for each code are presented for the total population, RDs, and laypeople (including males and females, younger and older, and those who were living with children or not). The top five codes with highest mean response frequency per person for the 364 responses in the total population (N = 180) were Education (31%), Eating Habits (25%), Food Knowledge (24%), Health (22%), and Children (22%).

Table 2: Mean Frequencies and Standard Deviations (SD) of Coded *Shokuiku* Responses Ordered by Decreasing Frequency

Rank	Category	Code	Total N=180 Mean (SD)	Lay N=120 Mean (SD)	Male N=60 Mean (SD)	Female N=60 Mean (SD)	RD N=60 Mean (SD)	Significant Differences Lay vs RD	Lay M vs RD	Lay F vs RD	Lay M vs Lay F
1	Method	Education (unspecified place)	0.31 (0.46)	0.28 (0.45)	0.40 (0.49)	0.17 (0.38)	0.37 (0.49)			*	*
2	Objective	Eating Habits	0.25 (0.43)	0.18 (0.39)	0.18 (0.39)	0.18 (0.39)	0.38 (0.49)	*		*	
3	Objective	Food Knowledge	0.24 (0.43)	0.23 (0.43)	0.18 (0.39)	0.28 (0.45)	0.27 (0.45)		*		
4	Objective	Health	0.22 (0.41)	0.24 (0.43)	0.22 (0.42)	0.27 (0.45)	0.17 (0.38)				
5	Objective	Children	0.22 (0.42)	0.24 (0.43)	0.28 (0.45)	0.20 (0.40)	0.18 (0.39)				
6	Objective	Awareness	0.14 (0.35)	0.12 (0.32)	0.12 (0.32)	0.12 (0.32)	0.18 (0.39)				
7	Objective	Life Skills	0.11 (0.31)	0.09 (0.29)	0.12 (0.32)	0.07 (0.25)	0.13 (0.34)				
8	Objective	Nutrition Knowledge	0.08 (0.27)	0.08 (0.28)	0.12 (0.32)	0.05 (0.22)	0.07 (0.25)				
9	Objective	Enjoy Eating	0.07 (0.25)	0.04 (0.20)	0.03 (0.18)	0.05 (0.22)	0.12 (0.32)		t		
10	Objective	Food System	0.06 (0.24)	0.05 (0.22)	0.03 (0.18)	0.07 (0.25)	0.08 (0.28)				
11	Method	Education at School	0.06 (0.24)	0.07 (0.25)	0.05 (0.22)	0.08 (0.08)	0.05 (0.22)				
12	Others	Don't Know about It	0.05 (0.22)	0.07 (0.25)	0.03 (0.18)	0.10 (0.30)	0.02 (0.13)				t
13	Objective	Family	0.03 (0.17)	0.03 (0.16)	0.02 (0.13)	0.03 (0.18)	0.03 (0.18)				
14	Method	Education at Home	0.03 (0.17)	0.03 (0.16)	0.03 (0.18)	0.02 (0.13)	0.03 (0.18)				
15	Target	All Generations	0.03 (0.17)	0.05 (0.22)	0.02 (0.13)	0.02 (0.13)	0.02 (0.13)				
16	Objective	Food Culture	0.02 (0.15)	0.02 (0.13)	0.02 (0.13)	0.02 (0.13)	0.03 (0.18)				
17	Objective	Eating Environments	0.02 (0.15)	0.03 (0.16)	0.02 (0.13)	0.03 (0.18)	0.02 (0.13)				
18	Method	Promotion by Government	0.02 (0.15)	0.01 (0.09)	0.02 (0.13)	0.00 (0.00)	0.03 (0.18)				
19	Target	Adults	0.02 (0.15)	0.03 (0.16)	0.03 (0.18)	0.00 (0.00)	0.02 (0.13)				
20	Others	Critical views	0.02 (0.13)	0.01 (0.09)	0.00 (0.00)	0.02 (0.13)	0.03 (0.18)				
21	Objective	Seasonality	0.01 (0.08)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.02 (0.13)				
22	Objective	Food Safety	0.01 (0.08)	0.02 (0.13)	0.00 (0.00)	0.03 (0.18)	0.00 (0.00)				
23	Method	Education in the Community	0.01 (0.08)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.03 (0.18)		*		
24	Method	Promotion by Private Sector	0.01 (0.08)	0.01 (0.09)	0.00 (0.00)	0.02 (0.13)	0.00 (0.00)				

Significance was accessed by nonparametric Mann-Whitney U Test. *P < 0.05, t < 0.1

Table 2: Mean Frequencies and Standard Deviations (SD) of Codes Ordered by Frequency in Response to a Question about *Shokuiku* (Cont.)

			Younger	Older	With Children	No children	Significant Differences	
			N=58	N=62	N=27	N=93		
Rank	Category	Code	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Lay younger vs Lay older	Lay no children vs with children
1	Method	Education (unspecified place)	0.38 (0.49)	0.19 (0.40)	0.41 (0.50)	0.25 (0.43)	*	
2	Objective	Eating Habits	0.22 (0.42)	0.15 (0.36)	0.22 (0.42)	0.17 (0.38)		
3	Objective	Food Knowledge	0.22 (0.42)	0.24 (0.43)	0.33 (0.48)	0.20 (0.41)		
4	Objective	Health	0.17 (0.38)	0.31 (0.48)	0.30 (0.47)	0.23 (0.42)	t	
5	Objective	Children	0.31 (0.47)	0.18 (0.39)	0.30 (0.47)	0.23 (0.42)	t	
6	Objective	Awareness	0.07 (0.26)	0.16 (0.37)	0.11 (0.32)	0.12 (0.33)		
7	Objective	Life Skills	0.09 (0.28)	0.10 (0.30)	0.07 (0.27)	0.10 (0.30)		
8	Objective	Nutrition Knowledge	0.10 (0.31)	0.06 (0.25)	0.00 (0.00)	0.11 (0.31)		t
9	Objective	Enjoy Eating	0.03 (0.18)	0.05 (0.22)	0.00 (0.00)	0.05 (0.23)		
10	Objective	Food System	0.07 (0.26)	0.03 (0.18)	0.04 (0.19)	0.05 (0.23)		
11	Method	Education at School	0.12 (0.33)	0.02 (0.13)	0.07 (0.27)	0.06 (0.25)	*	
12	Others	Don't Know about It	0.03 (0.18)	0.10 (0.30)	0.00 (0.00)	0.09 (0.28)		
13	Objective	Family	0.03 (0.18)	0.02 (0.13)	0.00 (0.00)	0.03 (0.18)		
14	Method	Education at Home	0.05 (0.22)	0.00 (0.00)	0.00 (0.00)	0.03 (0.18)	t	
15	Target	All Generations	0.00 (0.00)	0.03 (0.18)	0.00 (0.00)	0.02 (0.15)		
16	Objective	Food Culture	0.03 (0.18)	0.00 (0.00)	0.04 (0.19)	0.01 (0.10)		
17	Objective	Eating Environments	0.05 (0.22)	0.00 (0.00)	0.07 (0.27)	0.01 (0.10)	t	t
18	Method	Promotion by Government	0.00 (0.00)	0.02 (0.13)	0.00 (0.00)	0.01 (0.10)		
19	Target	Adults	0.02 (0.13)	0.02 (0.13)	0.07 (0.27)	0.00 (0.00)		*
20	Others	Critical views	0.00 (0.00)	0.03 (0.18)	0.00 (0.00)	0.01 (0.10)		
21	Objective	Seasonality	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)		
22	Objective	Food Safety	0.03 (0.18)	0.00 (0.00)	0.04 (0.19)	0.01 (0.10)		
23	Method	Education in the Community	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)		
24	Method	Promotion by Private Sector	0.00 (0.00)	0.02 (0.13)	0.00 (0.00)	0.01 (0.10)		

Significance was accessed by nonparametric Mann-Whitney U Test. *P < 0.05, t < 0.1

Principal Component Analysis

PCA was conducted on the codes with mean frequency of 0.05 or more, separately for the total population, RDs, and laypeople, and also with the lay population separately for males and females, younger and older, and those who were living with children or not. All components and their component loadings > 0.4 (or < -0.4) extracted for each group are shown in Tables 3–6. Results for total and lay population are shown in Table 3, lay males and lay females in Table 4, lay younger and older in Table 5, lay living with/without children in Table 6, and RDs in Table 7.

Table 3: Principal Component Analysis Solution for Total Sample and Laypeople

		Total (N=180)							Lay (N=120)				
		7 components (66.79% of variance)							5 components (56.52% of variance)				
Category	Code	1	2	3	4	5	6	7	1	2	3	4	5
Objective	Life Skills		-0.522		0.458								
Objective	Health							-0.905		-0.52			
Objective	Nutrition Knowledge						0.797		0.653			-0.441	
Objective	Food Knowledge					-0.768					0.513		
Objective	Eating Habits		0.712						0.516				
Objective	Food System		0.559						0.726				
Objective	Eating Environments												
Objective	Enjoy Eating			-0.798									
Objective	Awareness					0.541	-0.497					0.841	
Method	Education (unspecified place)			0.443				0.459		0.758			
Method	Education at Home	0.767											
Method	Education at School	0.715									0.416		-0.406
Target	Children			0.564		0.446				0.627			
Target	Adults												
Target	All Generations												0.845
Other	Don't Know about It				-0.857								

For the total population (N = 180) including both RDs and laypeople, seven components explained 66.79 percent of the variance in twelve codes. Education at Home/Education at School (Method of Food Education), Eating Habits/Food System (Objective of Food Education), and Education/Children (Method and Target of Food Education) were the top three components. While Education loaded positively on a component with Children, it also loaded negatively on components with Enjoy Eating and Health. Awareness loaded positively with Children but negatively with Food Knowledge and Nutrition Knowledge. Life Skills loaded negatively on Don't Know about Food Education as well as Eating Habits and Food System.

For the lay population (N = 120), five components explained 56.52 percent of the variance in twelve codes. Nutrition Knowledge/Eating Habits/Food System (Objective of Food Education), Education/Children (Method and Target of Food Education), and Food Knowledge/Education at School (Objective and Method of Food Education) were the top three components. Similar to the total population, Children loaded positively on a component with Education, but the association between the two codes for the lay population was stronger than for the total population. In contrast to the total population which grouped Eating Habits along with Food System only, Nutrition Knowledge also loaded positively on a component with these two codes for the lay population. Education at School loaded negatively on a component containing All Generations.

When the lay population responses were analyzed separately for males and females, however, differences in the component structure emerged. For males (N = 60), five components explained 69.87 percent of the variance in nine codes. The number of codes included in the analysis was smaller than that for the total population and lay females (12 codes) because the mean frequency of many codes did not reach the 0.05 threshold. Four out of five components contained response codes with negative component loadings on each other, meaning that these codes were opposite rather than similar to each other, except Education at School/Children. For example, Food Knowledge and Life Skills loaded negatively on components with Eating Habits. Nutrition Knowledge had opposite signs to Awareness. For females (N = 60), five components explained 61.52 percent of the variance in twelve codes. Nutrition Knowledge/Food

System/Eating Habits, Awareness/Enjoy Eating, and Education/Life Skills were the top three components. Food Knowledge also loaded negatively on components containing Awareness and Enjoy Eating. Interestingly, some codes exhibited inverse patterns of association for lay males and lay females. Education at School loaded positively with Children for males but negatively for females. Eating Habits was positively associated with Nutrition Knowledge and Food System for females but negatively with Food Knowledge and Life Skills for males.

Table 4: Principal Component Analysis Solution for Lay Males and Lay Females

		Lay male (N=60) 5 components (69.87% of variance)					Lay female (N=60) 5 components (61.52% of variance)				
Category	Code	1	2	3	4	5	1	2	3	4	5
Objective	Life Skills					-0.9			0.745		
Objective	Health	-0.677								0.79	
Objective	Nutrition Knowledge			-0.816			0.798				
Objective	Food Knowledge		-0.79					-0.759			
Objective	Eating Habits		0.646			0.482	0.544				
Objective	Food System						0.606				
Objective	Eating Environments										
Objective	Enjoy Eating							0.428			
Objective	Awareness			0.612				0.677			
Method	Education (unspecified place)	0.854							0.773		
Method	Education at Home										
Method	Education at School				0.819					-0.632	-0.588
Target	Children				0.702						0.804
Target	Adults										
Target	All Generations										
Other	Don't Know about It										

Differences across age groups were examined by the comparison of younger and older groups of the lay population. For the younger group (N = 58), six components explained 66.58 percent of the variance in twelve codes. The top three components were Education at School/Education at Home, Nutrition Knowledge/Eating Habits/Food System, and Eating Environment/Food System. For the older (N = 62), four components explained 61.38 percent of variance in ten codes. The top three were Education/Children, Nutrition Knowledge/Enjoy Eating, and Awareness. For the younger group, Food System (0.601) loaded positively on a single component with Eating Environments (0.787), while no component showed strong associations between these two codes for the older group. Food System also loaded positively on Nutrition Knowledge and Eating Habits for the younger group.

Table 5: Principal Component Analysis Solution for Younger and Older Laypeople

		Lay younger (N=58) 6 components (66.58% of variance)						Lay older (N=62) 4 components (61.38% of variance)			
Category	Code	1	2	3	4	5	6	1	2	3	4
Objective	Life Skills			-0.448		-0.478					-0.808
Objective	Health				0.523		0.473	-0.643			
Objective	Nutrition Knowledge		0.795						0.789		
Objective	Food Knowledge						0.811			-0.816	
Objective	Eating Habits		0.537								0.665
Objective	Food System		0.605	0.601							
Objective	Eating Environments			0.787							
Objective	Enjoy Eating								0.731		
Objective	Awareness				-0.806					0.71	
Method	Education (unspecified place)	-0.51				0.438	-0.404	0.802			
Method	Education at Home	0.758									
Method	Education at School	0.782									
Target	Children					0.779		0.629			
Target	Adults										
Target	All Generations										
Other	Don't Know about It										

In order to assess the impact of living with children, principal component solutions of laypeople who were/were not living with children were also examined. For those who were living with children (N = 24), five components explained 70.78 percent of variance in twelve codes. The top three components were Education/Children, Awareness/Adults, and Food Knowledge/Education at School. Only this subgroup had a component containing the response code Adults, while all other subgroups had components containing Children. For those who were not living with children (N = 93), four components explained 50.29 percent of variance in eleven codes. The top three components were Education/Children/Eating Habits, Awareness/Food System, and Nutrition Knowledge. The variance explained was low compared to other subgroups, meaning that the eleven codes did not group together because the group may have diverse views, or there may be subgroups within this population that differ in their views based on gender and age or other characteristics.

Table 6: Principal Component Analysis Solution for Laypeople Living with and without Children

		Lay living with children (N=24) 5 components (70.78% of variance)					Lay living without children (N=93) 4 components (50.29% of variance)			
Category	Code	1	2	3	4	5	1	2	3	4
Objective	Life Skills					0.73				-0.817
Objective	Health				0.734				*-0.385*	
Objective	Nutrition Knowledge								0.834	
Objective	Food Knowledge			0.768				-0.619		
Objective	Eating Habits				-0.594		0.493			0.484
Objective	Food System							0.43		
Objective	Eating Environments			-0.597	0.548					
Objective	Enjoy Eating									
Objective	Awareness		0.803					0.675		
Method	Education (unspecified place)	0.854					0.673			
Method	Education at Home									
Method	Education at School			0.416		-0.679				
Target	Children	0.792					0.537			
Target	Adults		0.777							
Target	All Generations									
Other	Don't Know about It									

Lastly, RDs were compared with the lay population. The principal component solution for RDs (N = 60) contained six components that explained 74.61 percent of the variance in ten codes, with the top three components as follows: Food Knowledge/Food System/Eating Habits, Nutrition Knowledge/Health, and Enjoy Eating. These top components contained codes about objectives of food education rather than methods like education. In contrast to the lay males who tended to associate Education with Children, for RDs Education loaded negatively on components with Children as well as Enjoy Eating. Nutrition Knowledge (0.77) loaded positively on Health (0.862) for RDs, while the association between these two codes was weak (< 0.4) for the lay population and these codes had inverse component loadings among laypeople not living with children.

Table 7: Principal Component Analysis Solution for RD

		RD (N=60) 6 components (74.61% of variance)					
Category	Code	1	2	3	4	5	6
Objective	Life Skills						0.922
Objective	Health		0.77				
Objective	Nutrition Knowledge		0.862				
Objective	Food Knowledge	0.787					
Objective	Eating Habits	0.621					-0.345
Objective	Food System	0.735					
Objective	Eating Environments						
Objective	Enjoy Eating			0.894			
Objective	Awareness					0.639	
Method	Education (unspecified place)			-0.59	-0.59		
Method	Education at Home						
Method	Education at School					0.802	
Target	Children				0.83		
Target	Adults						
Target	All Generations						
Other	Don't Know about It						

Below we present results for six key patterns of component structure that emerged from comparisons of subgroups: Education/Children, Eating Habits/Food Knowledge/Food System, Health/Nutrition Knowledge, Enjoy Eating/Awareness, Food System/Eating Environments, and Adults/Awareness.

Education/Children

Education was the most prevalent response code for the lay population (31%), and it was especially prevalent among lay males (40%) and those who were living with children (41%). This response code was positively associated with Children in the total lay population. However, the comparison by gender showed different associations. Education formed the first component for lay males. For lay males, Education at School was positively associated with Children, but these codes were inversely associated for lay females. For lay females, Education was paired with Life Skills, which consists of knowledge and skills beyond those related to eating. This suggests that lay females may consider education outside of school such as home education and education in the community. The association between Education and Life Skills among lay females' *Shokuiku* domains suggests that they tend to conceptualize food education beyond simply focusing on children and include adult education which can train adults to cultivate life skills throughout the life course. For RDs, Education and Children were inversely associated and Education at School was positively associated with Awareness, suggesting that similar to lay females, RDs (who are primarily women) did not associate Education exclusively with Children. Thus, the comparison of people's understandings of education indicated a clear divide between males and females that transcends occupational differences.

Eating Habits/Food Knowledge/Food System

Eating Habits was the most prevalent code (38%) for RDs and was associated with Food Knowledge (which includes knowledge of balanced meals and combinations of different types of food) and Food System (which includes production, processing, and distribution of food). These

three codes were in the first component for RDs. RDs appear to have an integrated model which encompasses knowledge and skills of food as well as production of food, and they conceptualize food education as more than just nutrition education. This conceptual model is aligned with goals of the *Shokuiku* Basic Law providing broader approaches to food education. This result may be influenced by responses of school and public administration dietitians, who tend to more actively engage with *Shokuiku*-related programs, and comprise two thirds of our RD group. Gender differences in objectives of food education were observed among laypeople. For lay females, both Eating Habits and Food System were paired with Nutrition Knowledge, which includes knowledge of nutrients and nutritional balance, not Food Knowledge. These codes (Nutrition Knowledge/Eating Habits/Food System) comprised the first component for lay females, suggesting that lay females also share an integrated model. However, for lay males, Eating Habits was negatively associated with Life Skills as well as Food Knowledge, suggesting that they tend to conceptualize knowledge of eating habits, food items, and life skills separately rather than integrating them. Many lay males may be familiar with the term *Shokuiku* through media, but not the content of policy, and may answer based on a literal translation of the term *Shokuiku*.

Health/Nutrition Knowledge

Health and Nutrition Knowledge were associated only for RDs. This suggests that compared to laypeople, RDs are more likely to conceptualize knowledge of nutrients and nutritional balance as associated with health of people, not surprising given their training as dietitians. However, for laypeople who were not living with children, the codes were negatively correlated, meaning that those who gave responses related to health were less likely to list words coded as nutrition knowledge. For laypeople who were living with children, Health was paired with Eating Environments which includes social environments around food and eating, suggesting that people living with children conceptualize social eating environments as related to health.

Enjoy Eating/Awareness

For lay females, the second component consisted of Enjoy Eating and Awareness. These two codes focus on philosophical rather than behavioral aspects of eating and emphasize changing people's values associated with eating. The code Enjoy Eating focuses on pursuing the pleasure of eating and well-being. The code Awareness includes raising awareness of issues related to food as well as the value of food. These codes were inversely associated with Food Knowledge, suggesting that lay females are less likely to associate acquisition of food-related knowledge with the pleasure of eating and appreciation of food. In contrast, RD components showed a different structure: RDs paired Awareness and Education at School, but conceptualized Enjoy Eating and Education as inversely related. This means that raising awareness and appreciation of food is related to education at school, but pursuing the pleasure of eating is not related to education which is guided by others but it can be discovered by people themselves.

Food System/Eating Environments

Food System and Eating Environments loaded positively among the younger lay group. These codes focus on macro-aspects of food including food production and social eating environments. For the younger group, the code Food System also loaded positively on Nutrition Knowledge and Eating Habits which are micro-aspects of food, suggesting that they have an integrated model of food education like RDs and lay females. In contrast, components of older groups concentrated on micro-aspects of food such as knowledge of food items, eating habits, and the pleasure of eating. The comparison of different age groups suggests that older generations of laypeople focus on micro-aspects of food, but younger generations have a more integrated view and tend to associate food education with knowledge of both micro- and macro-aspects of food.

Adult/Awareness

As noted earlier, the code Children was paired with Education or Education at School for the total lay population and its subgroups except lay females. When laypeople who were living with children or not were compared, however, Adults and Awareness were associated among those who were living with children. They formed the second component, following the first component of Education/Children. This suggests that those who were living with children were more likely to view food education as not only providing education for children but also helping raise awareness among adults. This view is closer to what the government has tried to promote for more than a decade as well as views of lay females and RDs, and it may reach those living with children because they learn about food education from their children. Despite the similarity with the views of lay females and RDs, the result is not biased by overrepresentation of females, because there were approximately equal numbers of male and female laypeople living with children (44.4% and 55.5% respectively). However, it also highlights why this idea may not have reached those not living with children.

Discussion

The larger purpose of this research is to explore how people (both lay and RDs) understand current food education so that we can address gaps in knowledge and understanding, and develop more effective public health nutrition programs and policies. Principal component analysis on ideas of food education for all subgroups resulted in four to seven components and explained 50.29–74.61 percent of the variance in participants' responses. Although 20–30 percent of lay and RD respondents associated food education with education, eating habits, food knowledge, health, and children, these variables were conceptualized differently across subgroups. Lay males tended to perceive food education narrowly as school education for children, while many lay females and RDs (who are mostly women) had a broader view on food education, which was not limited to education for children but involved integration of knowledge and skills for food consumption as well as food production. Furthermore, lay males and lay females living with children also viewed food education as not only for children but also adults. The comparison of different age groups of laypeople showed that the younger group associated food education with macro-level knowledge of food such as food system and eating environments, while the older group focused on micro-level knowledge. These differences between subgroups indicate that there are considerable gaps in socially and culturally mediated understandings of food education. This suggests that explanatory models for food education vary between laypeople and RDs, and within the lay population between males and females, between younger and older groups, and between those who are living with children or not. These results have implications for design of effective food education for populations with different sociodemographic backgrounds.

Several studies have explored people's knowledge and understanding of food literacy and food education. In addition to several literature reviews (e.g., Cullen et al. 2015; Brooks and Begley 2014; Begley and Vidgen 2016), several studies based on primary sources have focused on specific populations including youth at risk (Thomas and Irwin 2011), food education certificate holders (Kimura 2011a), food experts and young people experiencing disadvantages (Vidgen and Gallegos 2010), adolescents (Ronto et al. 2016a), home economics teachers (Ronto et al. 2016b), and university students (Colatruglio and Slater 2016). Most of them, except Kimura's (2011a) work, were designed to offer common definitions of food literacy or apply existing ideas of food literacy, so they did not explicitly examine gaps in knowledge and understanding across different groups using the same method. Most of the studies focused on consumption of food, and a few included food production such as agriculture, environment, and ecology (Bellotti 2010). The studies by Ronto et al. (2016a; 2016b) reported that both home economic teachers and adolescents showed limited knowledge of macro-aspects of food literacy such as animal welfare and environmental sustainability. Our approach differs from previous

studies in that our questions, with open-ended freelists, allowed for new domains of food literacy and food education, which often are not considered by researchers (Schrauf and Sanchez 2008), and allowed us to compare understandings of experts and laypeople using the same method.

The comparison of different demographic groups showed a clear divide between men and women and indicated impacts of two structural issues underlying current food-related programs inside and outside of Japan. In Japan, a large proportion of housework and child-rearing is done by married women. Japanese married men living with children aged eighteen or younger spend the least time on housework among twenty-four countries, and they work long hours (International Social Survey Programme Research Group 2014). This gendered division of household labor and family values underlines policy discourses of *Shokuiku* programs (Kojima 2011). Many government-funded *Shokuiku* programs have been held at schools and in communities, including agricultural and fishing communities in rural areas (Ministry of Internal Affairs and Communications 2015), so it is difficult for full-time workers, especially males, to participate and see their relevance. However, even among male workers, those who were living with children are more likely to have opportunities to be exposed to these programs and understand that adults should be involved. Furthermore, current understanding of food literacy and food education is built on the assumption that it is required for those who lack food knowledge and skills (Kimura 2011a). Education for children is important for future generations to understand complex food-related issues. However, the child-centered bias of many people's understanding of food education and food literacy may discourage some populations (e.g., singles or couples not living with children) from getting involved, even though they are powerful tools for adult learning and social change (Sumner 2013).

Despite increasing gender equity around the world, food-related work is still dominated by women in many societies. The feminization of care work is partly driven by gender expectations and norms on who provides "care." For example, at the household level, women spend two to ten times more time on unpaid care work including cooking, cleaning, and taking care of children, than men around the world (Ferrant, Pesando, and Nowacka 2014). While more men are involved in cooking at home, primary responsibility for routine work of "feeding the family" falls mostly on women and family meals become a site of gender conflict wherein women feel obligated to provide care (Meah and Jackson 2013). Compared with men, more women feel obligated to cook for their family members (Daniels et al. 2012). The gendered norms also persist at professional levels: most nutrition occupations are dominated by women with about 90 percent of dietitians being women (Statistics Bureau of Japan 2010; Statistics Canada 2013; United States Census Bureau 2015); this is consistent with our study population (91.7% of RDs are female). Ethnographic research has shown that nutrition professionals require two types of knowledge: 1) food science developed in male-dominated nutrition science and 2) socially grounded public health knowledge which they cultivate as female professionals (DeVault 1995). Even in the health promotion literature, most of the gender discussions focus on women, and few studies explore the complexity of issues around men (Smith and Robertson 2008). Thus, a taken-for-granted idea that caring for other people's health is a responsibility of women has been perpetuated in public health. This pervasive assumption may discourage not only policy-makers and practitioners but also scholars from considering the complexity of issues around men as well as women who lack partners or children to "care" for, which in turn often leads to blaming them for their lack of knowledge, skills, and motivation. The gendered social structure may continue to influence health disparities between males and females. In Japan, obesity (BMI > 25) and diabetes (defined as Hemoglobin A1c rate > 6.1) were more prevalent among males than females across all age groups over ten years old (MHLW 2016). In order to reduce the gender disparity, further research and interventions are required to consider the impact of gender relations and develop more gender-inclusive frameworks of food education as well as health promotion.

Another issue underlying current food education and food literacy is excessive attention to consumption of food at the individual level, despite an emphasis on the totality of food in theory.

The current framework may not be sufficient to accommodate the range of complex interconnected issues affecting food-related behavior and policy. For example, Japanese *Shokuiku* encountered a critical issue after the Fukushima nuclear incident in 2011. Before the incident, domestic food was promoted as safer and healthier than imports, because it was fresher and more regulated by the government. However, the nuclear accident concerns about radioactive contamination of food discouraged many consumers from buying domestic products from the affected areas. Despite its theoretical holistic approaches to food, in actual practice the narrower constructs of *Shokuiku* failed to handle food safety issues after the Fukushima incident (Reiher 2012). In other words, the current food education framework in Japan appears to be a small expansion of nutrition education by nutrition professionals, most of whom are not experts on food safety and production. Therefore, *Shokuiku* policy lacks strong synergies between food consumption and production which hinders holistic implementation. In fact, the focus of *Shokuiku* policy, identified in its five-year agenda called the *Shokuiku* basic plan (*shokuiku kihon keikaku*), has gradually shifted from encompassing the totality of food to blaming lack of knowledge, skill, and even morality of individuals and households rather than addressing underlying societal issues (Takeda, Banwell, and Dixon 2016). Thus, the over-attention on individual knowledge and skills risks ignoring societal issues influencing behaviors and perceptions of individuals and households. Multisectoral and interdisciplinary cooperation is crucial to implement and sustain the holistic ideas of food literacy and education in practice.

Limitations

This study aimed to describe the understanding of food education among dietitians and laypeople in urban Japan. However, the sample size and potential sampling bias may limit our conclusions. The lack of comparable groups separated by gender, age, and living with children or not between RDs and laypeople limits our ability to control for these variables. For example, more than 90 percent of RDs were female and 89 percent of them were not living with children. Thus, we could not fully analyze the influence of occupation independent from differences by gender and household structures. For the comparison of laypeople living with children or not, the sample sizes of the two groups were not equal and data may be skewed due to difficulties recruiting people living with children, who likely are too busy to participate in interviews. Furthermore, due to the small sample size, we could not explore gender differences among those who were living with children. The impacts of gender on understanding of food education and literacy among parents and grandparents of young children is important to consider in future research.

Although using two coders of different backgrounds is more likely to reduce individual biases in coding, and the high interrater reliability suggests robustness in the coding processes, coding may be influenced by excessive detail in our categories. For example, knowledge of food was separated into several codes including nutrition, food, seasonality, food system, and culinary culture. Because discussions about definitions of food literacy and food education are not yet settled and because this study was designed to explore diversity and complexity of ideas of food education and literacy, we decided that it was appropriate to develop a codebook following grounded theory as well as holistic anthropological approaches that allowed for as-yet undocumented cultural differences. Future studies should try to remain open to new categories that researchers and policy-makers may not consider. Codes and components will be more robust if coders have different academic and cultural backgrounds.

Conclusion

This research explored understandings of *Shokuiku* (food education) shared among Japanese people in two major urban areas of Japan and examined differences by occupation, gender, age, and household structure. Despite the popularity of holistic approaches of food education as well as food literacy, few studies examine different understandings of these concepts among diverse

groups of people from different cultures. Many Japanese laypeople and dietitians view food education as associated with education, eating habits, and knowledge of food. However, principal component analysis showed different underlying patterns of understandings about food education. For example, in line with the literature on food literacy and food education, RDs and lay females tended to associate food education with interconnectedness of several aspects of food including food knowledge, habits, and food system, while lay males tended to associate food education with education at school focusing on children only. The difference suggests that the current food education framework reinforces societal gender roles and may lead some lay males to believe that food education and food literacy are not relevant to them but rather for children only. To improve the effectiveness of programs for the entire population, it is necessary to reconsider the current policy framework that overemphasizes children and to develop more gender-inclusive understandings of food education and literacy.

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