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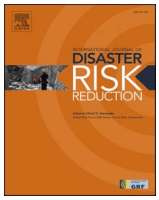

Food and nutrition assistance activities at emergency shelters and survivors' homes after the Great East Japan earthquake, and longitudinal changes in vulnerable groups needing special assistance

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ABSTRACT

During disasters, some vulnerable individuals are unable to eat the food that is distributed and thus need special assistance. Hence, the aim of this study was to reveal what kinds of nutrition assistance are provided following a disaster, which groups of vulnerable individuals need special nutrition assistance, and at which phase.

This cross-sectional survey was using a self-administered postal-based questionnaire. We analyzed data from 435 registered dietitians who had worked in the areas affected by the Great East Japan Earthquake, collected from a questionnaire survey.

At emergency shelters, the groups most identified as needing special assistance in phase 0 were infants and children, followed by elderly and then nursing mothers. In phases 2 and 3, the most identified group was elderly, followed by diabetes patients, and then hypertension patients. The much information that dietitians used to identify vulnerable individuals needing special assistance was provided by doctors and public health nurses. At survivors' homes, the group most identified as needing special nutrition assistance was elderly in all phases.

This study showed that the vulnerable groups that need special nutrition assistance differ by phases after disaster. The needs for nutrition assistance were infants and elderly in early stage, and chronic disease patients and elderly in mid-to long-term. Therefore, it is necessary to provide nutrition assistance at the appropriate timing according to priority.

1. Introduction

Various natural disasters have occurred in recent years. Prior research on large-scale disasters has revealed the challenges of nutritional health following a disaster. In the early phases following a disaster, there is an exacerbation of chronic diseases such as hypertension and hyperglycemia [1,2] and an increase in cardiovascular disease [3,4]. When survivors live in shelters for a long-term period, effects have also been observed on obesity [5–7]. If conditions of poor nutrition persist, there is concern that these types of physical symptoms will worsen. In actuality, poor diet and nutrition do present problems during disasters [8–10]. These problems can be divided into food quantity and quality. Furthermore, vulnerable individuals needing special assistance who cannot eat the food that is distributed at emergency shelters include infants and children with food allergies. In cases where appropriate food cannot be provided over the long term, survivor's health and lives may be in jeopardy.

Immediately following a disaster, individuals must obtain energy through food. However, the amount of food and energy provided in emergency shelters is insufficient. One month after the Great East Japan Earthquake, approximately 7% of emergency shelters provided only one or two meals per day [10]. To secure the required number of meals and the necessary quantities of nutrients at the emergency shelters, the Ministry of Health, Labour and Welfare, Japan published Nutritional Reference Values for emergency shelters [11,12]. The Nutritional Reference Values for dietary planning at emergency shelters were 2000

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kcal for energy, 55 g for protein, 1.1 mg for vitamin B_1, 1.2 mg for vitamin B_2, and 100 mg for vitamin C. These values were based on the Dietary reference Intakes for Japanese in 2010. However, one month after the Great East Japan Earthquake, only 28.9% of emergency shelters were able to achieve this energy requirement [13]. Furthermore, survivors who cannot even eat food that is provided at shelters face a serious risk of malnutrition. A study of all emergency shelters in City A, one of the most damaged areas, one month after the Great East Japan Earthquake found that vulnerable individuals with special dietary needs included infants who needed milk, elderly and disabled people who had trouble swallowing, and people with food allergies [10]. A study of the earthquake disaster in Athens, Greece also found that at evacuation sites where food was provided equally, intake was especially low among elderly, and their nutritional intake was deemed insufficient [14]. Mothers and their children who experienced cyclone Aila in India were affected by nutritional status for a long time [15]. On the other hand, nutritional interventions for children aged less than 5 years following natural disaster can greatly improve malnutrition [16], suggesting the importance of nutritional interventions for vulnerable individuals following a disaster.

In addition, research has shown that the quality of food at emergency shelters is inadequate. Relief supply consisted primarily of carbohydrates, such as instant food products, sweet breads, rice balls, and cup noodles [10]. In addition, due to an ongoing reliance on convenience store lunch boxes, there were large amounts of fried foods, high-salt, and usually insufficient amounts of vegetables, leading to an unbalanced diet [17]. In emergency shelters, it is not only general survivors who must rely on these meals but also children, elderly, and vulnerable individuals with chronic diseases. There have also been cases wherein relief supply consisted many sweets with few meals at all [18]. Factors such as the lack of variation in meals, long-terms stays at emergency shelters, and fear of aftershocks in the case of large earthquakes also contribute to decreased appetite [19].

In addition to the stress of living in an emergency shelter, the health of survivors may decline as a result of these dietary habits given the effects of poor nutrition over extended periods of time. However, most research that exists regarding poor nutrition has focused on the relatively early periods following a disaster. The number of studies that have been published on the activities conducted by specialists such as dietitians to improve nutrition in cases of long-term evacuations is insufficient. Furthermore, from a mid-to long-term perspective, it remains unclear what kind of assistance is needed for vulnerable individuals requiring special nutrition assistance after a disaster and what assistance is needed during which phase.

Thus, we conducted a survey of nutrition assistance activities carried out by members of the Japan Dietetic Association (“JDA”) living in the three prefectures affected by the Great East Japan Earthquake during the first six months following the disaster and then analyzed the specific nutrition assistance activities carried out at emergency shelters and the situation for vulnerable individuals needing special nutrition assistance who were unable to eat the food that was distributed. Furthermore, we analyzed not only vulnerable individuals taking refuge in emergency shelters but also those taking refuge at home, to provide a measure of assistance for this group, which tends to be overlooked during disaster times.

2. Methods

2.1. Study population

This study was a cross-sectional survey and descriptive analysis, using data by postal questionnaire. Survey questionnaires were sent in August 2012 to 1911 registered dieticians (RDs) who were members of the JDA and lived in the three most affected prefectures—Iwate, Miyagi, and Fukushima. Letters were sent to the same RDs in October 2012 to remind them to complete the survey. The objective of the study and the confidentiality of the data were described in the letters. The questionnaire stated that returning the questionnaire meant consent to participate in the study.

2.2. Measurements

The self-administered questionnaire contained 157 items. The sections of the questionnaire were as follows: 1) the characteristics of participants, 2) the recognition and usage of some tools provided by the Japanese government, 3) questions about participants’ jobs in their facilities for each phase following the disaster, 4) questions about the assistance activities in emergency shelters for each phase following the disaster, 5) questions about the assistance activities in survivors’ homes for each phase following the disaster, and 6) open-ended questions. This study used and analyzed 9 of the 157 questionnaire items. The 9 questionnaire items had sociodemographic information of individuals (sex, age, occupation category, damage to workplace) and two parts as shown below:

2.2.1. Assistance activities in emergency shelters

The survey items included the assistance activities conducted at emergency shelters, the groups of vulnerable individuals identified as needing special assistance, and the method used to identify those vulnerable individuals. The survey elicited responses for each of the four phases following the disaster based on phases category by disaster assistance guidelines at the time of Great East Japan Earthquake [20]. Phase 0 was defined as the first three days following the day of the earthquake, phase 1 was four days to one month after the earthquake, phase 2 was one-to-two months after the earthquake, and phase 3 was three-to-six months after the earthquake. The assistance activities conducted at emergency shelters were assessed by asking the question: ‘What kind of assistance activities did you do at the emergency shelter?‘. The assistance activities were divided into 12 categories, where respondents were asked to check all that applied (1. Meal provision, 2. Cooking, 3. Cooking advice, 4. food ordering, 5. Arranging for cooking implements, 6. Assessment of meal provision, 7. Assessment of individual dietary intake, 8. Nutrition counseling, 9. Health education, 10. Cooperation with local government, etc., 11. Cooperation with hospitals, etc., 12. Other). The exist of vulnerable individuals identified as needing special assistance at emergency shelters were assessed by asking the question: ‘Did you find the following disaster vulnerable people?‘. Vulnerable individuals were divided into 13 categories, where respondents were asked to check all that applied (1. Pregnant women, 2. Lactating women, 3. Infants and children, 4. Diabetes patients, 5. Hypertension patients, 6. Kidney disease patients, 7. Other patients requiring dietary therapy, 8. Food allergies, 9. Elderly, 10. Disabilities, 11. Foreigners (Vulnerable individuals who can’t understand Japanese and cannot ask for help.), 12. Did not exist (There were no exist vulnerable individuals.), 13. Could not find (Dietitians could not find the vulnerable individuals, even if they were there.)). The methods that dietitians used to identify vulnerable individuals needing special nutrition assistance at emergency shelters were assessed by asking the question: ‘If you find vulnerable individuals, how did you find them?‘. The methods were divided into seven categories, where respondents were asked to check all that applied (1. Information from other dietitians, 2. Information from doctors, public health nurses, etc., 3. Information from local governments, 4. Information from emergency shelter managers, etc., 5. Name list, 6. Direct questioning, 7. Other).

2.2.2. Assistance activities in individuals’ homes

We tallied the types of assistance activities conducted at survivors’ homes and the groups of vulnerable individuals identified as needing special assistance. The survey collected responses for each of the four phases, as described in section 2.2.1. The assistance activities conducted at survivors’ homes were divided into eight categories, where respondents were asked to check all that applied (1. Meal provision, 2.

food ordering, 3. Cooking support, 4. Assessment of dietary intake, 5. Nutrition counseling, 6. Cooperation with local government, etc., 7. Cooperation with hospitals, etc., 8. Other). As with emergency shelters, vulnerable individuals needing special assistance were divided into the 13 categories listed in section 2.2.1, where respondents were asked to check all that applied.

2.3. Data analysis

Of the 1991 questionnaires mailed, we received responses from 435 JDA members (response rate: 22.8%). Since some respondents did not answer all questions used in the analysis, percentages in the questionnaire were calculated using the number of valid answers for each question as the denominator. To identify dietitians who conducted assistance activities at emergency shelters, the study considered those who responded that they had participated in nutrition and food assistance for disaster survivors taking refuge at emergency shelters as such dietitians (134 respondents). To identify dietitians who conducted assistance activities at sites such as survivors' homes, the study considered those who responded that they had participated in nutrition and food assistance at sites such as disaster survivors' homes as such dietitians (88 respondents). Respondents who participated in assistance activities both at emergency shelters and survivors' homes were included in both tallies. IBM SPSS Statistics 16.0 for Windows (IBM) was used for analysis.

2.4. Ethical considerations

Appended to the questionnaire was a survey request form that clearly stated the objectives of the survey, the voluntary nature of the survey, that there would be no negative consequences for not participating in the survey, that the survey would not be used for any purposes besides its stated objectives, and that respondents' names would not be identifiable when the results were released. The questionnaires were anonymous, and stated that returning the questionnaire meant consent to participate in the study. The present study was approved by the Institutional Ethics Committee of the National Institute of Health and Nutrition (Current National Institute of Biomedical Innovation, Health and Nutrition), Japan (approval number: "20120626-05").

3. Results

A total of 435 participants responded. Of the 435 completed questionnaires, 134 respondents had participated in nutrition assistance at emergency shelters, 88 had participated in nutrition assistance at survivor's home, and 52 had participated in nutrition assistance at both. Thus, we analyzed only the data from these 134 and 88 respondents. More females responded (around 90%) to the questionnaire, as shown in Table 1.

Table 2 shows the nutrition assistance activities conducted by dietitians at emergency shelters. In phase 0 (the first three days after the earthquake), the most common assistance activity was meal provision, followed by cooking, cooking advice, and food ordering. In phase 1 (four days to one month after the earthquake), the most common assistance activity was still meal provisions. However, the focus of meal provision activities shifted from the meal provision stage itself to the assessment stage, with the continuation of activities such as assessment of the meal provision and cooperation with local government, etc. In phase 2 (one-to-two months after the earthquake), the most common assistance activities were assessment of the meal provision and nutrition counseling. This trend also continued in phase 3 (three-to-six months after the earthquake).

Table 3 shows the groups of vulnerable individuals that dietitians identified as needing special assistance at emergency shelters. The most common response for phase 0 was "Could not find," with approximately 40% of dietitians unable to identify which groups required special nutrition assistance. In phase 0, the most identified group needing special assistance was infants and small children, followed by elderly and then Lactating women. In phase 1, the most identified group was elderly, followed by infants and small children. Compared to phase 0, the

Table 1
Participants characteristics and responses (n = 435).

	Total (n = 435)		Assistance activities in emergency shelters (n = 134)		Assistance activities in individuals' homes (n = 88)	
	N	%	n	%	n	%
Sex						
Male	7	1.6	3	2.2	2	2.3
Female	387	89.0	121	90.3	77	87.5
Unknown	41	9.4	10	7.5	9	10.2
Age						
20–29 years	60	13.8	11	8.2	8	9.1
30–39 years	115	26.4	27	20.1	14	15.9
40–49 years	107	24.6	33	24.6	20	22.7
50–59 years	109	25.1	41	30.6	28	31.8
60–69 years	36	8.3	20	14.9	15	17.0
70–79 years	4	0.9	0	0	2	2.3
Unknown	4	0.9	2	1.5	1	1.1
Occupation category						
Welfare facility	130	29.9	23	17.2	12	13.6
Hospital	121	27.8	19	14.2	15	17.0
Government	59	13.6	46	34.3	28	31.8
School	35	8.0	12	9.0	2	2.3
Education/Research	19	4.4	10	7.5	9	10.2
Community activities	21	4.8	13	9.7	12	13.6
Feeding facility	8	1.8	1	0.7	1	1.1
Other dietitian positions	12	2.8	4	3.0	3	3.4
Other occupations	8	1.8	1	0.7	1	1.1
Unemployed	18	4.1	4	3.0	4	4.5
Unknown	4	0.9	1	0.7	1	1.1
Damage to workplace						
None	142	32.6	43	32.1	30	34.1
Partially	222	51.0	62	46.3	38	43.2
Completely destroyed	12	2.8	8	6.0	5	5.7
Unknown	59	13.6	21	15.7	15	17.0

Table 2
Nutrition assistance activities conducted by dietitians at emergency shelters.

Activity	Phase 0: 0–3 days (n = 65)		Phase 1: 4 days–1 month (n = 87)		Phase 2: 1–2 months (n = 77)		Phase 3: 3–6 months (n = 66)	
	n	%	n	%	n	%	n	%
1. Meal provision	46	70.8	48	55.2	34	44.2	24	36.4
2. Cooking	31	47.7	31	35.6	26	33.8	21	31.8
3. Cooking advice	25	38.5	33	37.9	32	41.6	31	47.0
4. Food ordering	23	35.4	36	41.4	34	44.2	24	36.4
5. Arranging for cooking implements	17	26.2	28	32.2	23	29.9	14	21.2
6. Assessment of meal provision	19	29.2	43	49.4	43	55.8	40	60.6
7. Assessment of individual dietary intake	3	4.6	14	16.1	25	32.5	23	34.8
8. Nutrition counseling	7	10.8	21	24.1	43	55.8	40	60.6
9. Health education	2	3.1	1	1.1	7	9.1	12	18.2
10. Cooperation with local government, etc.	21	32.3	39	44.8	39	50.6	35	53.0
11. Cooperation with hospitals, etc.	5	7.7	8	9.2	8	10.4	9	13.6
12. Other	10	15.4	10	11.5	11	14.3	12	18.2

n: Number of dietitians who conducted assistance activities at emergency shelters in each phase.
%: Percentage of the number of responses to number of dietitians who conducted assistance activities at emergency shelters in each phase.

Table 3
Groups identified by dietitians as needing special nutrition assistance at emergency shelters.

Group	Phase 0: 0–3 days (n = 56)		Phase 1: 4 days–1 month (n = 65)		Phase 2: 1–2 months (n = 61)		Phase 3: 3–6 months (n = 58)	
	n	%	n	%	n	%	N	%
1. Pregnant women	6	10.7	16	24.6	14	23.0	12	20.7
2. Lactating women	11	19.6	16	24.6	14	23.0	12	20.7
3. Infants and small children	19	33.9	28	43.1	20	32.8	18	31.0
4. Diabetes patients	9	16.1	24	36.9	30	49.2	27	46.6
5. Hypertension patients	5	8.9	19	29.2	28	45.9	23	39.7
6. Kidney disease patients	4	7.1	14	21.5	18	29.5	16	27.6
7. Other patients requiring dietary therapy	2	3.6	15	23.1	16	26.2	19	32.8
8. Food allergies	6	10.7	15	23.1	13	21.3	10	17.2
9. Elderly	16	28.6	32	49.2	33	54.1	30	51.7
10. Disabilities	5	8.9	14	21.5	12	19.7	10	17.2
11. Foreigners	3	5.4	4	6.2	1	1.6	2	3.4
12. Did not exist	4	7.1	4	6.2	5	8.2	8	13.8
13. Could not find	24	42.9	13	20.0	12	19.7	13	22.4

n: Number of dietitians who identified groups needing special nutrition assistance at emergency shelters in each phase.
%: Percentage of the number of responses to number of dietitians who identified groups needing special nutrition assistance at emergency shelters in each phase.

identification of patients with diabetes, hypertension, kidney disease, pregnant women, disabilities, and food allergies increased in phase 1. In phase 2, the most identified group was elderly, followed by diabetes and hypertension patients. This trend continued in phase 3.

Table 4 shows the methods by which dietitians identified the groups of vulnerable individuals needing special assistance at emergency shelters. In phase 0, the most common method was direct questioning. In phase 1, the most common methods were direct questioning and obtaining information from doctors, public health nurses, etc. In this phase, approximately 40% of dietitians also made use of information from local governments, etc. and information from emergency shelter managers. This trend continued in phases 2 and 3.

Table 5 shows the nutrition assistance activities actually carried out by dietitians at survivors' homes. The most common assistance activity carried out in phase 0 was meal provision, followed by food ordering and cooking support. In phase 1, the most common assistance activity was food ordering, followed by meal provision and nutrition counseling. In phase 2, the most common assistance activity was nutrition counseling, followed by meal provision and food ordering. In phase 3, the most common assistance activity was nutrition counseling; however, the next most common activities were assessment of dietary intake and cooperation with local government, thus marking a shift to the assessment of actual food intake.

Table 6 shows the groups of vulnerable individuals identified as needing special nutrition assistance at survivors' homes following the disaster. In phase 0, the most common response was "Could not find" the vulnerable individuals needing special assistance, with approximately 40% of dietitians unable to identify who required special assistance at home. Of those who could be identified as requiring special assistance during phase 0, the most identified group was elderly, followed by

Table 4
Methods that dietitians used to identify vulnerable individuals needing special nutrition assistance at emergency shelters.

Method	Phase 0: 0–3 days (n = 31)		Phase 1: 4 days–1 month (n = 54)		Phase 2: 1–2 months (n = 52)		Phase 3: 3–6 months (n = 46)	
	n	%	n	%	n	%	N	%
1. Information from other dietitians	6	19.4	14	25.9	15	28.8	15	32.6
2. Information from doctors, public health nurses, etc.	9	29.0	30	55.6	28	53.8	26	56.5
3. Information from local governments	8	25.8	20	37.0	21	40.4	19	41.3
4. Information from emergency shelter managers, etc.	9	29.0	21	38.9	20	38.5	19	41.3
5. Name list	3	9.7	6	11.1	6	11.5	5	10.9
6. Direct questioning	14	45.2	30	55.6	31	59.6	24	52.2
7. Other	4	12.9	6	11.1	3	5.8	2	4.3

n: Number of dietitians who used methods to identify vulnerable individuals needing special nutrition assistance at emergency shelters in each phase.
%: Percentage of the number of responses to number of dietitians who used methods to identify vulnerable individuals needing special nutrition assistance at emergency shelters in each phase.

Table 5
Nutrition assistance activities conducted by dietitians at survivors' homes.

Activity	Phase 0: 0–3 days (n = 33)		Phase 1: 4 days–1 month (n = 40)		Phase 2: 1–2 months (n = 36)		Phase 3: 3–6 months (n = 61)	
	n	%	n	%	n	%	n	%
1. Meal provision	19	57.6	19	47.5	12	33.3	12	19.7
2. Food ordering	17	51.5	21	52.5	11	30.6	8	13.1
3. Cooking support	8	24.2	6	15.0	3	8.3	1	1.6
4. Assessment of dietary intake	2	6.1	4	10.0	9	25.0	22	36.1
5. Nutrition counseling	1	3.0	8	20.0	13	36.1	33	54.1
6. Cooperation with local government, etc.	2	6.1	7	17.5	9	25.0	21	34.4
7. Cooperation with hospitals, etc.	1	3.0	3	7.5	3	8.3	4	6.6
8. Other	7	21.2	8	20.0	9	25.0	13	21.3

n: Number of dietitians who conducted assistance activities at survivors' homes in each phase.
%: Percentage of the number of responses to number of dietitians who conducted assistance activities at survivors' homes in each phase.

Table 6
Groups identified by dietitians as needing nutrition assistance at survivors' homes.

Group	Phase 0: 0–3 days (n = 31)		Phase 1: 4 days–1 month (n = 34)		Phase 2: 1–2 months (n = 31)		Phase 3: 3–6 months (n = 51)	
	n	%	n	%	n	%	N	%
1. Pregnant women	0	0.0	1	2.9	2	6.5	4	7.8
2. Lactating women	0	0.0	2	5.9	2	6.5	4	7.8
3. Infants and small children	4	12.9	5	14.7	5	16.1	9	17.6
4. Diabetes patients	1	3.2	4	11.8	5	16.1	21	41.2
5. Hypertension patients	3	9.7	6	17.6	6	19.4	21	41.2
6. Kidney disease patients	0	0.0	1	2.9	2	6.5	12	23.5
7. Other patients requiring dietary therapy	1	3.2	3	8.8	6	19.4	13	25.5
8. Food allergies	1	3.2	2	5.9	3	9.7	4	7.8
9. Elderly	10	32.3	13	38.2	13	41.9	33	64.7
10. Disabilities	1	3.2	3	8.8	5	16.1	11	21.6
11. Foreigners	0	0.0	0	0.0	0	0.0	0	0.0
12. Did not exist	5	16.1	5	14.7	2	6.5	3	5.9
13. Could not find	13	41.9	12	35.3	12	38.7	11	21.6

n: Number of dietitians who identified groups needing special nutrition assistance at survivors' homes in each phase.
%: Percentage of the number of responses to number of dietitians who identified groups needing special nutrition assistance at survivors' homes in each phase.

infants and small children. In phase 1, the most common response was also "Could not find" the vulnerable individuals needing special assistance. Of those who could be identified as requiring special assistance during phase 1, the most identified group was elderly, followed by hypertension patients. In phase 2, the most identified group was still elderly, followed by hypertension patients and other patients requiring dietary therapy. In phase 3, the most identified group was also elderly, followed by hypertension patients and diabetes patients.

4. Discussion

The aim of this study was to reveal which groups of vulnerable individuals need special nutrition assistance following a disaster and at which phase; thus, a survey was conducted targeting members of the JDA in the affected areas of Iwate, Miyagi, and Fukushima prefectures following the Great East Japan Earthquake. At emergency shelters, the groups most identified as needing special nutrition assistance in phase 0 were infants and small children, followed by elderly; however, in the subsequent phases, elderly, diabetes patients, and hypertension patients were find more commonly. At survivors' homes, the group most identified as needing special nutrition assistance was elderly in all phases. The vulnerable individuals needing special nutrition assistance differed depending on the phase of the disaster, it is necessary to provide nutrition assistance at the appropriate timing according to priority.

The study revealed that the types of assistance offered by dietitians after a disaster vary according to the phase. In phase 0, the main types of assistance needed included cooking and arranging food, while in later phases, assistance for the maintenance and advancement of good health became necessary, including nutrition counseling and assessment of dietary intake. Our previous research has shown that at emergency shelters one month post-disaster, there were insufficient amounts of almost all food products except grains [10]. For dietitians who conduct nutrition assistance activities during disasters, meal provision and menu-making skills are essential given that nutritionally limited and minimal ingredients are available. In cases where life at an emergency shelter becomes prolonged, dietitians must conduct nutrition counseling and intake assessments in an environment in which clinical data are inaccessible. We created and published a new dietary assessment sheet [21], based on the assessment sheet used by the Japan Dietetic Association–Disaster Assistance Team (JDA–DAT) during the 2015 Kumamoto earthquake. This assessment sheet is designed to help dietitians assess the nutritional situation during a disaster; however, it is necessary to develop simpler tools that anyone can use, including during a disaster. Since the type of nutrition assistance that is necessary varies according to the phase of the disaster, the necessary assistance skills will also vary according to the timing of the assistance provided. Thus, it is also necessary to consider when different dietitians should be dispatched during a disaster, based on their occupational scope and expertise in non-disaster period.

We found that the vulnerable groups that need special nutrition assistance differ by phases after disaster. Infants and small children, who are considered most at risk during a disaster, were the most common group that needed nutrition assistance at emergency shelters in phase 0, thus revealing the need to prioritize their assistance. As for infants and children, the issue is not limited to their inability to eat the food that is provided; children also tend to be picky eaters, and cases have been noted where children have refused food due to unfamiliar meals and an unfamiliar living environment [19]. The needs for Infant nutrition assistance at emergency shelters were declining over time. One possibility is that vulnerable such as infants and small children who had been initially considered vulnerable were not increase at latter phases because they moved from emergency shelters to welfare shelter, relatives' house and their homes as time went by Refs. [19,22]. This suggests that emergency shelters are not comfortable for infants and small children to live in. Furthermore, there were hygienic problems for infant not only in the acute phase but also in the mid-to-long-term phase [22]. This suggests that different skills will be needed depending on when a dietitian is providing assistance after a disaster. Thus, the expertise of pediatric dietitians should be included in assistance schedules, for example, in the relatively early periods following a disaster.

We also found that nutrition assistance needs are dependent on the phase for two other reasons: (1) because the assistance necessary for vulnerable individuals with chronic diseases such as hypertension and hyperglycemia increase over time following a disaster, and (2) because it is necessary to provide ongoing mid-to long-term assistance for elderly, whose needs do not diminish over time. Hypertension patients have high nutrition assistance needs, and the association between diet and chronic diseases after a disaster is speculated [1]. Health conditions rapidly worsen such as blood pressure and blood sugar by prolonged evacuation has increased the need for food and nutritional assistance for chronic disease patients [23]. Many of the foods distributed during disasters, such as canned and retort-packaged foods, are high in salt; this is not ideal diet for survivors already living under conditions of increased hypertension. In fact, it has been reported that an increase of merely a gram of salt per day increases the risk of disaster hypertension by 16% [24]. Furthermore, a negative correlation has been found between hypertension following a disaster and the consumption of milk and dairy products [25]; thus, it is important to try to ensure a balanced diet by eating a variety of foods, including milk and dairy products, even following a disaster.

Additionally, there was an increase in obesity following the Great East Japan Earthquake, especially among survivors living in temporary housing [5,7]. Assistance that is tailored to living situations could lead to more effective nutrition assistance following a disaster. Considering that a high proportion of the information that dietitians used to identify vulnerable individuals needing special assistance was provided by doctors and public health nurses, it is important to ensure that collaborative relationships are established with medical professionals during non-disaster periods. In particular, it is necessary to share basic knowledge about disaster nutrition.

To ensure that vulnerable individuals needing special assistance do not become malnourished following a disaster, it is essential that a system be established that can quickly provide food relief that is responsive to the specific needs of recipients. In the early stages of a disaster, nutrition assistance for infants and the elderly is needed with priority, and support for the elderly will be prolonged. This was common after the other disasters such as Athens earthquake and Kumamoto earthquake [14,19,22]. Therefore, it is also necessary to generalize in other affected areas as a vulnerable individuals to give priority to support them. Regarding preparations, the household food stockpile rate in Japan at that time was about 47.4% [26], so we think that it was not sufficient as a preparation for Great East Japan Earthquake. Therefore, severely food shortages may occur in countries and regions with low food stockpiling rates than Japan. In Japan, programs such as the Japan Disaster Food Certification System and the Disaster Food Certification System for Vulnerable Individuals with Special Dietary Needs have been created [27]. The Disaster Food Certification System for Vulnerable Individuals with Special Dietary Needs recognizes four types of foods suitable for vulnerable individuals needing special assistance: foods for allergies, foods for difficulty swallowing, low-protein foods for kidney disease, and foods to replenish liquids and electrolytes. These certified foods are marked with a distinctive logo so that suitable meals can easily reach vulnerable individuals with special needs, even in the midst of turmoil. In Israel, an information sharing model linking local institutions was constructed using a GIS-based tool to care for medically vulnerable populations following emergencies [28]. It would be desirable to move beyond country level programs and create a shared international structure to provide nutritional assistance to vulnerable individuals needing special assistance following a disaster. Furthermore, it is needed that research into the food insecurity and mental and physical health conditions for nutrition assistance dietitians in near future.

One of the limitations of this study was the low response rate.

Considering that the survey was conducted 1.5 years after a major disaster, the affected areas were still amid recovery, thus making it difficult to procure the cooperation of many participants. Therefore, it is possible that the results obtained in this study do not properly reflect the actual conditions in the affected areas after the disaster. A second limitation is that because the participants were responding to the survey 1.5 years after the disaster struck, it is possible that there were memory biases.

5. Conclusion

This study revealed the phases during which assistance is required for vulnerable individuals needing special assistance, who are strongly impacted in situations of poor nutrition following a disaster. We divided the six-month post-disaster period into four phases and surveyed members of the JDA in the areas affected by the Great East Japan Earthquake about the types of nutrition assistance activities they conducted and which groups of vulnerable individuals needed special assistance in each phase. The results showed that it is necessary to prioritize the assistance of infants and children at emergency shelters in early phase, and chronic disease patients in mid-to long-term. It was also important to provide ongoing mid-to long-term assistance for elderly, whose needs do not decline over time. Thus, it is hoped that a shared international system can be established to quickly provide assistance to vulnerable individuals needing special nutrition assistance following a disaster.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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