

Short Communication

Stockpiles and food availability in feeding facilities after the Great East Japan Earthquake

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Food stockpiles and methods of ensuring food availability after the Great East Japan Earthquake of March 11, 2011 have been studied. Questionnaires were sent to 1911 registered dietitians and general dietitians who were members of the Japan Dietetic Association in August 2012. Four hundred thirty-five dietitians (22.8%) completed the questionnaire about work involved in feeding facilities, types and administration of meals, and food stockpiles. Methods of ensuring food availability, preparation, and accommodating food for special dietary uses were recorded for the three-day period immediately following the earthquake, and the period from 4 days to one month after the earthquake. Three days after the earthquake, differences in administration of meals at feeding facilities providing three meals daily, food stockpiles, organization, contactable facilities, and how to contact them for food items were assessed. Sixty-nine percent of all feeding facilities in this study had stockpiles of food before the Great East Japan Earthquake. Administration of meals in feeding facilities and the possibility of contact with cooperative feeding facilities were found to correlate positively with ensuring the availability of food groups. Food scores were higher in facilities providing three meals daily by direct administration of meals and with accessible public administrators, cooperative facilities and suppliers, and facilities that were contactable by landline telephone, mobile phone, fax or email. The necessity for natural disaster-readiness through continuous stockpiling food at feeding facilities is confirmed. Each prospective feeding facility must be required to plan its stockpiles, their turnover and replaceability to maximise food security in the face of disaster.

Key Words: stockpile, food supply, dietitian, feeding facility, Japan

INTRODUCTION

Ensuring access to water and food during a disaster is a serious problem. Several studies showed that deterioration in nutritional status after the earthquake affected the health status of diabetic patients and others.¹⁻³ The Japanese government recommends the stockpiling of food sufficient for a 2-week duration to deal with emergencies such as the incidence of new strains of influenza or other disasters. The stockpile should include a portable gas stove and easily cooked food that can last for 3 days if there is a shortage or lack of electricity, gas, or water, or restricted transportation.⁴ Most of the feeding facilities provide three daily meals in the areas where patients and residents live. Therefore, it is important to ensure food availability for residents and users of facilities. Accordingly, the Ministry of Health, Labour and Welfare (MHLW) required administrative dietitians to support specified food-service facilities, develop a food-supply system, and enhance food stockpiles in the event of a health-care crisis.⁵ (The 2008 notification was discarded following enforcement of the 2013 notification by the MHLW).^{5,6} Nevertheless, the specific details of the stockpiles have been left to the responsibility of each facility under present circumstances.

Stockpiles of household food from 14 states were reported

in a United States study.⁷ In Japan, stockpiled food in households and municipalities of prefectural centers were investigated.⁸⁻¹⁰ The Ministry of Education, Culture, Sports, Science and Technology studied stockpiles at schools.¹¹ However, reports on food stockpiles at hospital kitchens and facilities for the elderly are scarce.¹² Other studies have investigated food items and groups at evacuation centers and the food they were unable to obtain.^{13,14} The food provided at hospitals was reported on; however, there are limited reports on ensuring food availability for their kitchens during emergencies.¹⁵

The objective of this study was to explore food stockpiles and supply after emergencies such as an earthquake. The findings of this study could be used to solve food stockpiles and nutrition problems in future disasters. A questionnaire survey was conducted among registered

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dietitians and general dietitians of Iwate, Miyagi, and Fukushima prefectures where damage was more serious in the Great East Japan Earthquake of March 11, 2011.

MATERIALS AND METHODS

Study design

Survey questionnaires were sent to 1911 registered dietitians and general dietitians with the Japan Dietetic Association (JDA) in the Iwate, Miyagi, and Fukushima prefectures in August 2012. Letters were to the same dietitians 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. Return of the questionnaire implied consent of the dietitians (participants) to participate in the study. The study was reviewed and approved by the ethics committee of the National Institute of Health and Nutrition in Japan. Questionnaires were collected by mail at the end of October 2012.

Questionnaire

The questionnaire was self-administered and included questions on the work involved in feeding facilities, types and provision of meals, stockpiles (food, prepared food, food for special dietary uses such as powdered milk for infants, and meals for sick people), emergency generators, and operating kitchens with equipment and facilities damaged by the earthquake. Questions on food availability, possibility of cooking, organization of kitchen facilities, and ensuring facilities were able to be contacted, and what methods were used to contact them were included in the questionnaire. In a contactable facility, public administrators included the prefectural government and health centers. Each question was asked for the period from the earthquake to 3 days after the earthquake, and the period of 4 days to 1 month (period of 1 month) after the earthquake. Gender and age group at the time of the earthquake were also recorded.

Fifteen food items were used for the analysis of food availability and related factors in facilities which were providing three meals daily.

Statistical analysis

Participants were included in the analysis if they answered questions on types of feeding facilities. Hospitals, facilities for the elderly, and facilities for the disabled were included in the group of facilities providing three meals daily. Schools, nursery schools, and others were included in the others group. Descriptive statistics and cross-tabulations were used to summarize the characteristics, stockpiles, and ensuring food availability at all facilities, facilities providing three meals daily, and others.

The percentage response to each question was calculated with the number of valid responses as the denominator. Ensuring food availability, preparing food, and food for special dietary uses, possibility of cooking, organization, contactable facilities, and how to contact them were analyzed by all feeding facilities, facilities providing three meals daily, and others. Dietitians would be trying to use a variety of foods to provide meals and to meet nutritional requirements in feeding facilities in ordinary times. In this study, from this viewpoint of ensuring the necessary nutrients by using variety of foods, food scores were used to

examine the meals provided. Food scores were calculated as total number of 15 food items (water, rice, bread, noodles, potatoes, pulses, nuts and seeds, vegetables, fruits, mushrooms, algae, fishes and shellfishes, meats, eggs and dairy products) that feeding facilities had provided.

The statistical significance of differences in food scores between providing meals in feeding facilities, stockpiles of food, and contactability at the period of 3 days were tested by Mann-Whitney *U* test. Differences between facilities and electricity/gas damaged by the earthquake were examined for statistical significance using the chi-square test. A *p* value of $p < 0.05$ (two-tailed) was considered to be significant. All statistical analysis was performed with SPSS software (version 18.0; IBM SPSS, Tokyo, Japan).

RESULTS

Questionnaires were sent to 1911 dietitians and 435 completed the questionnaire (response rate, 22.8%). Two hundred seventy-eight (63.9%) participants were involved in feeding facilities at the moment of the earthquake. Seven (2.5%) answered about multiple feeding facilities and we could not distinguish between the responses for facilities in relation to the provision of three meals daily or other arrangements; therefore these were excluded from the analysis. Of the study participants, 90.8% were women. Participants in their 30s made up 28.4% of the population, 27.7% were in their 40s, and 26.9% were in their 50s. In facilities providing three meals daily, 50.7% were hospitals, 41.3% were facilities for the elderly, and 8.0% were facilities for the disabled. In other facilities, 58.6% were schools, 29.3% were nursery schools, and 12.1% were others (Table 1). Direct administration of meals was performed in 49.3% of all feeding facilities. Food was stockpiled at 69% of all feeding facilities, including 80.3% of facilities providing three meals daily, and 25.5% of other facilities. Food for special dietary uses was stockpiled at 56.3% of facilities providing three meals daily and 23.2% of other facilities. Emergency generators, portable gas stoves, or water were not stockpiled at 9.4% of facilities providing three meals daily. On the other hand, these items were not stockpiled at 48.3% of other facilities. Damage at all feeding facilities included 62.3% with some damage of the facilities, 59.8% lacked a water supply, and 64.2% lacked electricity and/or gas. In the facilities providing three meals daily, 82.4% of hospitals and 76.1% of facilities for the elderly had stockpiles of food and 65.7% of hospitals and 48.8% of facilities for the elderly had stockpiles of food for special dietary uses. Stockpiles at schools included food (6.3%), emergency generators (8.8%), portable gas stoves (11.8%), and water (23.5%).

Responses on ensuring food availability at 3 days and 1 month after the earthquake are shown in Table 2. In all feeding facilities, 70.5% could ensure water availability, and 76.5% of facilities providing three meals daily could ensure water 3 days after the earthquake.

Three days after the earthquake, facilities providing three meals daily ensured food availability of fishes and shellfishes (47.4%), meats (49.3%) and eggs (46.9%). One month after the earthquake, these facilities ensured food availability of fishes and shellfishes (60.6%), meats

Table 1. Types of food provision, stockpiles, and damage in facilities after the earthquake

		All feeding facilities [†]		Facilities providing three meals daily [‡]		Other facilities [§]	
		<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Administration of meals	Direct administration	133	49.3	91	42.7	42	73.7
	Partly consignment	65	24.1	54	25.4	11	19.3
	Completely consignment	72	26.7	68	31.9	4	7.0
Food stockpiles	Yes	185	69.0	171	80.3	14	25.5
	No	37	13.8	9	4.2	28	50.9
	In stock [¶]	46	17.2	33	15.5	13	23.6
Food for special dietary uses	Yes	130	49.2	117	56.3	13	23.2
	No	110	41.7	78	37.5	32	57.1
	No need	24	9.1	13	6.3	11	19.6
Other stockpiles [‡]	Emergency generator	94	34.7	87	40.8	7	12.1
	Portable gas stove	145	53.5	128	60.1	17	29.3
	Water	180	66.4	157	73.7	23	39.7
	None of the above	48	17.7	20	9.4	28	48.3
Facilities damaged by the earthquake	Damaged	5	2.0	4	2.1	1	2.0
	Partly damaged	152	62.3	119	61.7	33	64.7
	No damage	87	35.7	70	36.3	17	33.3
Equipment damaged by the earthquake [‡]	Water supply	162	59.8	133	62.4	29	50.0
	Electricity/gas	174	64.2	140	65.7	34	58.6
	Cooking facility	47	17.3	29	13.6	18	31.0
	Cooking machinery	67	24.7	55	25.8	12	20.7
	Tableware	32	11.8	26	12.2	6	10.3
	Dishwasher	84	31.0	76	35.7	8	13.8
	Elevator	104	38.4	99	46.5	5	8.6
	There was no damage above	50	18.5	38	17.8	12	20.7

[†] All feeding facilities (*n*=271)

[‡] Hospitals, facilities for the elderly, facilities for the disabled (*n*=213)

[§] Facilities providing less than two meals daily. Schools, nursery schools, offices, other facilities (*n*=58)

[¶] Multiple answered. Denominator of each feeding facility. All feeding facilities: 271, facilities providing three meals daily: 213, other facilities: 58.

(63.4%) and eggs (63.8%). Availability of dairy products in facilities providing three meals daily was the lowest among the food groups with 34.7% at the period of 3 days and 43.2% at the period of 1 month. In 61.5% of facilities providing three meals daily, canned food was still available 3 days after the earthquake. Calorie-dense food, concentrated liquid diet, and dietary supplements were major foods for special dietary uses that were available in all feeding facilities 3 days and 1 month after the earthquake. In all feeding facilities, 63.1% ensured food availability from their suppliers and stores, but 10% were unable to ensure a supply of food from anywhere and 14.4% were not able to cook at 3 days after the earthquake.

In facilities providing three meals daily, 51.2% could contact their suppliers at 3 days after the earthquake, next, cooperating facilities (33.8%) and public administrators (30.5%). Direct contact was the best way to contact feeding facilities (45.4% for all feeding facilities and 47.9% for facilities providing three meals daily) at 3 days after the earthquake. Landline telephone (70.1% for all feeding facilities and 71.4% for facilities providing three meals daily) and mobile phone (58.3% for all feeding facilities and 59.2% for facilities providing three meals) were the main ways to contact feeding facilities at 1 month after the earthquake. In the facilities providing three meals daily, 25.0% of hospitals and 37.5% of facilities for the

elderly were in contact with public administrators at 3 days after the earthquake. In addition, 25.9% of hospitals and 43.2% of facilities for the elderly had contact with cooperating facilities at 3 days after the earthquake.

The relationship between providing meals, food stockpiles, contactability, and food scores at 3 days after the earthquake are shown in Table 3. The food scores were higher in facilities providing three meals daily by direct administration of meals than in those partly or completely through consignment ($p<0.05$).

Subjects who were able to contact public administrators, cooperating facilities, and suppliers had higher food scores than those who could not ($p<0.05$). Subjects who were able to use landline telephones, mobile phones, faxes, and email had higher food scores than those who did not have access to communication technology ($p<0.05$). No significant difference was found in food scores in regard to contactability by facilities damaged by the earthquake. But electricity/gas damaged by the earthquake was related to possible contactability by landline telephone (<0.001) and fax (<0.001).

DISCUSSION

This study examined the food-supply conditions at feeding facilities after the Great East Japan Earthquake and found that food stockpiles and contactability affected the

Table 2. Ensuring food availability and contactability in feeding facilities at 3 days and 1 month after the earthquake

		All feeding facilities [†]		Facilities providing three meals daily [‡]		Other facilities [§]	
		From the earthquake to 3 days after (%)	4 days to 1 month (%)	From the earthquake to 3 days after (%)	4 days to 1 month (%)	From the earthquake to 3 days after (%)	4 days to 1 month (%)
Food groups	Water	70.5	74.5	76.5	77.0	48.3	65.5
	Rice	67.9	76.4	75.1	81.2	41.4	58.6
	Bread	27.7	48.7	29.1	47.4	22.4	53.4
	Noodles	21.4	43.2	23.9	43.2	12.1	43.1
	Potatoes	42.4	62.0	46.5	63.8	27.6	55.2
	Pulses	28.0	48.3	30.0	49.3	20.7	44.8
	Nuts and seeds	25.1	43.5	26.3	42.3	20.7	48.3
	Vegetables	55.0	70.1	62.9	73.2	25.9	58.6
	Fruits	38.4	60.9	42.7	61.5	22.4	58.6
	Mushrooms	29.5	49.4	33.3	50.7	15.5	44.8
	Algae	32.8	45.0	35.7	45.1	22.4	44.8
	Fishes and shellfishes	40.2	57.6	47.4	60.6	13.8	46.6
	Meats	43.2	61.3	49.3	63.4	20.7	53.4
	Eggs	41.0	60.9	46.9	63.8	19.0	50.0
Dairy products	30.3	42.4	34.7	43.2	13.8	39.7	
Food for special dietary uses	Calorie dense food	21.4	28.8	27.2	36.2	0.0	1.7
	Low calorie food	6.6	10.7	8.0	13.1	1.7	1.7
	Low protein food	7.0	11.8	8.9	15.0	0.0	0.0
	Protein dense food	8.5	14.0	10.3	17.4	1.7	1.7
	Low protein, calorie dense food	5.5	10.3	7.0	13.1	0.0	0.0
	Concentrated liquid diet	32.5	47.6	41.3	60.1	0.0	1.7
	Powdered milk	3.7	6.6	1.9	3.8	10.3	17.2
Solid food	2.6	5.9	0.9	2.8	8.6	17.2	

[†] All feeding facilities ($n=271$)

[‡] Hospitals, facilities for the elderly, facilities for the disabled ($n=213$)

[§] Facilities providing less than two meals daily. Schools, Nursery schools, Offices, Other facilities ($n=58$)

^{||} Multiple answered. Denominator of each feeding facilities. All feeding facilities: 271, facilities providing three meals daily: 213, other facilities: 58.

[¶] Prefectural government and health center

Table 2. Ensuring food availability and contactability in feeding facilities at 3 days and 1 month after the earthquake (cont.)

		All feeding facilities [†]		Facilities providing three meals daily [‡]		Other facilities [§]	
		From the earthquake to 3 days after (%)	4 days to 1 month (%)	From the earthquake to 3 days after (%)	4 days to 1 month (%)	From the earthquake to 3 days after (%)	4 days to 1 month (%)
Food for special dietary uses	Lactose free food	0.0	1.1	0.0	1.4	0.0	0.0
	Allergy free food	1.5	3.0	0.9	2.3	3.4	5.2
	Food for elderly and dysphagia	15.1	23.2	18.8	29.1	1.7	1.7
	Low sodium foods	0.7	3.7	0.9	4.7	0.0	0.0
	Drink for hydration	10.7	22.9	12.2	27.7	5.2	5.2
	Dietary supplement	23.2	36.2	28.2	44.6	5.2	5.2
	Enriched rice	5.2	6.3	6.1	6.6	1.7	5.2
	None of the above was needed	8.9	8.1	4.2	4.7	25.9	20.7
How to ensure food	Suppliers/stores	63.1	70.1	71.4	75.6	32.8	50.0
	Public administration	18.5	31.7	19.7	35.7	13.8	17.2
	Stockpile of supply alliance	14.8	18.5	17.8	22.1	3.4	5.2
	Cooperation facilities	9.6	16.6	10.8	20.2	5.2	3.4
	Neighborhood	17.0	15.9	19.2	19.7	8.6	1.7
	Volunteer	6.3	11.1	7.5	12.7	1.7	5.2
	Couldn't ensure food	10.0	2.2	7.5	0.9	19.0	6.9
Possibility of cooking	Possible	73.4	74.2	81.7	79.8	43.1	53.4
	Possible with the assistance	2.6	3.0	2.3	3.3	3.4	1.7
	Impossible	14.4	3.7	10.3	1.9	29.3	10.3
Contactable facilities	Public administrators [¶]	36.2	44.3	30.5	41.3	56.9	55.2
	Cooperating facilities	31.7	38.7	33.8	40.8	24.1	31.0
	Suppliers	47.6	57.6	51.2	59.2	34.5	51.7
	Prefectural Dietetic Association	0.7	6.6	0.9	6.1	0.0	8.6
	Japan Dietetic Association	0.0	1.1	0.0	1.4	0.0	0.0
	Council of feeding facilities	2.6	4.8	2.8	4.7	1.7	5.2

[†] All feeding facilities ($n=271$)

[‡] Hospitals, facilities for the elderly, facilities for the disabled ($n=213$)

[§] Facilities providing less than two meals daily. Schools, Nursery schools, Offices, Other facilities ($n=58$)

^{||} Multiple answered. Denominator of each feeding facilities. All feeding facilities: 271, facilities providing three meals daily: 213, other facilities: 58.

[¶] Prefectural government and health center

Table 2. Ensuring food availability and contactability in feeding facilities at 3 days and 1 month after the earthquake (cont.)

		All feeding facilities [†]		Facilities providing three meals daily [‡]		Other facilities [§]	
		From the earthquake to 3 days after (%)	4 days to 1 month (%)	From the earthquake to 3 days after (%)	4 days to 1 month (%)	From the earthquake to 3 days after (%)	4 days to 1 month (%)
Contactable facilities	Medical institution	2.2	5.5	2.3	6.6	1.7	1.7
	Others	1.1	2.2	0.9	2.8	1.7	0.0
	Didn't have contact	15.1	9.6	16.0	10.3	12.1	6.9
How to contact	Landline telephone	39.1	70.1	40.8	71.4	32.8	65.5
	Mobile phone	32.8	58.3	33.8	59.2	29.3	55.2
	Fax	10.3	44.3	10.8	44.6	8.6	43.1
	Email	10.7	26.9	10.8	25.4	10.3	32.8
	Internet	5.2	24.4	6.6	23.5	0.0	27.6
	Direct contact	45.4	31.4	47.9	33.3	36.2	24.1
	None of the above	8.5	1.1	7.5	0.9	12.1	1.7

[†] All feeding facilities ($n=271$)

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[¶] Prefectural government and health center

Table 3. Food scores on stockpiles and contactability in facilities that provide three meals daily[†] at 3 days after the earthquake

		<i>n</i>	Mean	SD	Median	25, 75 percentile	<i>p</i> value
Administration of meals	Direct administration	91	7.5	5.1	8.0	2.0, 12.0	0.030
	Partly/completely consignment	122	5.9	4.8	5.0	2.0, 10.0	
Food stockpiles	Yes/in stock	204	6.7	5.0	6.0	2.0, 11.0	0.324
	No	9	4.9	4.1	5.0	1.5, 8.5	
Contactability: public administrators [‡]	Possible	65	7.8	4.9	7.0	3.5, 12.5	0.020
	Impossible	148	6.1	5.0	5.0	2.0, 10.8	
Contactability: cooperating facilities	Possible	72	7.6	5.2	8.0	2.0, 12.0	0.040
	Impossible	141	6.1	4.9	6.0	2.0, 10.0	
Contactability: suppliers	Possible	109	7.9	4.7	8.0	3.5, 12.0	<0.001
	Impossible	104	5.3	5.0	4.0	1.0, 10.0	
Contactability: landline telephone	Possible	87	8.4	5.2	9.0	4.0, 13.0	<0.001
	Impossible	126	5.4	4.5	4.0	1.0, 9.0	
Contactability: mobile phone	Possible	72	7.6	4.9	8.0	3.0, 11.8	0.039
	Impossible	141	6.1	5.0	5.0	2.0, 11.0	
Contactability: fax	Possible	23	10.7	5.0	13.0	8.0, 15.0	<0.001
	Impossible	190	6.1	4.8	6.0	2.0, 10.0	
Contactability: email	Possible	23	8.7	5.0	9.0	5.0, 13.0	0.034
	Impossible	190	6.3	5.0	6.0	2.0, 11.0	

SD: Standard Deviation

Differences in food scores between category at the period of 3 days were tested by Mann-Whitney *U* test

Food scores were calculated as total number of 15 food items (water, rice, bread, noodles, potatoes, pulses, nuts and seeds, vegetables, fruits, mushrooms, algae, fishes and shellfishes, meats, eggs and dairy products) that feeding facilities had provided.

[†] Hospitals, facilities for the elderly, facilities for the disabled (*n*=213)

[‡] Prefectural government and health center

availability of foods.

The percentage of food stockpiles in this study was higher than a previous study.¹² In all feeding facilities, 69% had food stockpiles before the Great East Japan Earthquake. A study on feeding facilities in Kagoshima prefecture in 2004 found that 37% of the study subjects had food stockpiles.¹² Comparing this study and the previous one has limitations because the circumstances around these study sites and years are different. However, the previous study mentioned that the number of feeding facilities with stockpiles had increased after the Great Hanshin-Awaji Earthquake in 1995.¹² The present study was conducted in 2012 and it meant the Niigata-Chuetsu earthquake (2004) and Niigata Chuetsu-Oki earthquake (2007) were already occurred.

In the present study, schools stockpiled food (6.3%) and water (23.5%). A nationwide survey which targeted public and private schools after the Great East Japan Earthquake conducted by the Ministry of Education, Culture, Sports, Science and Technology reported that schools stockpiled food (30.2%) and water (33.7%).¹¹ Generally, schools do not provide meals three times daily, but do play an important role as evacuation centers according to previous disasters.¹⁶ Therefore, improving stockpiles in schools is recommended.

Our findings suggest that dairy products are one of the food groups that are hard to keep available after a disaster. In this study, food availability of most food groups was more than 60%; however, dairy products were 40% for all feeding facilities and facilities providing three meals daily 1 month after the earthquake. Dairy products are an essential food source of calcium, of which it is recommended to ingest adequate amounts at developmental stages in which bone mass accumulation rates are highest such as

adolescence. In this regard, if evacuation is prolonged, attention should be paid to ensure that food sources of this nutrient are available to those who need it most.¹⁷ Therefore, measures to ensure dairy products are available must be considered. Food for special dietary uses was stockpiled by 65.7% of hospitals, which are considered to have the highest need for them. The average stockpiles of food for special dietary uses at facilities providing three meals daily was 56.3%. In particular, 60.1% of facilities providing three meals daily could ensure availability of concentrated liquid diet and 36.2% could ensure availability of calorie-dense food. People who need these kinds of foods experience difficulties substituting other foods that they can absorb nutrients from thus once stockpiles of these special dietary uses are depleted, other substitutes must be offered continuously.

The Ministry of Health, Labour and Welfare recommends that the nutritional reference quantities for energy, protein, vitamin B₁, vitamin B₂ and vitamin C be adequate for up to 3 months after a disaster.¹⁸ But the results of food availability in this study demonstrated difficulties in ensuring sources of protein and vitamins. Therefore each feeding facility should be required to consider how it would ensure food stocks to meet reference amounts for citizens, including patients.

The importance of solidarity was shown in this study. Providing meals in feeding facilities and being able to contact cooperating facilities was strongly related to ensuring food groups were available. The operation of a nationwide support network between hospitals outside the disaster area to relieve hospitals in the disaster area played an important role for the early procurement of food for hospitals after the Great Hanshin-Awaji Earthquake.¹⁵ Additionally, this study demonstrated that the

use of landline telephones, mobile phones, faxes, and email made a difference in ensuring food availability. But facilities where electricity/gas supplies were damaged by the earthquake were less likely to be contactable by landline telephone or fax. Thus, there is a need to improve communication methods to enhance cooperation between facilities and suppliers in the event of a disaster.

In this study, no significant difference was found in food scores between those with food stockpiles and those without. One of the explanations may be that we did not ask about the kind of stockpiles. From Table 2, it can be seen that 76.5% could ensure water and 75.1% could ensure rice in facilities which provided three meals daily for three days after the earthquake. Understandably, this was problematic where stockpiles comprised only water and rice.

One of the limitations of this study was that only 22.8% of the distributed questionnaires were returned. However, the return rate was similar to another survey whose subjects were JDA members.¹⁹ This questionnaire was distributed to registered dietitians who were the members of the Dietetic Association of one of three prefectures. However, the disaster damage did not occur in the whole prefecture, and only affected part of the prefecture. Therefore, it is possible that dietitians who did not belong to the disaster area did not answer the questionnaire.

Another limitation was that we asked the subjects to identify the food and prepared food that could be kept available. Accordingly, the foods not chosen were those that could not be kept available. However, it is possible that foods that were not chosen included foods that were not necessary to keep available. Food scores were used to assess meal provisions but we could not assess amount of food or nutritional quality, particularly whether it was fresh or canned. We also could not establish the capacity of the feeding facilities which did or did not receive evacuees. It is possible that this information would have accounted for some of the differences observed. In addition, the availability of registered dietitians in three prefectures and transportation issues could have affected the differences in availability and variety of food between prefectures. Limited sample size meant we could not analyze the intra-prefectural availability of foods.

In conclusion, in the Great East Japan Earthquake, the provision of meals in feeding facilities and the ability to communicate between cooperating facilities were factors in ensuring food availability and variety. Therefore, each facility which may be called upon in a natural disaster needs to plan for meal provision in feeding facilities which can communicate with other food support facilities. Guidelines should be established in ways which promote and maintain solidarity between facilities.

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AUTHOR DISCLOSURES

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Short Communication

Stockpiles and food availability in feeding facilities after the Great East Japan Earthquake

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日本东部大地震后用餐设施库存和食品供应

本课题研究了日本 2011 年 3 月 11 日东部大地震之后的食品库存以及确保食品供应的方法。2012 年 8 月研究人员将问卷发给了日本营养师协会的 1911 名注册营养师和普通营养师。435 名营养师(22.8%)完成了关于食品用具、类型、饭菜的处理和食品的储存情况的问卷。研究记录了震后三天内以及从震后第四天到一个月之间确保食物供应的方法、食物的准备和一些特殊用途食物的储存。地震三天后，对供餐点提供每日三餐、食物的储存、组织和管理、以及如何能联系到供餐点进行了评估。本研究中，在日本东部大地震之前 69%的供餐点都有食物贮备。供餐点食物的供给和与供餐点有合作关系的食物集团现存食物成正相关。能直接提供一日三餐、公众容易找到、提供有线电话、手机、传真和电子邮件的供餐点的评分较高。本研究证实了为自然灾害在供餐点贮备食物的必要性。必须要求每个未来供餐点规划它的食物贮备、定期更换和可替代性，以最大限度地提高在灾难面前的粮食安全。

关键词：物资储备、食品供应、营养师、食品用具、日本