

### Mindset Change from Emergency Food to Disaster Preparation Food to Support Disaster Survivors

The Great East Japan Earthquake forced up to 470,000 survivors to evacuate their homes, who were provided with approximately 8.4 million meals of rations over a week’s time. In the future, if a major earthquake strikes a highly populated region, creating evacuees an order of magnitude greater than this latest earthquake did—particularly should one occur in the Tokyo metropolitan area—then the survivors would need 75 million meals of rations or more for that first week afterward.

At present, emergency food stockpiled by local governments and households is low in absolute quantities and little of this food can be eaten without water or heat, which may be unavailable immediately after an earthquake. Furthermore, there are few cases of large, diverse stockpiles prepared with long-term emergency living conditions for survivors in mind, and much emergency food goes unused, as it is disposed of after its shelf life expires. It is important that we change the mind from conventional “Emergency food” that stockpilers assume will not be used, to “Disaster preparation food” (food prepared for disaster) that can be used in usual days as well as prove especially useful during a disaster.

Until now, no research on food has been conducted that takes the needs of survivors and nutrition during a disaster into consideration. It is important to do the following: 1) research on nutritional science as it applies during a disaster, 2) develop techniques to process food for disaster response, 3) develop packaging techniques for disaster preparation food and 4) develop cooking equipment for disaster preparation food. We also need to consider how to utilize the disaster preparation food in the daily life. The authors of this report recommend the advancement of this research and development and the creating of Disaster Food Certification Standards that incorporate the conditions required for disaster preparation food.

Conducting research and development and building infrastructure will require separate roles for the private sector, universities, government agencies, etc. upon incorporation within the Basic Disaster Prevention Plan, the government’s fundamental plan for disaster response.

One of the pressing issues to prepare for major earthquakes and other disasters likely to occur in the future is to create disaster preparation food stockpiling systems and build substantial disaster preparation food stockpiles.

(Original Japanese version: published in March/April 2012)

**Table : Disaster Preparation Food Coverage**

Recipients	First Stage		Second Stage	Third Stage	Notes
	No Drinkables	w/ Drinkables			
Residents (General)	×	△	△	×	
Residents (Special Needs)	×	×	×	×	
Patients & Inmate	×	×	×	×	
Non-Residents (workers, stranded commuters, etc.)	×	△	/	/	
Relief Workers (General)	×	△	△	/	incl. residents responding to disaster
Relief Workers (Special)	/	/	△	/	firefighters, SDF, etc.

△: Current emergency food partially helps

×: Current emergency food mostly does not help

Compiled by the Science and Technology Foresight Center

# Shifting from Emergency Food to Disaster Preparation Food to Help Disaster Survivors

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## 1 Introduction

On March 11, 2011, a magnitude 9.0 earthquake struck off the Sanriku coast. Along Tohoku region's Pacific coast, eight prefectures experienced shaking of M6 weak or greater on the Japanese seismic intensity scale. The earthquake spawned a massive tsunami higher than anyone had predicted and that caused an accident at a nuclear power plant. The disaster, called the Great East Japan Earthquake, left 15,854 dead and 3,276 missing (as of March 1, 2012).<sup>[1]</sup>

As of March 14, 2011, the damage inflicted by the disaster affected some 470,000 people.<sup>[2]</sup> In the disaster zone, the Japanese government's disaster personnel who responded to the emergency were joined by the Self-Defense Forces, the Fire and Disaster Management Agency (FDMA), the National Police Agency and the Japan Coast Guard engaging in rescue and relief operations, alongside medical institutions providing emergency care. Others worked to restore utilities. In all there were up to hundreds of thousands of personnel handling these and other related tasks each day. Even if all these people were provided only two meals a day to carry out their work, that necessitated at least 1.2 million meals daily. The government's Emergency Disaster Response Headquarters procured and transported necessities on its own because of the disaster zone's extent and the impaired ability of local governments to function. In addition, various organizations engaged in rescue operations and other activities also distributed emergency supplies. Especially in the area affected by the tsunami, civilian emergency stockpiles and inventories were distributed, but interruptions to communications networks and damage to roads were widespread while fuel was in short supply, thus delaying aid from outside the region and complicating

the provision of rations for disaster survivors and emergency response personnel.

One of the emergency response measures taken thus far has been the recommendation of an approximately three-day stockpile of emergency food.<sup>[3]</sup> It is generally believed that appropriate food is emergency food (food for emergency use) that can be stored at room temperature and has a long shelf life, which allows disaster survivors to hold out until outside help arrives. However, many issues have been pointed out concerning emergency food in the aftermath of an earthquake. After the Great Hanshin-Awaji Earthquake, it was shown that decisions made prior to the earthquake on preparing stockpiles were based solely on the perceived convenience of long shelf lives, while inadequate attention was paid to helping survivors and relief workers in disaster zones that lack access to utilities. Furthermore, after the Niigata Chuetsu Earthquake and the Niigata Chuetsu-oki Earthquake, it was determined that there was a need to consider the quality of food, including variety (due to the distress of continuously eating the same thing), as well as warm foods, rather than simply the quantity of food distributed to disaster survivors. It became clear that food relief to those who require it must provide food that meets the recipients' needs.<sup>[4]</sup> In addition, it was pointed out that the large number of people affected by the Great East Japan Earthquake and extended periods of living under emergency living conditions in isolated areas led to both insufficient quantities and quality.<sup>[5]</sup>

Earthquakes are expected to continue to strike Japan in the future. There are many issues concerning the inability to respond to earthquakes: the way emergency food is handled, the way we think about emergency stockpiles, and post-earthquake response. We need to rethink our ideas about emergency food in accordance with the purpose of facilitating secondary

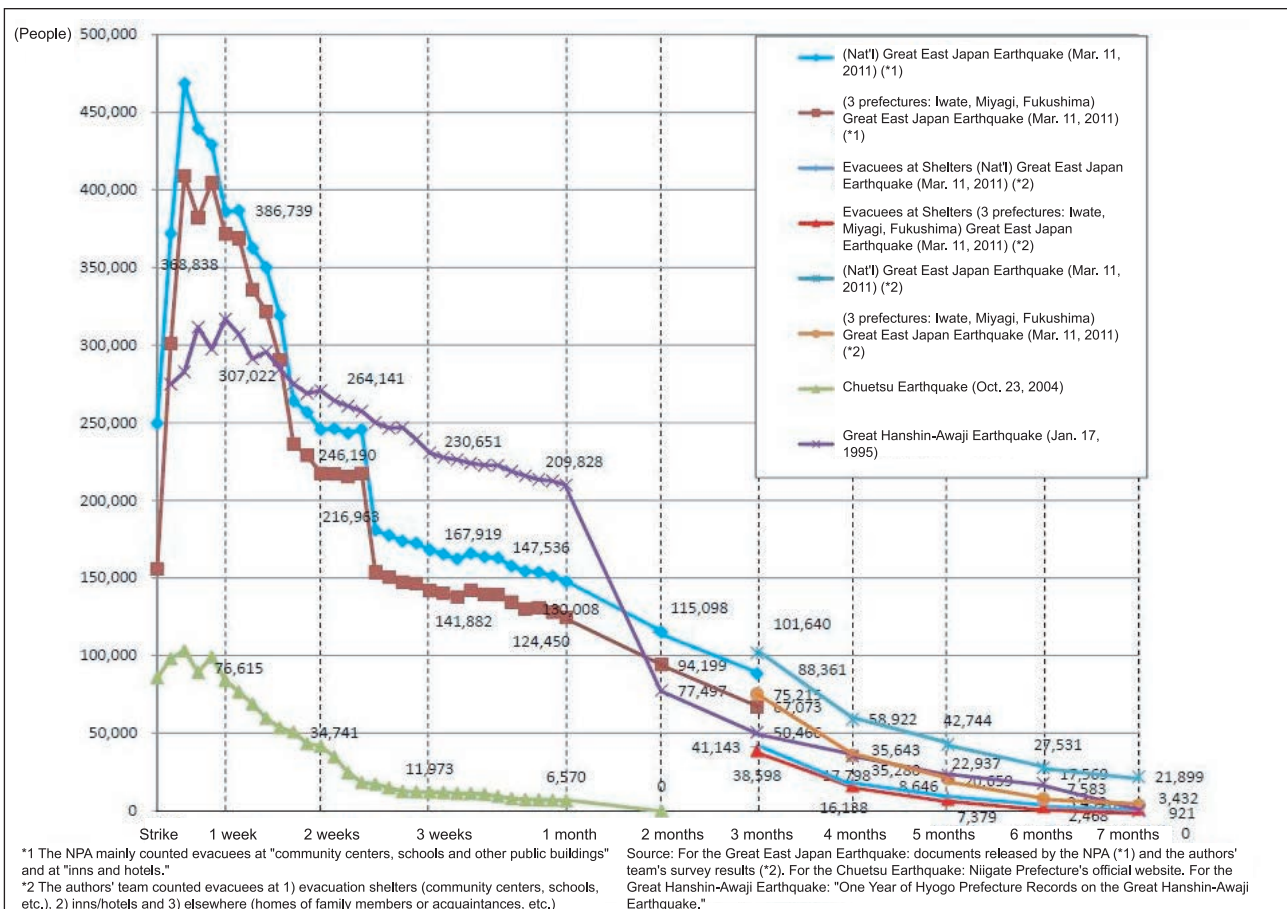
disaster prevention and recovery in terms of survivors' health. When arranging for rations in a disaster zone, it is essential to consider water and heating—in addition to the food itself—in addition to the effects of inaccessibility to water and heated/boiled water due to utility disruptions. Rations must be examined in a concrete and gradual manner. Moreover, the authors would also like to see disaster mitigation shift from the conventional concept of emergency food to one of

“disaster preparation food” (food prepared for disaster) that is based on appropriate ways for households and companies to provide their own stockpiles and for the government to provide public stockpiles and assistance.

**Table 1 : Damage by Major Disasters (Real & Projected)**

Disaster Name	"Deaths (incl. missing)"	Evacuees	"Procurements (Rations)"	"Shortages (Rice)"
Great Hanshin-Awaji Earthquake	6,437	320,000 (Peak time: 1 week later)		
Great East Japan Earthquake	19,225 <sup>[1]</sup>	470,000 (Peak time: 3 days later)	"8,400,000 meals/ week"	
Tokai Earthquake	7,900 - 9,200	1,900,000/1 week later	"23,510,000 meals/ week"	"Max 410,000 kg"
Tonankai/Tokai Earthquake	12,000 - 18,000	5,000,000/1 week later		"Max 2,500,000 kg"
Tokyo Metropolitan Area Earthquake	11,000	7,000,000/max	"75,100,000 meals/ week"	
Tokai/Tonankai/Nankai Earthquake	28,000			

Source: Compiled by the Science & Technology Foresight Center based on Reference #2, #6, #7



**Figure 1 : Evacuees from the Great Hanshin-Awaji, Great East Japan and Chuetsu Earthquakes**

Source: Reference #2

## 2 Numbers of Evacuees in Recent Earthquakes and Future Estimates

The maximum number of evacuees (those living in evacuation shelters) from the Great Hanshin-Awaji Earthquake was 320,000 people and from the Great East Japan Earthquake 470,000 people. In the case of future earthquakes, such as a Tokai, Tonankai, Nankai or Tokyo metropolitan area earthquake, an estimated peak of 1.9 million to 7 million evacuees—around 10 times as many—will be created. While there was a need for a weekly provision of approximately 8.4 million meals after the Great East Japan Earthquake, a Tokyo metropolitan area earthquake would necessitate an estimated 75 million meals a week (see Table 1).

In addition, while evacuee numbers after the Great Hanshin-Awaji Earthquake and Great East Japan Earthquake peaked one week afterward and three days afterward, respectively, some were forced to continue living in evacuee conditions for half a year or longer (see Figure 1).

## 3 Food-Related Problems in Times of Emergency

Here we address food in terms of disaster response by giving dedicated attention to each situational concern and food stockpile problem.

### 3-1 Concerns over Food

#### (1) Concern over Delayed Restoration of Utilities

Power was fully restored five days after the Great Hanshin-Awaji Earthquake (see Figure 2). While 90% was restored five days after the Great East Japan Earthquake, more than a month was required to bring it completely back on line. Contrarily, it took 83 days to restore gas after the Great Hanshin-Awaji Earthquake, but only 44 days after the Great East Japan Earthquake.

It took about three months to fully repair water mains after the Great Hanshin-Awaji Earthquake, but due to the destruction wrought by the Great East Japan Earthquake, gas services were not fully restored even

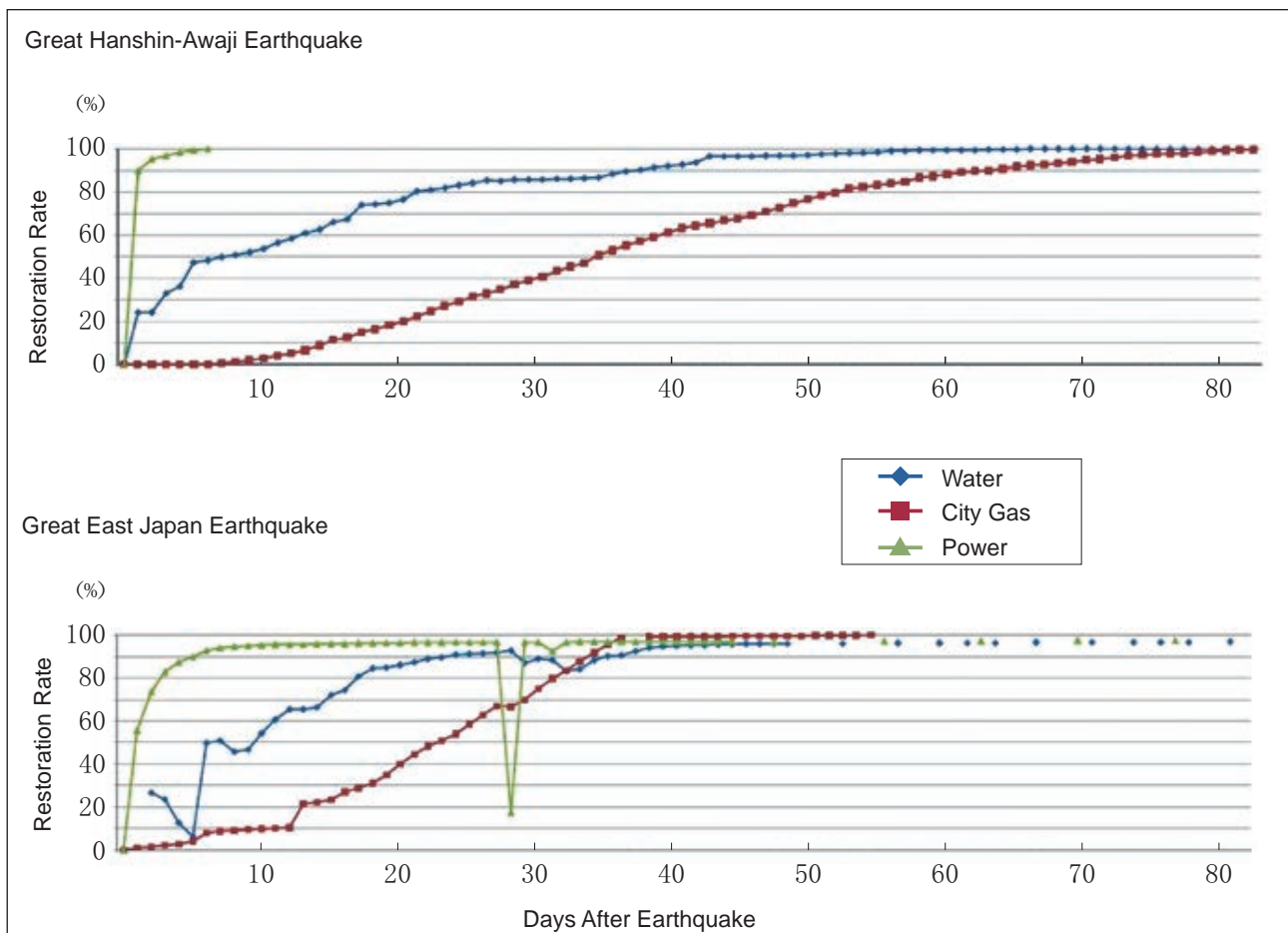


Figure 2 : Restoration of Utilities after the Great Hanshin-Awaji and Great East Japan Earthquakes

Source: Reference #9

a year afterward.<sup>[8]</sup>

Food is stockpiled under the assumption that utilities will be restored soon after a disaster. This is exemplified by stockpiled food requiring hot water to consume. However, restoring utilities after a large-scale disaster covering a widespread area or in a major city requires more time, thus invalidating this assumption.

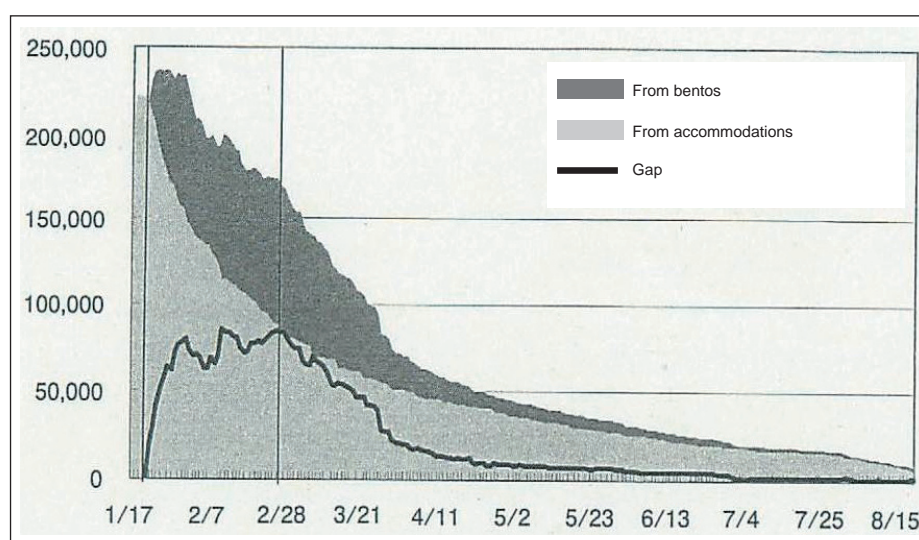
**(2) Concern over Delayed Food Assistance**

Starting a week after the Great Hanshin-Awaji Earthquake struck, the number of bentos (portable boxed meals) distributed to evacuation shelters exceeded the number needed to feed the evacuees housed there. The idea was for disaster survivors who had remained in their homes but depleted their stockpiles to come pick them up at the shelters, but distribution peaked on February 28, over a month after the earthquake. In other words, this shows that there were many people who still could not procure

sufficient rations for themselves even after a month had passed since the earthquake struck.<sup>[4]</sup>

After the Great East Japan Earthquake, the distribution and delivery of rations were still not well organized, even after utilities had been restored to allow the transport of said supplies. In many cases, there was no place to put the needed rations. There were cases when rice balls, bread and some of the other such food that spoils soon and was brought to the disaster zone from the outside took time to reach their destinations due to damaged and congested roads, thus failing to achieve the goal of such efforts.

This explains the risk that it may take a long time to go and deliver relief supplies to survivors of a disaster occurring in a major city or over a widespread area, as well as the risk that inadequate food stockpiles may lead to food shortages.

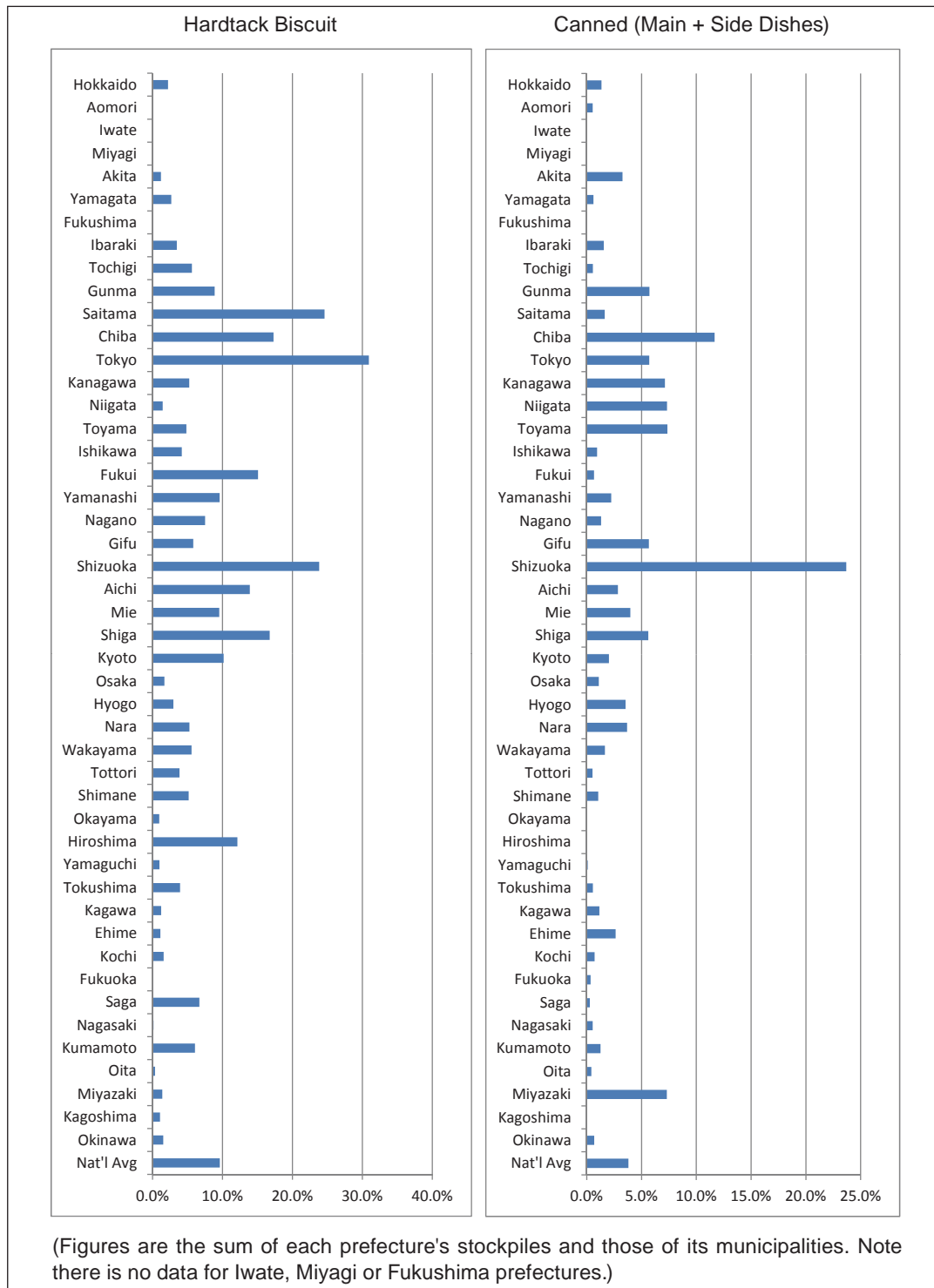


**Figure 3 :** Calculations of Evacuee Numbers after the Great Hanshin-Awaji Earthquake  
Source: Reference #2

**Table 2 :** Examples of Regional/Local Government Food Stockpiles (Current Stockpiles)

Category	Food Name	Prefectures									Cities					
		Osaka	Shiga	Toyama	Yamanashi	Tokyo	Saitama	Chiba	Gunma	Ibaraki	Kumamoto	Kobe	Nishinomiya	Kyoto	Kanazawa	Hiratsuka
A	Canned Rice Porridge			○					○	○						
B	<b>Hardtack Biscuits</b>		○	○	○		○	○	○		○		○	○		
	Crackers					○		○			○					
	Biscuits							○								
	Canned Bread								○	○						
	Dietary Supplements										○					
B or C	Canned (Main/Side Dishes)		○	○						○		○				
C	<b>Pregelatinized Rice</b>	○	○	○		○	○		○		○	○	○	○	○	
	<b>Canned Freeze-Dried Emergency Food (veg. stew, etc.)</b>		○	○	○										○	○
	<b>Powdered Milk</b>	○									○	○	○	○	○	
	Instant Noodles					○										
D	Rice	○	○	○		○	○	○	○							
	Drinking Water (Ref.)	○		○	○			○	○	○						

Compiled by the Science and Technology Foresight Center based on References #4, #10



**Figure 4 : Ration Stockpiles by Prefecture**

Compiled by the Science and Technology Foresight Center based on Reference #11

[NOTE 1] Although this topic is not addressed by this report, providing water that humans need to live is even more important than food. Potable water and other drinkables must by all means be stockpiled.

Furthermore, stockpiles come in two forms: “actual stockpiles” and “distributable stockpiles.” As the names imply, actual stockpiles are rations that are in storehouses, etc. belonging to the government that would use them, while distributable stockpiles are rations kept in storehouses by traders for use in case of a disaster and are subject to contracts concluded in advance between the trader and a local government. This report generally addresses the former: actual stockpiles. While many local governments have distributable stockpiles, a major disaster such as the Great East Japan Earthquake can make distribution channels grind to a halt and inflict damage on trader storehouses, thus posing the risk that these stockpiles will not function.

### 3-2 Ration Stockpile Problems

#### 3-2-1 Categories

Rations stockpiled for disasters and other such emergencies (i.e. emergency food) can be categorized as follows according to differences in their ease of consumption.

Category A: Food requiring no preparation and consumed without a drinkable

Food such as rice porridge and jelly drinks that can be eaten as is, is easy to swallow and does not require an accompanying drinkable during consumption.

Category B: Food requiring no preparation and consumed with a drinkable

Food such as bread and crackers that can be eaten as is, but requires an accompanying drinkable. Includes some canned/retort pouch food servings requiring no preparation and dried foods that can be eaten after only adding water (e.g. freeze-dried rice cakes).

Category C: Food eaten after adding or immersing in hot water

Food such as freeze-dried foods and pregelatinized rice to which hot water is added when consumed, or food such as retort pouch curry and retort pouch food servings that are immersed in hot water prior to consumption. This includes instant noodles prepared by adding hot water.

Category D: Food that must be cooked

Food such as polished rice and spaghetti that must be cooked using a heat source.

A look at examples of food stockpiles belonging to local governments (see Table 2) shows that a number of governments stockpile rice porridge, a Category A food, and many stockpile typical hardtack biscuits, a Category B food. Among Category C foods, a number of local governments stockpile canned and freeze-dried emergency food that can stay in storage for a long time (10 years at room temperature) because of special canning processes or freeze-drying that reduces moisture to an extremely low level, as well as pre-cooked rice dried with hot air for long-term

storage. Many prefectures stockpile rice, a Category D food. Food in Categories B through D requires a certain amount of water to consume, and there are cases in which such foods are not stockpiled together with water supplies.

#### 3-2-2 Ration Stockpiling Problems

##### (1) Low Absolute Quantities of Stockpiles

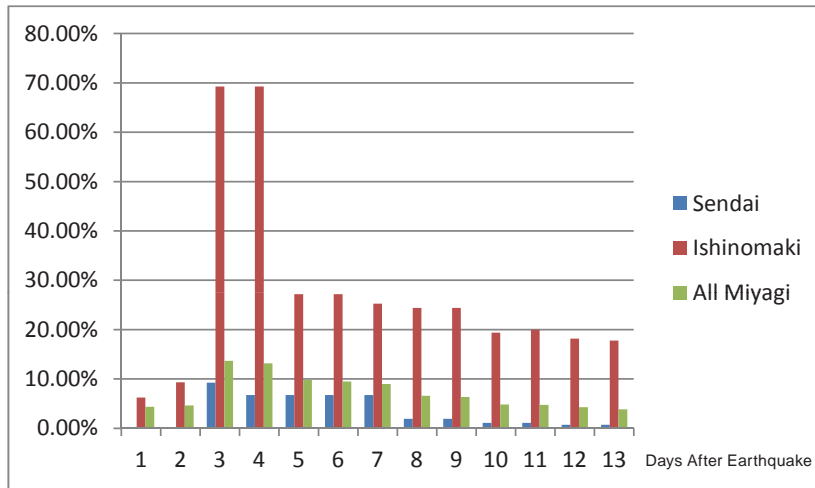
According to an FDMA survey of the current state of rations stockpiled by prefectural and municipal governments across Japan (current as of April 1, 2011),<sup>[10]</sup> the most commonly stockpiled food is hardtack biscuits, with approximately 12.3 million servings, followed by 4.85 million servings of canned food (main and side dishes) and roughly 1.3 million servings of instant noodles.

A look at stockpiles of hardtack biscuits and canned food (see Figure 4) shows that there are enough hardtack biscuit stockpiles on average to feed a little less than 10% of the Japanese population. Approaches vary among local governments, some of which do not stockpile hardtack biscuits at all, but Tokyo stockpiles enough of them to feed 30% or more of its residents. There are also some local governments that do not stockpile canned food, but Shizuoka Prefecture stockpiles enough to feed 23% of its residents.

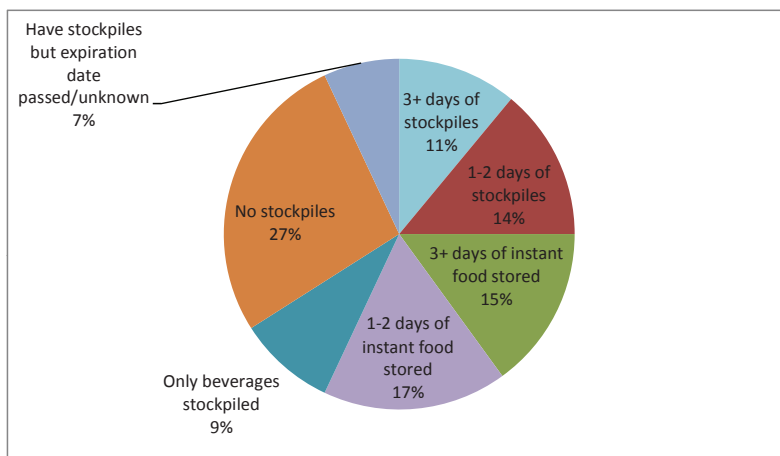
In general, the thinking behind determining the size of stockpiles is based on the assumption of providing a portion of survivors with two to three meals a day to satisfy their immediate needs, while relying on outside assistance to deliver the stockpiles to provide the rest.

However, in Miyagi Prefecture, which had the highest number of evacuees in the wake of the Great East Japan Earthquake (see Figure 5), they peaked at around 320,000 people three days after the earthquake (about 13.7% of the prefecture's population) and totaled 2.22 million evacuee-days (equivalent to around 95% of the prefecture's population) for the two weeks after the earthquake. If we look at individual cities we see that Ishinomaki, which had the highest proportion of its population evacuate, peaked at around 110,000 evacuees (about 69% of the population) three days after the earthquake and totaled around 570,000 evacuee-days (about 368% of the population) for the two weeks after the earthquake.

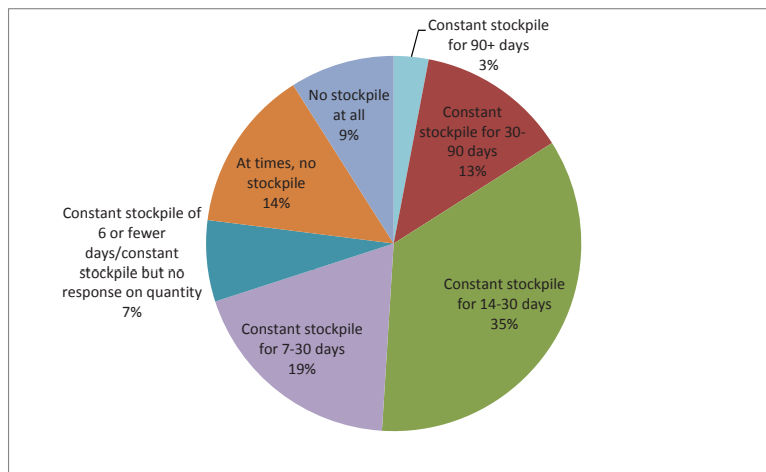
A future Tokyo metropolitan area, Tokai or Tonankai earthquake is expected to produce millions of evacuees (see Table 1). Current stockpiles are



**Figure 5 :** Changes in Number of Great East Japan Earthquake Evacuees (% of Population in Miyagi Prefecture)  
Prepared by the STFC based on Reference #12



**Figure 6 :** Ration Stockpiles of Japanese Households  
Compiled by the Science and Technology Foresight Center based on Reference #13



**Figure 7 :** State of Independent Stockpiles of Household Rations in Switzerland  
Compiled by the Science and Technology Foresight Center based on Reference #14

[NOTE 2] Switzerland provides an example from outside Japan of well-prepared stockpiles. The country produces little of its own food, so the Swiss government prepares stockpiles in case foreign food supplies become unavailable. Comprising the country’s emergency stockpiles are “compulsory stockpiles” governed by contracts between the Swiss Federal Council and private-sector food importers (four months’ worth of rations for all citizens: sugar, rice, cooking oil, coffee and wheat), as well as household stockpiles (a recommended 14 days’ worth per person including rice or pasta, cooking oil, sugar, cheese, meats, fish, canned fruits, vegetables, crackers, chocolate, soup, tea and coffee).<sup>[14]</sup> Seventy-seven percent of households stockpile the recommended amount, of which roughly two-thirds is enough to last two weeks or longer (see Figure 7).



**Table 3 : State of Ration Stockpiles in Tokyo (2 Days after Earthquake)**

Unit: 10,000 meals

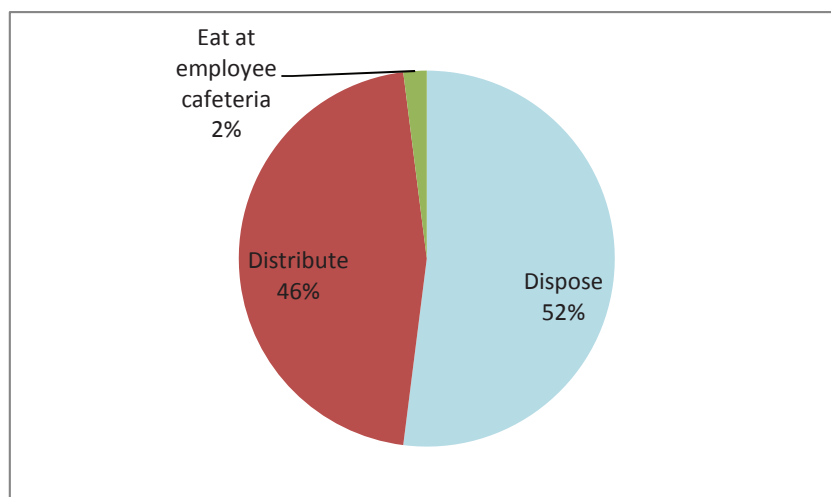
Item	Category	Pref.	Ward	Munic.	Total	Pop. %
Crackers, etc.	B	45	185	81	311	23.9%
Pregelatinized Rice	C	100	328	203	631	48.6%
Instant Noodles (Cups)	C	120	0	0	120	9.2%
Other (Various)		0	353	99	452	34.8%
<b>Total</b>		<b>265</b>	<b>866</b>	<b>383</b>	<b>1514</b>	<b>116.6%</b>

Compiled by the Science and Technology Foresight Center based on References #17

**Table 4 : Results of Miyagi Prefecture Evacuation Shelter Nutrition Survey**

Item	Unit of Nutrition	Amount Needed	Evacuee Intake		
			1st Survey	2nd Survey	3rd Survey
			Apr	May	Jun
Energy	Kcal	2000	1546	1842	2019
Proteins	g	55	44.9	57.1	69.5
Vitamin B1	mg	1.1	0.72	0.87	1.36
Vitamin B2	mg	1.2	0.82	0.96	1.16
Vitamin C	mg	100	32	48.4	60.4
Notes		Data from a Ministry of Health, Labour and Welfare notification (Apr. 21, 2011)	Evacuee Intake is the average of all evacuation shelters at (the) sea-coast of Miyagi Prefecture		

Compiled by the Science and Technology Foresight Center based on press releases from the Health and Welfare Department, Miyagi Prefecture.



**Figure 8 : Processing of Expired Emergency Food (Survey Results)**

Compiled by the Science and Technology Foresight Center based on Reference #19

clearly insufficient even to temporarily provide the rations needed until outside assistance arrives.

At present, retail shops and distributor warehouses are keeping food inventories small to cut costs, etc. We cannot expect the large amount of stockpiled food from the private sector that can help disaster survivors to supplement government ration stockpiles.

According to a survey conducted prior to the Great East Japan Earthquake,<sup>[13]</sup> one in four households were

stockpiling rations in case of a disaster, and over half of those did not stockpile more than one or two days' worth of food (see Figure 6).

The results of a public opinion survey conducted by a newspaper after the earthquake showed that the number of households stockpiling potable water and rations had particularly gone up to over 50% in the areas adjacent to the Tohoku region. However, even if a high proportion of households are stockpiling

emergency supplies, this does not necessarily mean that they are adequately prepared to respond to a disaster.

While companies and schools in Japan still have small stockpiles,<sup>[15]</sup> more business continuity plans (BCPs) are recognizing the need for emergency stockpiles. The Tokyo Metropolitan Government (TMG) is now considering regulations that would oblige companies to stockpile supplies as a way to help stranded commuters.

## **(2) Little Food Suitable for Consumption after an Earthquake**

In the chaos that follows an earthquake, survivors should have food requiring no hot water, heat or other such preparation to eat.

While hardtack biscuits, crackers, regular biscuits and the like meet these conditions, they are harder to swallow when eating without a drink (i.e. water). There are local governments that stockpile rice porridge, which is easy to swallow, but they are few in number. Furthermore, because rice porridge has a low concentration of energy, it poses the problem of having to stockpile more of it to provide people with sufficient calories.

Food requiring hot water to eat such as pregelatinized rice and instant noodles cannot be used if utilities are cut off, thus making it impossible to heat water. (Although pregelatinized rice can be returned to its original form by adding unheated water, it takes time and must still be eaten cold if there is no way to heat it.)

The TMG, for example, has crafted plans to prepare ration stockpiles to last for two days after a disaster<sup>[16]</sup> (after which it would distribute emergency supplies of precooked rice). According to the Tokyo Local Disaster Prevention Plan formulated in fiscal 2007, the TMG has ration stockpiles for a total of roughly 15 million meals (116% of Tokyo's population; see Table 3). Pregelatinized rice and instant noodles make up nearly 60% of these stockpiles.

## **(3) Local Governments Do Not Assume Extended Emergency Living Conditions**

In many cases, emergency stockpiles are limited to a few different items selected based on their shelf life. Many local governments place a heavy emphasis on hardtack biscuits and flavored pregelatinized rice. Few dishes other than rice are stockpiled. In short,

stockpiles are prepared with the rations needed only for short-term, temporary emergency living conditions in mind.

Much food relief delivered to disaster zones is heavy on carbohydrates, such as rice balls and hardtack biscuits. When survivors eat these on a continual basis, they tire of the same taste and sweetened flavoring and cannot bear to keep consuming them.

Looking at the results of a nutrition survey of evacuees after the Great East Japan Earthquake (the case of Miyagi Prefecture; see Table 4), we see that their energy intake one month after the disaster was insufficient and it did not return to the minimum required amount until two months had passed. We also find that there were problems with their nutritional balance due to an initial lack of proteins and vitamins.

In addition, there was a report that living under long-term emergency conditions increases the rate of people with high blood pressure and blood pressure levels in general.<sup>[18]</sup> On top of a lack of exercise and psychological stress, a poorly-balanced diet (high in sodium, low in calcium, lacking in dietary fiber, etc.) may have also been a cause of these symptoms. Living under long-term emergency conditions requires a rich diet with large proportions of low-salt, high-sodium foods (primarily main dishes other than rice) and fruits and vegetables that are rich in fiber, high in calcium and low in sodium.

## **(4) Food Waste in Normal Times (Disposal after Shelf Life Ends)**

A high proportion of current stockpiles of rations (emergency food) is disposed of if there is no disaster because it is restricted to emergency use and not made available to eat otherwise (see Figure 8). This is why the authors have come to believe it preferable to use rations that can be used anytime—during an emergency or not—rather than emergency food that is restricted for use only during a major disaster.

# 4 | Mindset Change from Emergency Food to Disaster Preparation Food

## *4-1 Post-Disaster Stages and Rations*

Food can be categorized into the three stages below according to the status of utilities and other such conditions (see Table 5).<sup>[20]</sup>

**Table 5 : Rations, etc. Needed after a Disaster**

Stage		1st Stage	2nd Stage	3rd Stage
Period		Short-Term	Mid-Term	Long-Term
		Disaster – A Few Days	A Few Days – A Few Weeks	A Few Weeks – A Few Months
Situation		Need foods that do not require hot water or heat	Can use heated water with electricity, portable butane stove, etc.	Can cook ingredients using a heat source and cooking equipment
Utilities	(Drinking) Water	×	○	○
	Power	×	○	○
	Gas	×	×	○
Cooking facilities		×	△	○
Using Cooking		Stockpiled Rations	Stockpiled Rations	Stockpiled Rations
			Food Relief	Food Relief and Ingredients
				Self-Procured Ingredients

○: can use    △: can use some    ×: cannot use

Compiled by the Science and Technology Foresight Center

**1. First Stage**

Immediately after a disaster, power, gas and water utilities are cut off. Survivors need food that can be eaten without hot water or cooking and that is stored by households, companies, offices, evacuation shelters, etc.

**2. Second Stage**

Upon restoring power and other utilities, water can be heated. Survivors can make use of emergency/instant food requiring hot water. Furthermore, ration stockpiles are supplemented by outside food relief during the Second Stage.

**3. Third Stage**

All utilities are back on line, allowing survivors to use cooking equipment and steam, boil, grill, fry and otherwise prepare food and ingredients sent as relief from outside the disaster zone. This removes most constraints on foods available to eat.

Table 5 provides a matrix showing the relationships between stages and living conditions.

**4-2 The Differences between Emergency Food and Disaster Preparation Food**

Emergency food now (see Table 6) is food with a long shelf life for use in a disaster. It is prepared just in case an emergency happens, so we could say it is “food that will presumably not be used.” However, if we act on the presumption that a disaster will occur sometime, then we need to provide food for rescue/emergency workers, medical staff and personnel working to restore utilities, in addition to infants, the elderly and people on a restricted dietary regimen. Food needs also vary according to the aforementioned Stages as well as location (evacuation shelter, private

home, hospital, other facility, outdoor location, etc.).

In the aftermath of an earthquake, we need to have a broader concept than emergency food—“disaster preparation food” —that can respond to a variety of circumstances until living conditions return to normal (see Table 7).

Disaster preparation food includes seasoning as well as ingredients such as rice and flour in a broader sense. In the discussion that follows it mainly refers to precooked, processed food that can be eaten as is without adding cold water, hot water or requiring any other heating.

Table 8 shows the entire range of disaster preparation food envisaged by this report. Some of our current emergency food can be used to respond to a disaster in a way that qualifies it as disaster preparation food.

Other than the example of rice porridge, an emergency food that can be used without water in a Stage 1 situation, there are few other emergency foods that qualify as disaster preparation foods. By coordinating shelf lives, packaging and the like, thick liquid food for oral consumption used by hospitals and nursing homes as well as energy/sports drinks could be used as disaster preparation food.

However, other than rice porridge, there are few emergency foods that can be used by the sick, hospital patients and nursing home residents in all Stages.

**4-3 Independent Assistance, Collaborative Assistance and Government Assistance**

The question of who should be responsible for stockpiling disaster preparation food can be answered in terms of independent assistance, by which the organization to which one belongs (household,

**Table 6 : Examples of Current Emergency Food**

No.	Food Name	Shelf Life *1	Type of Production	Needed to Eat	Packaging	Calorie per Meal (Kcal)	Weight per Meal (g)	Price	Notes
First Stage Food (Group 1) (Edible as is)									
1	Rice Porridge	3 yrs	Canned	Nothing	Can	129	280	263	
First Stage Food (Group 2) (Edible as is, but needs water to swallow)									
2	Crackers A	10 yrs	Food in natural form	Nothing	Can	366	87	400	10 meals/can
3	Crackers B	10 yrs	Food in natural form	Nothing	Can	185	44	393	10 meals/can
4	Long-Lasting Bean Jelly	5 1/2 yrs	Food in natural form	Nothing	Polyethylene heavy duty bag + paper box	171	60	105	5 meals/box
5	Hardtack Biscuits	5 yrs	Food in natural form	Nothing	Can	468	110	315	incl. candy
6	Crackers	5 yrs	Food in natural form	Nothing	Can	681	132	315	
7	Bread	37 mths	Food in natural form	Nothing	Can	315	100	367	
8	Biscuits	3 yrs	Food in natural form	Nothing	Can	436	100	315	
9	Dietary Supplements	3 yrs	Food in natural form	Nothing	Aluminum foil + paper box	200	40	126	
10	Fish	3 yrs	Canned	Nothing	Can	246	100	150	
First Stage Food (Group 3) (Add water)									
11	Rice Cakes	5 yrs	Freeze-dried	Water	Polyethylene heavy duty bag	377	109	420	
Second Stage Food (Group 1) (Add hot water)									
12	Stew A	10 yrs	Freeze-dried	Hot (or cold*2) water	Canned (enamel coating on both sides)	196	44	760	10 meals/can
13	Stew B	10 yrs	Freeze-dried	Hot (or cold*2) water	Canned (enamel coating on both sides)	134	31	581	10 meals/can
14	Rice Porridge	5 yrs	Pregelatinized Rice	Hot (or cold*2) water	Polyethylene heavy duty bag	84	23	242	
15	Rice Balls	5 yrs	Pregelatinized Rice	Hot (or cold*2) water	Polyethylene heavy duty bag	145	40	262	
16	Cooked Rice	5 yrs	Pregelatinized Rice	Hot (or cold*2) water	Polyethylene heavy duty bag	281	77	357	
17	Ochazuke	2 yrs	Freeze-dried	Hot (or cold*2) water	Polyethylene heavy duty bag	166	46	294	
Second Stage Food (Group 2) (Heat with hot water, etc.)									
18	Beef Curry	3.5 yrs	Retort pouch	Exothermic agent/hot water/microwave oven	Polyethylene heavy duty bag	175	180	299	
19	Gyudon Stock	3.5 yrs	Retort pouch	Exothermic agent/hot water/microwave oven	Polyethylene heavy duty bag	355	180	420	
20	Cooked Rice	3.5 yrs	Retort pouch	Exothermic agent/hot water/microwave oven	Polyethylene heavy duty bag	314	200	241	

\*1: Shelf Life: Period during which food can be consumed without losing flavor and still tastes good

\*2: Takes time if no hot water, but can return to original state with cold water

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**Table 7 : Comparison of Emergency Food and Disaster Preparation Food**

Name	Definition	Used By	Stages of Use	(Possible) Requirements				
				Shelf Life	Non-Disaster Use	Ingredient Labeling	Labeling w/ Users & Applicable Stages	Packaged so No Separate Utensils Needed
Emergency Food	Long-lasting food stockpiled to prepare for disasters	Mainly general survivors	1st & 2nd Stages	Generally 3+ yrs	No (*1)	Yes	No	Some
Disaster Preparation Food	Food needed to maintain psychological and physical health for disaster survivors (incl. those in need of assistance and survivors on a restricted dietary regimen; also disaster response personnel) between the time a disaster occurs and when life returns to normal	General survivors; survivors with restricted dietary regimens (infants, dysphagia patients, people requiring low-protein meals, etc.); relief workers (FDMA, SDF, local gov't, volunteers, etc.)	1st through 3rd Stages	Depends on recipient and form of use (*2)	Yes (running stocks)	Yes	Yes	Should generally be taken into consideration for all emergency food

\*1: Often does not compete well against regular food products when one considers both price and flavor.

\*2: Food stockpiled for Government Assistance requires a certain shelf life, but a running stock maintained by a household, etc. should have graduated shelf lives as stockpiles are used.

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**Table 8 : Disaster Preparation Food Coverage**

Recipients	First Stage		Second Stage	Third Stage	Notes
	No Drinkables	w/ Drinkables			
Residents (General)	×	Δ	Δ	×	
Residents (Special Needs)	×	×	×	×	
Patients & Inmate	×	×	×	×	
Non-Residents (workers, stranded commuters, etc.)	×	Δ	/	/	
Relief Workers (General)	×	Δ	Δ	/	incl. residents responding to disaster
Relief Workers (Special)	/	/	Δ	/	firefighters, SDF, etc.

Δ: Current emergency food partially helps  
 ×: Current emergency food mostly does not help

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**Table 9 : Assistance Timing and Sources (Independent Assistance, Collaborative Assistance, Government Assistance) by Recipient**

Location	Recipient	1st Stage	2nd Stage	3rd Stage
Damaged Housing	Resident (not needing aid)	I	I, C	I, C
	Resident (needing aid in disaster)	I	I, C	I, C
Hospital, Nursing Facility, etc.	Hospitalized patient/inmate	I	I, C	I, C
	Health care worker	I	I, C	I, C
Company, Local Gov't, etc.	Company employee, civil servant	I	I, C	I, C
Evacuation Shelter	Stranded commuter	I, G	/	/
	Local resident (needing aid in disaster)	I, G	G	G
	Local resident (not needing aid)	I, G	G	G
	Local resident (responding to disaster)	I, G	G	G
	Company/gov't worker (responding to disaster)	I	I	I
Temporary Housing	Local resident (needing aid in disaster)	/	/	I, C
	Local resident (not needing aid)	/	/	I, C

I: Disaster preparation food prepared by recipient's organization (household, company, local gov't, etc.)  
 C: Disaster preparation food shared among organizations affected by a disaster  
 G: Assistance from the government

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company, local government, etc.) provides assistance; collaborative assistance, by which organizations affected by a disaster share rations; and government assistance, by which the government provides assistance (see Table 9).

**4-4 Disaster Preparation Food Conditions**

The authors believe the conditions that qualify food as disaster preparation food are the following.

**(1) Preparation and Consumption**

Disaster preparation food must be convenient (i.e. easy to eat) when it would presumably be used. It should also be easily swallowed, eatable without utensils, etc. out of consideration that it will be consumed in the wake of a disaster.

**(2) Nutritional Considerations for Assumed Emergency Living Conditions**

Living in emergency conditions is highly likely to subject survivors to an environment with low nutrition, high stress, etc. Considerations must be given to disaster food's nutritional value.

**(3) Packaging**

In the case of food requiring the use of utensils during consumption, packaging should contain utensils.

**(4) Shelf Life**

Because it is highly likely that refrigerators and freezers will be unusable during a disaster, disaster preparation food must be capable of continuous

storage at room temperature. Food that assumedly will only be eaten during a disaster, and which is stored through government assistance, must be repurchased and replaced whenever an expiration date passes. Thus, because of the costs involved, shelf life should be as long as possible. On the other hand, since food stored through independent assistance (particularly by households) is also used to supplement daily diets, this food does not necessarily have to have a long shelf life.

### (5) Price and Taste

Food stored through independent assistance may not prove helpful if it is food with a long shelf life, stored with the expectation that a disaster will not come. This is because expired shelf lives may go unnoticed until a disaster occurs, and also because it may not suit the palate if those consuming it are not accustomed to it. In order to avoid this—especially in the case of household food reserves—it is preferable to consume disaster preparation food on a regular basis by using a so-called running stock of food. Thus, the cost differs little from that of regular food and it will taste better.

Emergency food now generally has a shelf life of three or more years—longer than regular food. In proportion to consumable periods, the calorie cost (the cost per calorie) is high (see Figure 9). More specifically, the average calorie cost of regular food with a shelf life of one year is 0.5 Japanese yen (at 250 yen per meal, assuming each meal contains 500 calories), but this cost increases fivefold when shelf life is doubled. Because a running stock of reserves does not necessarily require long shelf lives, it needs to provide foods that have been selected out of consideration for a balance between cost and shelf life.

## 5 | Researches and Development in Japan and Abroad

Hardtack biscuits and pregelatinized rice, which have long shelf lives, have been used as so-called “emergency food” in case of earthquakes, storm and flood damage and the like. While pregelatinized rice has been improved somewhat by shortening rehydration times and such, in the half-century since World War II, Japan has not experienced a major natural disaster affecting the entire country and the Japanese have not conducted serious research on food used in disaster response that considers the nutrition

and the needs of survivors.

In recent years, companies that develop and produce ready-to-eat meals for the Japanese Self-Defense Forces (JSDF) have applied their techniques in new ways to start selling disaster preparation food. However, the purpose of developing foods for the JSDF has mostly been improved portability by switching from canned food to retort pouches.

In addition, cooked rice for emergency use has been produced in retort pouches to give it a long shelf life, but typically, regular, so-called sterilized cooked rice produced in a clean room has poor-quality flavor. Recently, production processes that ensure longer shelf life have improved the flavor of cooked rice for emergency use, and it is now being produced and sold.

The situation is the same outside of Japan, in that only food production techniques for military use have been applied to emergency food. In the United States, techniques for producing military food and space food for NASA have been applied to produce canned, freeze-dried emergency food that can be stored for 10 years at room temperature (or 25 years if stored within a certain temperature range), and some local governments and other entities in Japan have imported and stockpiled them.

## 6 | Research and Development Issues

Below we individually address research and development issues concerning disaster preparation food, as well as matters related to the use of disaster preparation food that warrant further consideration.

### 6-1 Disaster Preparation Food Research and Development Issues

#### (1) Nutritional Science in Disasters

Since there has been little research yet conducted on nutritional conditions determining what one should consume in each Stage of a disaster, this research needs to begin now. Such research should focus on the following points.

- Specifying periods of fasting that pose little health risk
- The effect of low-calorie diets on health (short- and long-term)
- From a nutritional science perspective, set the target number of days to again provide food that includes a

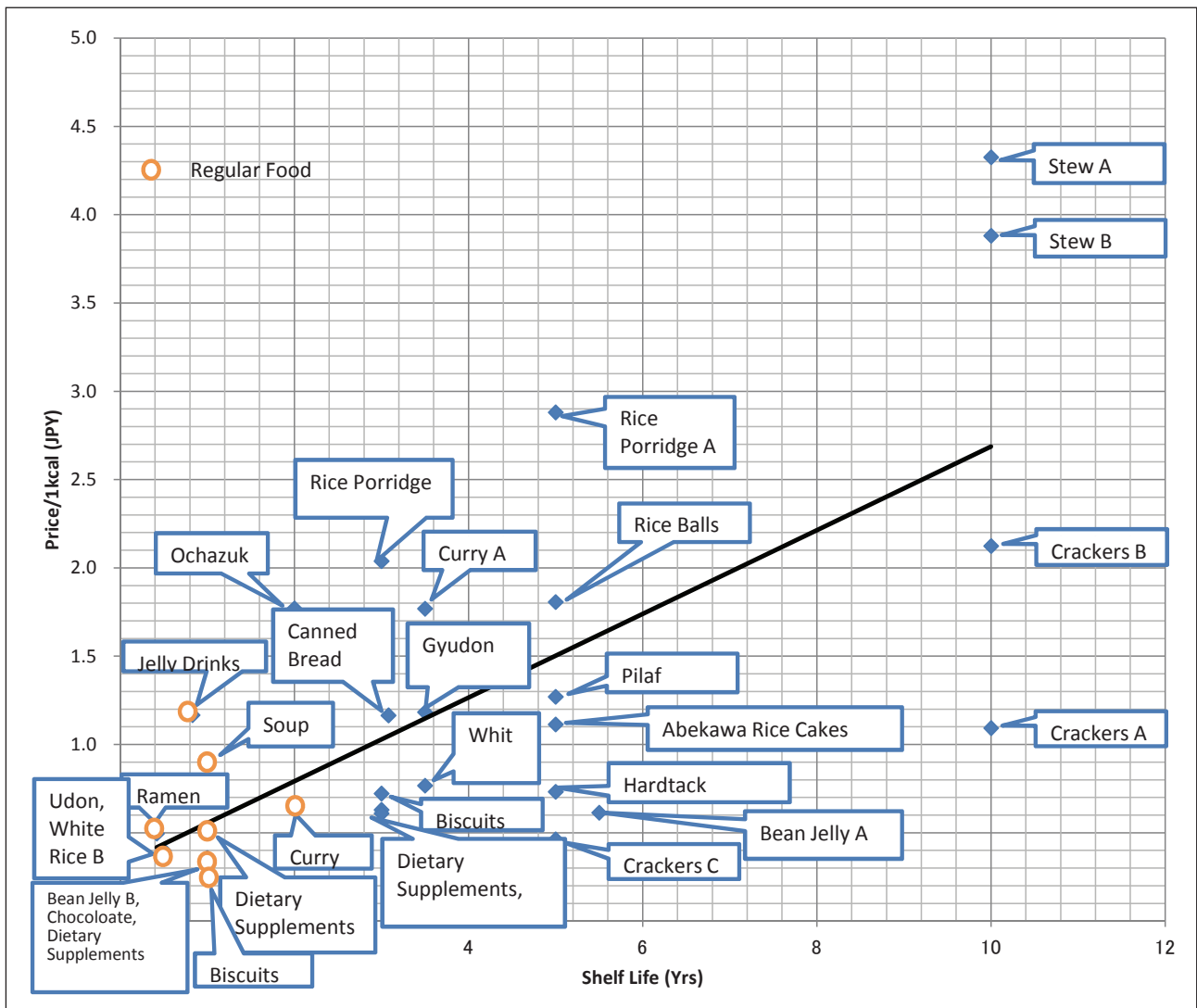


Figure 9 : Relationship between Shelf Life and Calorie Cost

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normal amount of energy and nutrition

- Meals and diets that allow for easy intake of nutrients in high-stress situations

elderly and people on a restricted dietary regimen

- Techniques for processing food that is easily consumed with little or no water

**(2) Processing Techniques of Food for Disaster Response**

Research and development of the following kinds of food processing techniques are needed to respond to interruptions to utilities such as water and power.

- Development and popularization of processing techniques that provide both long shelf life and good flavor (e.g. techniques for producing cooked rice and bread [as main dishes] with good flavor and that meet the sterilization conditions for retort pouches, and techniques for producing vegetables and side dishes with long shelf life while maintaining flavor, color and shape)
- Consideration for the nutrition and forms of food to make the special meals required of infants, the

**(3) Packaging Techniques for Disaster Preparation Food**

Packaging/container development thus far has used shelf life, portability and robustness as benchmarks, mostly for use by the JSDF, but development for disaster response should be based on the following.

- Development of containers/packaging with dual use as utensils and that are compact and in containers storable in high temperatures
- Combined with food preparation functions
- Containers/packaging allowing preparation without any cooking equipment
- Containers/packaging that can be heated up inside a microwave oven
- Containers/packaging that can change a food's flavor

#### **(4) Cooking Equipment for Disaster Preparation Food**

A disaster survivor who prepares a portable butane stove and the like beforehand, and is able to heat water after a disaster, can skip the First Stage and move straight on to the Second Stage. If survivors—households in particular—cannot use electricity or gas as a heat source but can use a portable butane stove to heat water and cook food, it may still pose a safety problem, depending on the circumstances of the disaster, because the stove's combustion produces flames and high temperatures. In addition, heat sources that employ chemical reactions are disposable and expensive.

It would be desirable to develop disaster food cooking equipment that is very safe and reusable.

### *6-2 Matters Related to the Use of Disaster Preparation Food that Warrant Consideration*

#### **(1) Larger Stockpiles**

Assuming the future occurrence of a large-scale disaster such as an earthquake, local governments, households and companies need to increase their stockpiles. Local governments in particular, whose financial situations make it difficult to increase spending, need to consider ways to expand actual stockpiles while holding down costs.

The following examples are methods that could possibly be adopted to achieve this.

- Example 1: Imbue distributor warehouses with disaster-prevention functions, store foods in them for a period of time during which they will not lose commercial value. While storing them there, they can be used as disaster preparation food in the event of a disaster, or shipped as commercial products should no disaster occur.

The TMG now stockpiles instant ramen in this manner.

- Example 2: Although convenience stores are being positioned more often these days as relief centers in times of disaster, we could go further by imbuing them with functions as disaster-prevention warehouses as well as disaster prevention centers to form a way of constantly maintaining at least a certain

inventory of disaster preparation food.

#### **(2) Broad Area Coordination of Stockpile Locations and Emergency Distribution Systems**

Prefectural and municipal governments acting independently are clearly inadequate to respond to a disaster, such as the Great East Japan Earthquake, that covers a wide geographical area. Local governments across a broad area need to divide up the tasks of stockpiling disaster preparation food among themselves. Under this premise, each local government should share, over a broad area, its understanding of local information such as its residents' characteristics (proportions of elderly people and infants, population density, etc.) and nearby transportation networks and to develop algorithms determining optimal types, amounts and locations of foods to stockpile.

After utilities were restored and it again became possible to transport rations in the wake of the Great East Japan Earthquake, there were many cases in which the necessary rations were not delivered where they were needed. One reason is that instead of professionals (i.e. distribution/logistics companies), it was government officials and volunteers who were coordinating ration distribution, a task to which they were not accustomed. Local governments need to create systems in advance to figure out each area's ration needs in a timely manner, then decide, based on the status of stockpiles and food relief, where to send what and rapidly deliver it to disaster zones and evacuation shelters. Furthermore, they should consider matters such as backup plans in the event that the distribution systems they initially intend to employ are disrupted.

#### **(3) Disaster Prevention Education that Considers Emergency Living Conditions**

Even if an adult knows what preparations are important to make in case of a disaster, it is still difficult to actually do it when a disaster occurs. Especially in the First Stage of emergency living conditions, most aid is in the form of independent assistance, so people need to learn how to stockpile home rations in advance so that they can use them to survive until help arrives. To do this, disaster prevention education should start in elementary and junior high school. This education should consider what emergency living conditions are like and include



content relating to disaster preparation food, such as the nutritional intake one needs in the event of a disaster, the rations one should stockpile and ways of obtaining food in a disaster.

### 6-3 *Creating Disaster Preparation Food Certification Standards and a Certification System*

In the long-term, Japan needs to encourage advances in the research and development discussed in Subsections 6-1 and 6-2, clarify the requirements demanded of disaster food, compile them in the form of Disaster Preparation Food Certification Standards, and create a national certification system for foods that satisfy these standards.

We expect that creating this system would produce the following results.

- It would become possible to produce disaster preparation food in accordance with the standards and to maintain the quality required of disaster preparation food.
- Providers (i.e. households, companies, local governments, etc.) would be able to consider the quantity and quality of the disaster preparation food they should provide, thus allowing them to stockpile more appropriately.
- Food producers would have a clear understanding of what is required and companies would have more incentive to produce a greater variety of foods.
- In the event of a disaster, the use of disaster preparation food would be simplified because instructions would be clearly printed on the food in a standard format.
- It would become possible to send relief supplies to individuals in a disaster zone more effectively by utilizing product numbers of the disaster preparation foods needed in the disaster zone, because distributors would know exactly what kinds of foods are stockpiled.

Disaster Preparation Food Certification Standards would have to incorporate the following information in order to clarify in which post-disaster stages each food can be used.

1. Disaster preparation food's nutritional information (especially caloric density, salt, vitamin and mineral content), measuring and labeling methods, etc.
2. Expiration date and assessment methods (including environmental conditions), labeling methods, etc.
3. Conditions for ingredients' edibility

4. Package labeling methods indicating that a product is disaster preparation food, as well as its dimensions, shape, durability and openability (including how to use with preparation equipment/tools)

5. Other information such as certification methods, requirements for certification marks, etc.

It should also be noted that in order to popularize the use of disaster preparation food, the authors believe it would be effective for the national government to provide preferential treatment to companies that produce and/or sell certified disaster preparation food and/or its packaging, etc.

The Japan Aerospace Exploration Agency (JAXA) has created standards to certify Japanese space food<sup>[21]</sup> consumed by astronauts aboard the International Space Station (ISS). These standards comply with those prescribed by the Food Sanitation Law and other related laws and regulations to maintain food safety in Japan, as well as to additional standards to keep astronauts healthy and safe in a micro-gravity environment and in the enclosed environment aboard the ISS. JAXA's standards would make a good reference point when considering Disaster Preparation Food Certification Standards.

## 7 | Conclusions

Figure 10 shows the relationships between the food-related problems addressed in Section 3 and the research and development issues addressed in Section 6.

In the event of a disaster, disaster preparation food that can deal with the issues discussed thus far is that which helps prevent secondary disasters relating to survivors' health, while also facilitating reconstruction by aiding independent disaster prevention organizations and firefighters, as well as evacuees and other residents engaged in volunteer activities, rather than simply responding to the disaster itself.

Moreover, because disaster food also functions and performs adequately for daily use (good nutritional balance, easy to consume in emergency conditions) and also imposes a low cost burden, popularizing the regular use of disaster preparation food under this new paradigm will contribute to a shift to healthier, richer dietary habits in everyday life, even when a disaster does not occur.

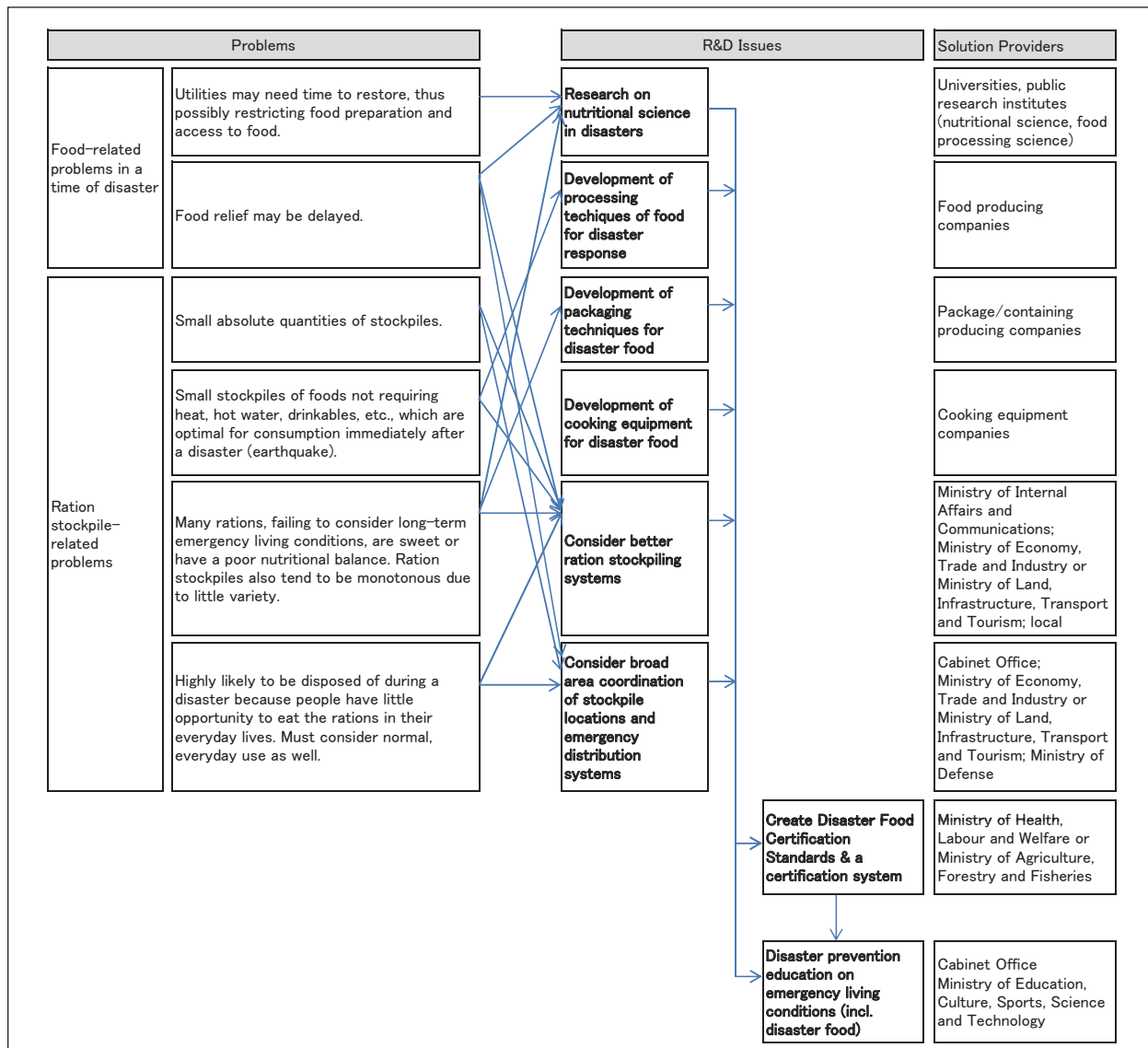
In addition, because disaster preparation food can

be stored at room temperature and does not require energy to distribute and store to keep on a certain temperature, it could also contribute to cutting CO<sub>2</sub> and other emissions, thus possibly leading to a transformation in the way Japanese people view their lifestyle by aiming to lead lives that will provide better protection against disasters while also being environmentally friendly.

Conducting research and development and building infrastructure related to disaster food will require separate roles for the private sector, universities, government agencies, etc. upon incorporation within the Basic Disaster Prevention Plan<sup>[22]</sup>, the government’s fundamental plan for disaster response drafted by the Central Disaster Prevention Council in accordance with the Basic Act on Disaster Control Measures.

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**Figure 10** : Relationship between Food-Related Problems and R&D Issues

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