Space Food and Disaster Food: Thinking about Food in Extreme Environments

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Photos: Courtesy of *vesta* (Ajinomoto Foundation for Dietary Culture)

Dr. Tsuboyama-Kasaoka Nobuyo, Head of Section of Global Disaster Nutrition at the National Institute of Health and Nutrition in Japan talks about space food and disaster food — Interviewed by the *vesta* editorial team.

Challenges in space and disaster nutrition research

I have always been interested in space and have tried to become an astronaut three times in the last 25 years. Because my parents were mountain climbers, I have been going to high altitudes since I was a child, while scuba diving has challenged me in the depths of the ocean, so I wanted to try the most extreme space. As you can see from the fact that you can get altitude sickness when you climb a mountain or submarine sickness when you dive in the ocean, you can really feel the changes in your body when you go to a special environment. The space environment is a microcosm of the phenomenon that everyday health problems on Earth are exacerbated in a short period of time under extreme environmental conditions. This is why I think food and nutrition are so important. In my astronaut application I always wrote, “I want to change food in space.”

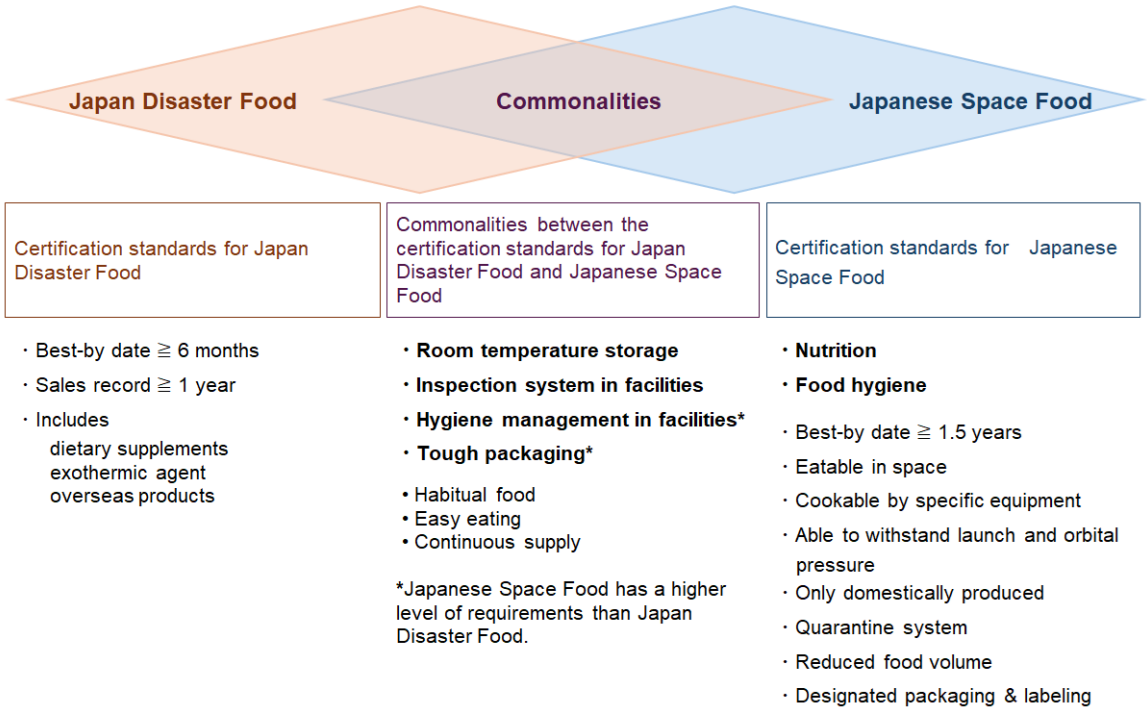
I was originally working in molecular nutrition, which deals with genes, when the Great East Japan Earthquake happened in March 2011, and I was sent to the disaster area as a registered dietitian. I saw

that the food situation was still so bad even three weeks after the earthquake, and I decided that I had to somehow change the near-starvation situation that was unfolding before my eyes in Japan, so I made a big shift to disaster research. Up until then, I had worked hard to study the functional mechanisms of nutrients and daily nutrient requirements. However, at the actual disaster site, the quantity and quality of nutrients were inadequate. I decided to do this because I was shocked by the situation of daily food shortages.

The world's first disaster food certification system

At that time, food in times of disaster consisted mainly of hardtack and biscuits. These foods were not nutritious and were not good in terms of quality such as taste, ease of eating, and variety. After seeing the disaster site, I wanted to increase the number of disaster foods that can be eaten warm even if you cannot cook, and that can be eaten with just water even if there is no hot water, and to promote disaster foods that provide good nutrition. This led to the launch of the Japan Disaster Food Certification System by the Japan Disaster Food Society in 2016. Having previously researched functional space foods, I had long thought that space foods would be useful in thinking about disaster foods. In fact, disaster foods are similar to space foods. In fact, the certification standards for Japan Disaster Foods are based on the certification standards for JAXA's Japanese Space Food[1] (Figure 1).

Figure 1: Comparison of certified standards of Japan Disaster Food and Japanese Space Food



Source: Similarities between Disaster Food and Space Food, Tsuboyama-Kasaoka N, Hamanaka K, et al. *J Nutr Sci Vitaminol.* 2022

Alpha rice, which is now widely used during disasters, comes in two types: one certified as Japan Disaster Food and one certified as Japanese Space Food, but the contents are almost the same. In disaster areas, such as the Noto Peninsula following the recent earthquake, water may be unavailable for long periods of time, and when it is difficult to prepare meals, disaster foods that can be easily eaten by simply

[1] Tsuboyama-Kasaoka N, Hamanaka K, Kikuchi Y, Nakazawa T. Similarities between Disaster Food and Space Food. *Journal of Nutritional Science and Vitaminology*. 2022; 68(5): 460-469

adding water or hot water are useful. Cooking and eating with dirty hands can lead to hygiene problems. Among Japan Disaster Foods, there is also a rice ball type of alpha rice that can be eaten hygienically without direct contact. This is also certified as Japanese Space Food. There are also alpha rice varieties such as *sekihan* (cooked rice with Japanese red beans) and jelly, and the same products are certified as both Japan Disaster Food and Japanese Space Food. However, the interest in disaster food is still not widespread, so we believe it is important to spread the awareness that disaster food = "nutrition" in special environments and space food also = "nutrition" in special environments.

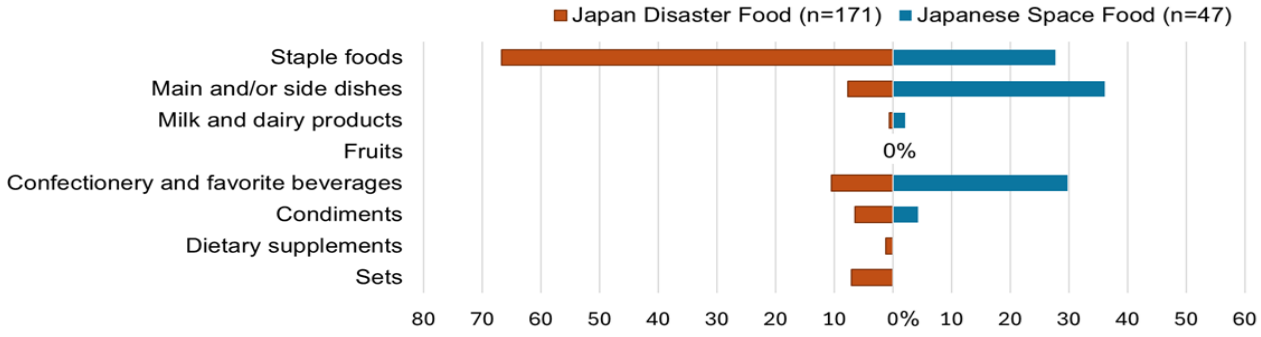
People say that space is just a dream from a faraway world, that it's useless, and that it's just a romantic idea. However, there are many similarities between space and disasters. The know-how to provide food during disasters can be useful in creating a food system in space, and we believe that the goal of creating a food system in space can also be useful on Earth, leading to changes in food during disasters.

The Cabinet Office's Basic Plan on Space Policy also lists national resilience, addressing global issues, and realizing innovation as one of its goals, and uses expressions such as realizing rapid disaster response. Words such as disaster prevention and disaster mitigation have begun to appear throughout the country's space policy.

Disaster foods and space foods are similar

Comparing the Japan Disaster Food and Japanese Space Food certification systems in 2021, most of the foods certified as disaster foods were carbohydrate-based[2] (Figure 2). At disaster sites, the focus is on saving the lives of those who have been rescued, and energy is a priority, so people tend to eat high-energy (high-calorie) foods and carbohydrates. However, this would mean a lack of necessary nutrients if the evacuation period is prolonged, so we are currently increasing the number of side dishes as much as possible and promoting the idea that people can get the nutrients they have been lacking from disaster foods such as soups and vegetable juices. Since Japanese Space Food includes many side dishes and favorite foods and beverages, we have promoted cooperation between Japanese Space Food certification and Japan Disaster Food certification, and created a system that makes it easier than ever for foods that have been certified as Japanese Space Food to also be certified as Japan Disaster Food. This will enable space food to be used in times of disaster, and in the future we hope to enable disaster foods to be used in space.

Figure 2: Comparison of certified products (as of June 16, 2021)



Source: Similarities between Disaster Food and Space Food, Tsuboyama-Kasaoka N, Hamanaka K, et al. *J Nutr Sci Vitaminol.* 2022

[2] Tsuboyama-Kasaoka N, Hamanaka K, Kikuchi Y, Nakazawa T. Similarities between Disaster Food and Space Food. *Journal of Nutritional Science and Vitaminology*. 2022; 68(5): 460-469

I think the above survey results that show Japanese Space Food contains many side dishes and favorite foods and beverages are because it is JAXA-certified Japanese Space Food. On the International Space Station, astronauts mainly eat space food from the United States (NASA) and space food from Russia (Roscosmos) as their basic standard meals. In addition, astronauts can choose and take what they want, called bonus food. Therefore, Japanese Space Food has a lot of variety, such as side dishes that are not available in NASA meals and Japanese sweets that are not available in the United States.

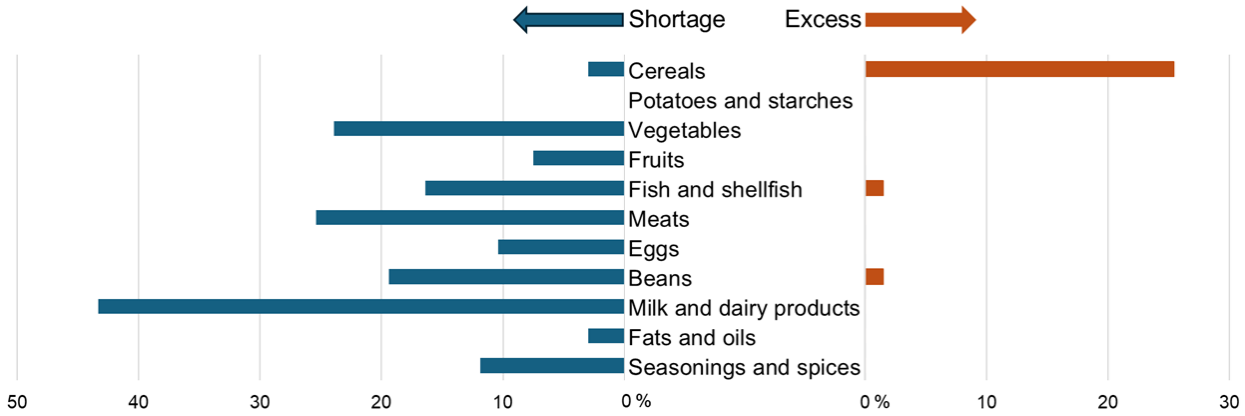
Bonus foods that allow you to enjoy Japanese flavors can be thought of as "reward foods." Recently, there has been an increase in the number of foods that Japanese people would like to eat in space, such as Japanese curry, ramen noodles, grilled chicken, canned mackerel, boiled hijiki seaweed, and sauteed burdock root. There are also rice crackers (*kakinotane* with peanuts) and *yokan* (sweet red bean paste), and these are foods that people normally eat and will be needed in the event of a disaster. The foods that people would want to eat in space may also be needed in the event of a disaster.

The reason why disaster meals tend to be high in carbohydrates is that people tend to think that a minimal meal is enough during a disaster, or they tend to put off eating. During a disaster, there is a lot of stress, appetite decreases, and even if food is available, people may not want to eat it. That's why we need good food, and we need the things we're used to eating and our favorite and habitual foods. Therefore, it is recommended that you stock up on foods that you normally like and enjoy, as stated in the "Food Stock Guide for Disaster Preparedness for Persons Requiring Special Care[3] (Ministry of Agriculture, Forestry and Fisheries)." In this sense, the current range of Japanese Space Food includes foods that we are accustomed to eating, has a wide variety of foods that many people like, and seems to be useful in special environments.

[3] "Food Stock Guide to Preparing for Disasters for Persons Requiring Special Care" (Ministry of Agriculture, Forestry and Fisheries) https://www.maff.go.jp/j/zyukyu/foodstock/guidebook/pdf/need_consideration_stockguide.pdf [in Japanese]

In fact, when a survey of food availability in evacuation centers was conducted about a month after the Great East Japan Earthquake, most centers reported that they were short of food. However, despite this finding, there was a surplus of food, most of which was cereals (Figure 3).[4] When we carefully analyzed the surplus food other than cereals, we found canned goods and chili beans that had been delivered from overseas. It seems that foods you are not used to eating normally are inedible even when there is not enough food. Normally you might try something you have never eaten before, but when you have no appetite and do not want to eat in a stressful environment, you may not feel like trying something you do not know the contents or taste of.

Figure 3: Food Provision at Shelters - Survey of Food Supply at All Shelters in S City after the Great East Japan Earthquake (24-25 days after the disaster, n=69 facilities)



***Source*:** What factors were important for dietary improvement in emergency shelters after the Great East Japan Earthquake?, Tsuboyama-Kasaoka N, et al. *Asia Pac J Clin Nutr*. 2014

The first time you go into space, you may get space sickness, and you may not have an appetite if you are not used to the environment. In fact, it is said that even astronauts eat less at the beginning. Just like in a disaster, I think how to eat deliciously when you have no appetite is a future challenge both in space and on Earth.

In the above survey, the items most lacking in shelters were dairy products, followed by meat, vegetables, beans, and seafood. The next most common missing items were condiments. The most commonly cited items were mayonnaise, ketchup, sauce, pepper, *dashi* (soup stock)[5], etc. The food at disaster sites is unbalanced, so perhaps there is a desire for more variety in flavors than just salt, soy sauce, and miso. If nothing else, I think this is evidence that seasonings and flavor variations are important even in times of disaster. Even in space, it is likely that people will need to add their own favorite flavors, change the flavor, or create their own originals.

The Ministry of Health, Labor and Welfare has published nutritional reference values for times of disaster[6], and while there are 33 types of nutrients needed in normal times, only five types have been selected as nutritional reference values for times of disaster. These nutrients are energy for living, protein

[4] Tsuboyama-Kasaoka N, Hoshi Y, Onodera K, Mizuno S, Sako K. 2014. What factors were important for dietary improvement in emergency shelters after the Great East Japan Earthquake? *Asia Pacific Journal of Clinical Nutrition*. 2014; 23(1): 159–166

[5] Dashi or dashi stock is made by boiling down umami ingredients from fish, mushrooms, dried foods, etc., or by powdering them. It is the basis of Japanese cuisine, adding umami, flavor, and aroma.

[6] "Nutritional Reference Values for Feeding at Evacuation Shelters" (Reference Values) (Ministry of Health, Labor and Welfare) https://www.mhlw.go.jp/stf/houdou/2r9852000001a159-img/2r9852000001a29m.pdf [in Japanese]

for building the body, and water-soluble vitamins (vitamin B1, vitamin B2, and vitamin C), which are stored in the body in small amounts and cause early deficiencies.

Even in a special environment like space, nutrients that are lacking early in the body are likely to cause deficiencies, so having more disaster foods that meet these five nutritional standards is believed to be useful in preventing nutrient deficiencies even in the early phases of space.

Turning Japan Disaster Food into a global standard

The greatest significance of the Disaster Food Certification System is that it can provide food that is safe to eat at any time, in any environment, even in places without water, electricity, or gas, and with poor sanitation. The most important thing is safety. It would be pointless if someone got food poisoning from eating food that had been stored. Even in space, in times of emergency, food with guaranteed safety is absolutely necessary.

And nutrition, which is the basis of the body, should not be overlooked, especially in a special environment. Not only deficiency, but also overnutrition can be a problem. If evacuation life continues for a long time after a disaster, people will eat more sweets and fried foods, and obesity will also become a problem in disaster areas. We cannot rule out the possibility that this will lead to disaster-related deaths, so controlling obesity even during disasters is considered a challenge. When I was doing genetic research, I found that mice that ate nutrients contained in fish (fish oil, taurine, etc.) were less likely to become obese, and this result was confirmed in a study of people affected by the Great East Japan Earthquake.[7] In men, the more frequently they ate seafood, the lower their risk of becoming obese two years later. Therefore, in addition to trying to increase disaster foods, we are also communicating the importance of seafood in support and food stockpiling in disaster areas. Disaster foods that combine such evidence with Japanese food culture will become one of the pillars.

I think the disaster food certification system is unique to Japan. This initiative is only possible because Japan is a disaster-prone country, and I think it was only possible in Japan, where the food culture has developed to this extent. In addition, we are working to make Japan Disaster Foods a global standard by having them certified by the International Organization for Standardization (ISO). We believe that what we are doing now will also become the standard for space food. The words disaster risk reduction and space do not necessarily conjure up images of food, but we believe this is an opportunity to raise awareness that nutrition policy is one of the most important issues in disaster risk reduction and space today.

International standardization efforts also promote business in the global market, so we also hope to use disaster food as a catalyst to boost Japan's economy. It will also lead to the spread of Japanese food culture around the world. To eat is to live, so we believe it is important that food can make everyone happy and enable them to live a rich life at all times.

(Interviewed on May 9, 2024)

7 Tsuboyama-Kasaoka N, Ueda S, Miyagawa N, Nishi N, Shimoda H, Sakata K, Ogawa A, Kobayashi S, 2022. Inverse association of seafood intake with becoming overweight among survivors of the Great East Japan Earthquake. *International Journal of Disaster Risk Reduction*. 2022; 79,103147 https://www.nibiohn.go.jp/eiken/disasternutrition/paper/201704.html (in Japanese)

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