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Analysis of The Household Food Stocks for Disaster

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Abstract

In Japan, a lot of natural disasters are expected to occur such as typhoon, heavy rain, heavy snowfall, flood, sediment disaster, earthquake, tsunami and volcanic eruption. In the future, large scale earthquakes, such as the Nankai Trough earthquakes are expected to occur with a high probability. When these disaster occurs, goods required for life especially food are needed. However, immediately after the occurrence of a major disaster, since the rescue of the injured people has priority and the traffic is stopped for long time, the goods such as food is assumed to be delivered late. In the event of a disaster, self-help and mutual assistance of the residents are important rather than public aid supplied by government. Therefore we should break away from the way of thinking to rely on public aid and to stock goods for disasters. The purpose of this study is to examine self-help and mutual assistance of residents using the household food stocks. We investigate the amount of food in the home, and consider whether we can cover the meal at the time of a disaster to use the household food stocks. Thus, we conduct a survey to analyze the amount of household food stocks in peacetime in Kanazawa (the provincial city) and Tokyo (the big city), and calculate the food basic unit. Moreover, we perform a simulation which assumes disaster, and examine self-help and mutual assistance of residents using the household food stocks. As a result, we find that there are more household food in Kanazawa than Tokyo. The total calories of meat, seafood, and vegetables are short of the calories which are necessary to refuge life for one day in both Kanazawa and Tokyo. In the future, we will perform a simulation that assumes the Nankai Trough earthquakes using the provincial city model and the big city model.

Keywords: household food stocks, large scale earthquake disaster, simulation analysis

1. Introduction

In Japan, a lot of natural disasters are expected to occur such as typhoon, heavy rain, heavy snowfall, flood, Sediment disaster, earthquake, tsunami and volcanic eruption. In the future, large scale earthquakes, such as the Nankai Trough earthquakes are expected to occur with a high probability. When these disaster occurs, supplies which required for life especially food and water are necessary. However, immediately after the occurrence of a major disaster, the goods such as food is assumed to be delivered late, since the rescue of the injured people has priority and the traffic is stopped for a long time. In Ishikawa Prefecture, prefectural government announces that it takes four days to deliver the supplies to all the victims, and they must use storage stored in the prefecture after a disaster for three days. [1]

Fig.1 shows the way of getting the foods after the East Japan great earthquake in Otsuchi-cho, Iwate. [2] In fact, the inhabitants used their household food stocks and got foods by mutual assistance in the area until the supplies were delivered at the time of disaster.

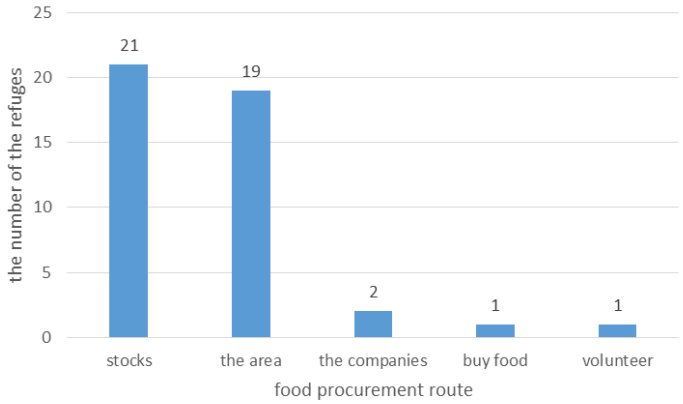

Fig. 1 – Food procurement route

Therefore we should break away from the way of thinking to rely on public aid and to stock goods for disasters. The purpose of this study is to examine self-help and mutual assistance of residents using the household food stocks. We investigate the amount of food in the home, and consider whether we can cover the meal at the time of a disaster to use them. Thus, we conduct a survey to analyze the amount of household food stocks in peacetime in Kanazawa (the provincial city) and Tokyo (the big city), and calculate the food basic unit (Kanazawa model: the provincial city model, Tokyo model: the big city model). Moreover, we perform a simulation which assumes disaster, and examine self-help and mutual assistance of residents using the household food stocks.

2. Past studies

Sizuoka Prefecture carried out the survey and analyzed the opinion poll about preparations for Tokai earthquake among the citizens. [3] However, studies investigating and analyzing the amount of the household food stocks are not performed. In Ishikawa Prefecture, the analysis about use of the household food stocks at the time of disaster was carried out. [4] However, studies investigating and comparing household food stocks which targeted at the resident of both provincial cities and big cities does not exist.

3. About the survey

We conducted a survey in Kanazawa City, Ishikawa Prefecture, and in Adachi Ward, Tokyo. The survey in Kanazawa was carried out in October, 2014. The distribution number is 5,000 sheets, and the response rate is 8 % (419 sheets). The survey in Tokyo was carried out in October, 2015. The distribution number is 9,500 sheets,

and the response rate is 4 % (397 sheets). In the survey, we asked questions about personal attributes, amount of foods in refrigerator and preserved foods, measures against disaster, and consciousness of disaster.

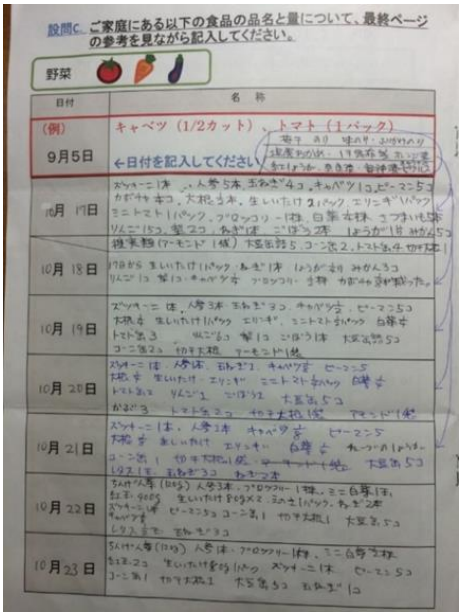

Fig. 2 — The example of the survey

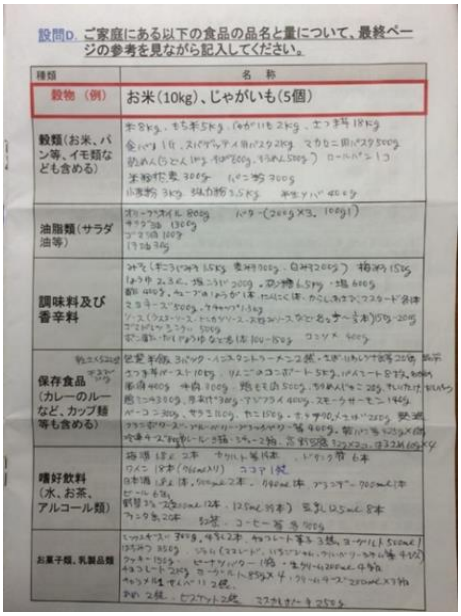

Fig. 3 — The example of the survey

4. Calculation of the basic unit

4.1 The way of calculating the basic unit

We calculated the food basic unit by analyzing the result of the survey about household food stocks. In this study, we define food basic unit as the amount of food which exists in each household, and the food basic unit is the gross weight of ingredient (meat, seafood, vegetables, canned foods, water) which is entered in the survey divided by the total number of household. In addition, we calculate two kinds of the food basic unit about meat, seafood, and vegetables. One is the mass basic unit whose unit is mass (Kg, g), and the other is the calorie basic unit whose unit is calories (kcal). The mass basic unit is hard to understand whether it is useful at the time of disaster. Thus, we convert mass into calorie to compare calorie basic unit with calories which people need to take in at the time of disaster. We use the mean value, the maximum value, and the minimum value of calories per 100g of each ingredient to convert mass into calorie. [5] Table 1 shows the mean, maximum, and minimum value of calories of each ingredient.

Table 1 — Calories per 100g of each ingredient

	the mean value	the maximum value	the minimum value
meat	223.8	501	95
seafood	139.7	370	23
vegetables	33.2	135	8

(kcal)

4.2 Mass basic unit

Fig.4, 5, 6, 7, 8 show the mass basic unit of meat, seafood, vegetables, canned foods, and water. There are more foods in Kanazawa than Tokyo about meat, seafood, vegetables, and canned foods, whereas there are more water in Tokyo than Kanazawa.

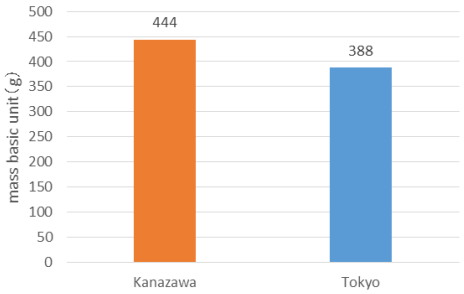

Fig. 4 – Mass basic unit of meat

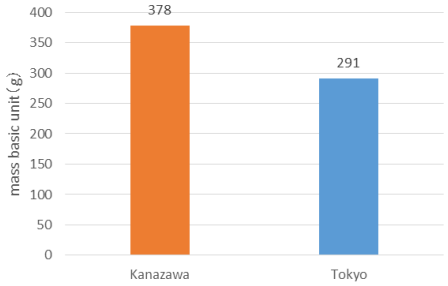

Fig. 5 – Mass basic unit of seafood

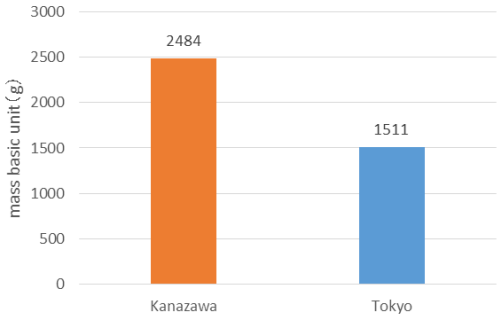

Fig. 6 – Mass basic unit of vegetables

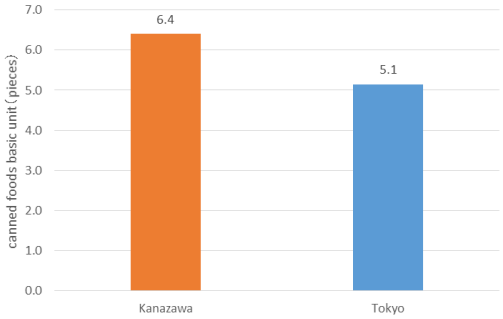

Fig. 7 – Mass basic unit of canned foods

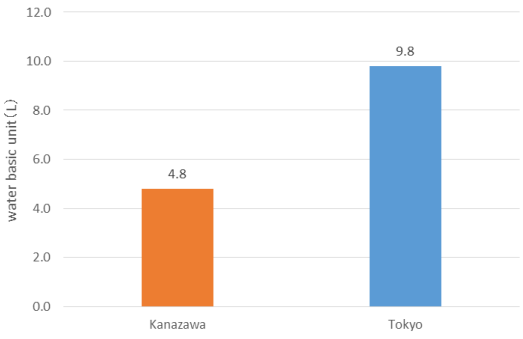

Fig. 8 – Mass basic unit of water

4.3 Calorie basic unit

We convert mass basic unit which are shown in Fig.4, 5, 6 into calorie basic unit. Fig.9, 10, 11 show calorie basic unit which are the result of conversion. Fig.12 shows total calories of meat,, seafood, and vegetables. There exist about 2,300 Kcal in Kanazawa, and 1,800 Kcal in Tokyo per household in peacetime.

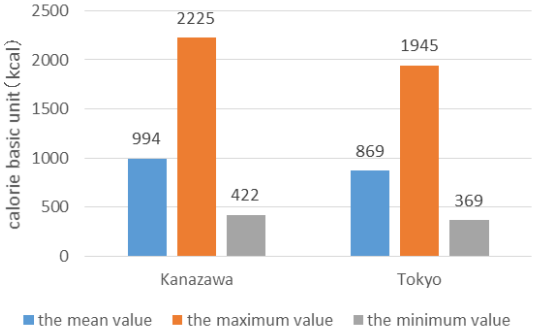

Fig. 9 – Calorie basic unit of meat

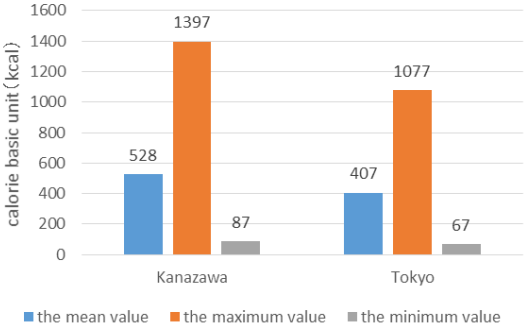

Fig. 10 – Calorie basic unit of seafood

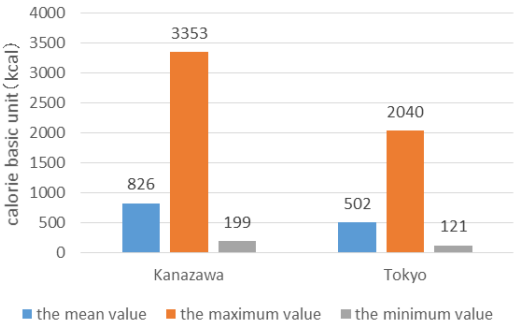

Fig. 11 – Calorie basic unit of vegetables

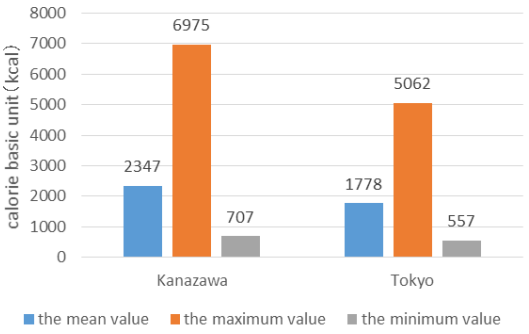

Fig. 12 – Calorie basic unit of the total

5. Simulation of food at the time of the earthquake

We simulate how many days we serve meals at the time of earthquake to use household food stocks in Kanazawa and Tokyo. We suppose that the food existing in the houses which are completely destroyed by the earthquake does not carry out, and thus we can't use them. We calculate the total amount of each food which can be used in the earthquake by using the basic unit and the number of buildings destroyed completely. Moreover, we calculated the amount of the food per citizen at the time of earthquake by dividing the population into the total amount of food.

5.1 Simulation in Kanazawa

We calculated the buildings which are completely destroyed at the time of earthquake by using the number of the building according to the building period in Kanazawa City [6] (Table 2), the measuring seismic intensity distribution in Kanazawa City [7] (Fig.13), and the complete destruction rate [8] (Fig.14, 15). The measuring seismic intensity distribution in Kanazawa is seismic intensity of excess probability 6% for 30 years.

Table 2 – The number of the building according to the building period

	wooden building						non-wooden building		
building time	～1962	1963～1971	1972～1980	1981～1989	1990～2001	2002～	～1971	1972～1980	1981～
number of the buildings	7410	8600	20040	20440	25050	28500	2160	9120	57650

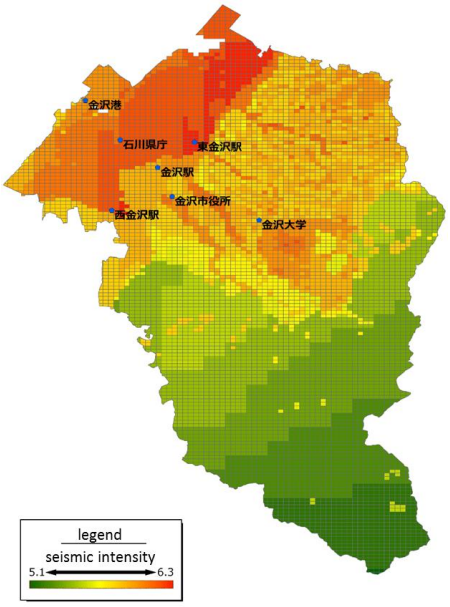

Fig. 13 — The measuring seismic intensity distribution

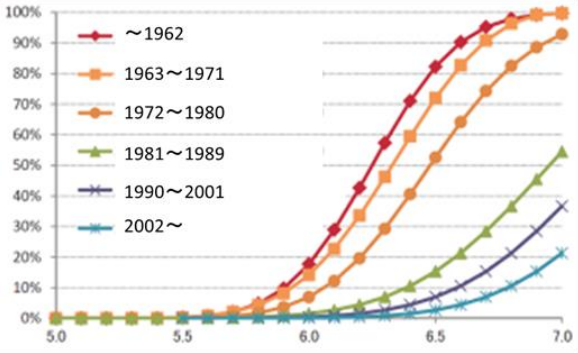

Fig. 14 — The complete destruction rate (wooden buildings)

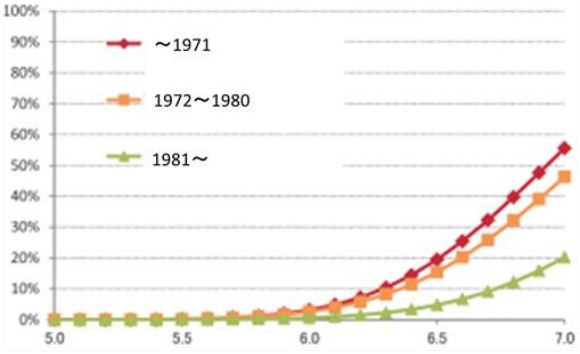

Fig. 15 — The complete destruction rate (non-wooden buildings)

According to the simulation, there exist canned food of 2.7 pieces, water of 2.0L per resident of the city. These food are useful at the time of disaster. We assume that water exist for one day, because the amount of water which a person needs per day is approximately 2.0L. Fig.16, 17, 18, 19 shows result of total of meat, seafood, and vegetables. It is said that 1,600~1,800Kcal is required per person per day for adults to refuge life. We find that the total calories of meat, seafood, and vegetables are short of the calories which are necessary to refuge life per day.

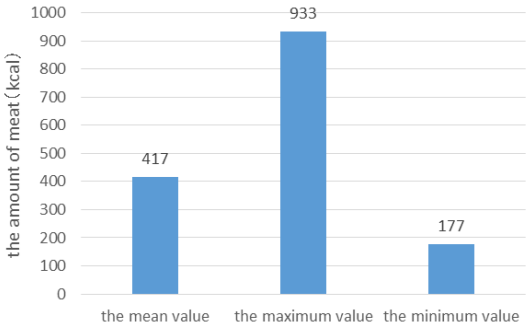

Fig. 16 － The amount of meat per citizen

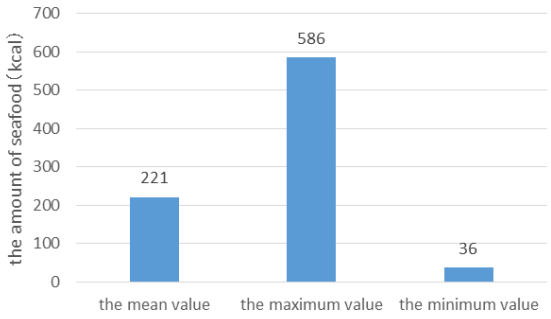

Fig. 17 － The amount of seafood per citizen

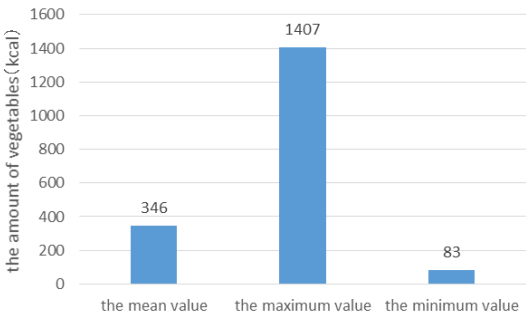

Fig. 18 － The amount of vegetables per citizen

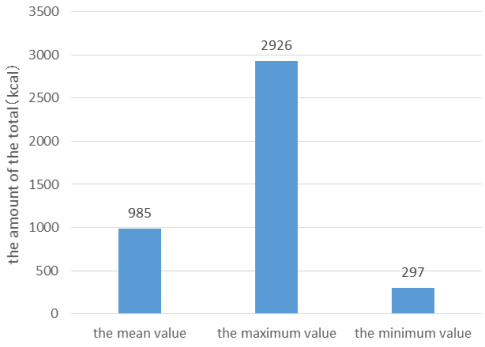

Fig. 19 － The amount of the total per citizen

5.2 Simulation in Tokyo

We assume Earthquake in northern Tokyo Bay [9] (Fig.20) to simulate in Tokyo. The government of Tokyo metropolis announce that 116,224 buildings are completely destroyed by rolling, liquefaction, collapsing of the slope ground by the earthquake. (Table 3) We use this value to simulate.

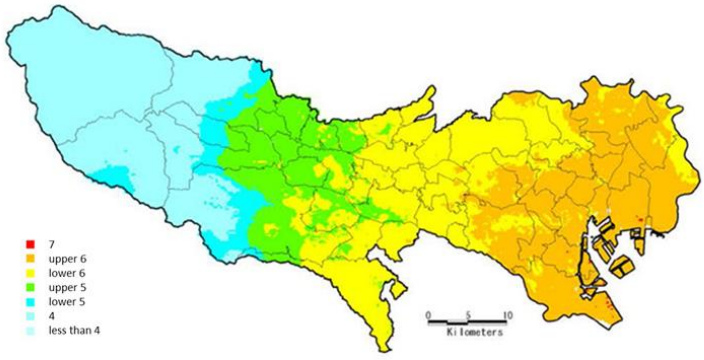

Fig. 20 — The seismic intensity distribution of Earthquake in northern Tokyo Bay

Table 3 — The number of buildings completely destroyed

rolling	liquefaction	collapsing of the slope ground	total
114,109	1,134	980	116,224

(the unit: buildings)

According to the simulation, there exist canned food of 2.4 pieces, water of 4.6L per resident of the city. These food are useful at the time of disaster. We assume that water exist for two days. Fig.21, 22, 23, 24 shows result of meat, seafood, vegetables, and total of them. We find that the total calories of meat, seafood, and vegetables are short of the calories which are necessary to refuge life per day in Tokyo.

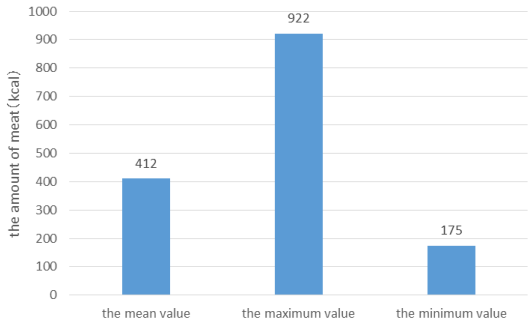

Fig. 16 — The amount of meat per citizen

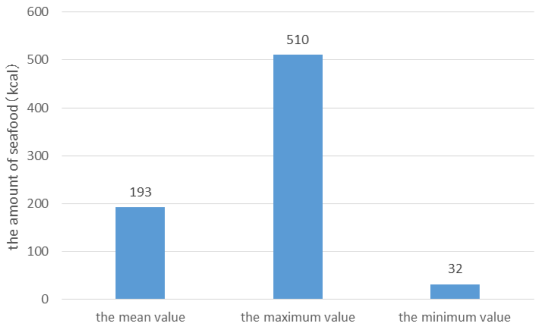

Fig. 17 — The amount of seafood per citizen

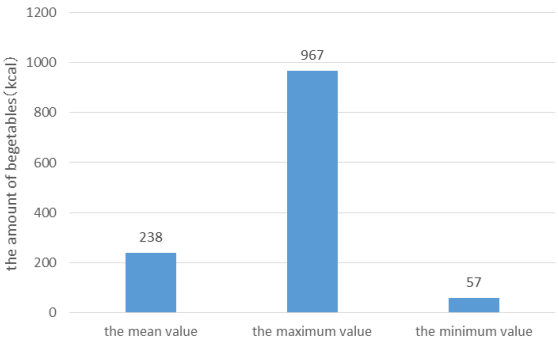

Fig. 18 — The amount of vegetables per citizen

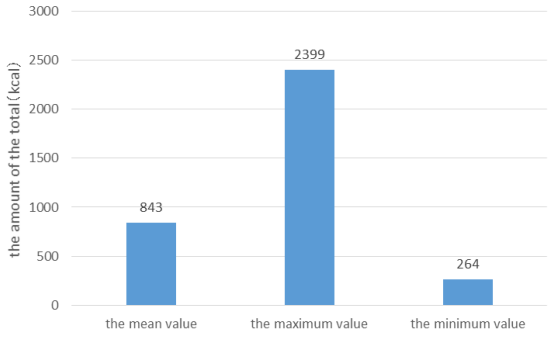

Fig. 19 — The amount of the total per citizen

5. Conclusion

We need to stop to rely on public aid and to stock goods for disasters. We examine self-help and mutual assistance of residents using the household food stocks. We find that there are more household food in Kanazawa than Tokyo. The total calories of meat, seafood, and vegetables are short of the calories which are necessary to refuge life per day in both Kanazawa and Tokyo.

We analyze meat, seafood, vegetables, canned food, and water. We will analyze grain and confectionery to grasp the total amount of household food, and examine whether we can cover the meal at the time of a disaster to use them. Moreover we will perform a simulation that assumes Nankai Trough earthquake using the provincial model and the big city model.

6. References

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