

# Study about Investigation to Establish the Cause of Shift Away from Rice Consumption of Young Generation

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**Abstract-** Presently in Japan, young generation shift away from rice consumption. Therefore, this study did investigation and analysis to establish the cause of shift away from rice consumption of young generation. This analysis was conducted using “Cramer's V” and “Correspondence Analysis” to original questionnaire by authors. The result of this study, establish three knowledge. The first is that although members of society were shift away from rice consumption, university students did not shift away it. The second is that shift away from rice consumption was only breakfast. The third is that was established characteristic and the cause of shift away from rice consumption of young generation.

**Keywords-** Shift Away From Rice Consumption, Cramér's V, Correspondence Analysis, Questionnaire Analysis

## I. INTRODUCTION

More and more people are eating less rice in Japan today, creating a de-facto shift away from rice consumption [1]. The Ministry of Agriculture, Forestry and Fisheries [2] is promoting the “*Mezamashi Gohan* (wake-up breakfast)” campaign to raise awareness of the importance of eating breakfast in an attempt to increase the nation's rice consumption. However, the survey conducted by the Ministry in October 2015 [3] shows that the annual rice consumption per person has more than halved from 118.0 kg in 1962 to 54.6 kg in 2015, and the demand for rice is falling by 8 tons every year. Notably, the younger the generation, the lower the rate of response for “I eat rice.” Some surveys report that approximately 20% of Japanese male in their 20s did not eat rice at all for a month. Elsewhere, according to the Family Income and Expenditure Survey 2016 [4], an average household spent less on rice than on bread.

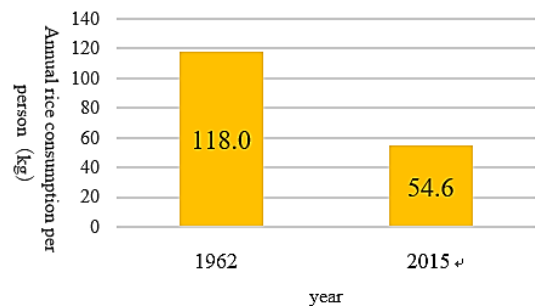


Figure 1. Annual rice consumption per person [3]

Therefore, this study targeted the young generation and revealed the characteristics of those who do not eat rice and the reasons for such behavior, using a questionnaire uniquely developed by the authors. The collected data were analyzed in a metric approach, using Cramer's V [5-6] and Correspondence Analysis [7-11].

In this study, the young generation is defined to be male and female aged between 15 and 24, drawing on descriptions given by the United Nations Information Centre and definitions used in the reference documents prepared by the Ministry of Health, Labour and Welfare [12-13]. Cramer's V was used to extract the question items that correlate with the question about staple food (i.e. do or do not eat rice), and these question items were analyzed using Correspondence Analysis to clarify the characteristics of those who do not eat rice as staple food and the reasons for not eating rice.

As a result, we found that, among these young people, it was the working people who shifted away from rice consumption rather than university students.

It also became clear that the trend of not eating rice only concerns breakfast among the daily three meals. Thus, the study further explains the characteristics of those who do not eat rice for breakfast and their reasons.

## II. EXISTING AND RELATED STUDIES

The survey by the Ministry of Agriculture, Forestry and Fisheries [14] points out the falling number of rice farmers due to the decreasing national demand for rice in Japan and the growing concern for lifestyle-related diseases associated with an unbalanced diet. Based on these findings, the survey recommends a plan to reconsider current lifestyles of the Japanese people and the ways to improve the national food self-sufficiency. This survey is based on the Family Income and Expenditure Survey, conducted monthly by the Ministry of Internal Affairs and Communications, in which approximately 9,000 households are randomly selected and surveyed.

Watanabe et al. [15] examined the reasons for the trend of not eating rice by investigating the diet, rice consumption, and rice purchases by product brand among female university students. Their study took the approach of surveying with a questionnaire, targeting female university students. Based on the results, they mention the trend of shifting away from rice consumption.

Yamada's seminar [16] proposes the promotion of pre-washed rice to boost rice consumption and discusses future government policies based on the present circumstances that rice farmers are facing. They also refer to rice export as well as import from other countries. Yamada et al. surveyed opinions of people regardless of age about agriculture in Japan and participation in the Trans-Pacific Partnership (TPP) Agreement. They recommend that a new system should be developed by comparing the survey results with the current system of agriculture and situations of the farming household in Japan.

Shirai et al. [17] from the Prof. Hayashi's seminar, Kwansai Gakuin University, focused on the question "why the Japanese stopped eating rice?" and investigated the rice consumption and the shift from rice to bread, in terms of prices, preferences, health, and efforts in preparing meals. They take these four points to consider the reasons why Japanese people do not eat rice as much as they did before. Shirai et al. focus on household rice consumption, which includes both younger and older generations. This study similarly uses a questionnaire uniquely developed by them, and they propose to increase rice consumption by introducing measures to make rice preparation easier.

Other than the above studies, there are articles referring to the decline of rice consumption year after year in Japan, the increase in imported wheat and meat from the US exacerbating the shift away from rice consumption, and the diminishing rice farmers leading to less rice production [18-20].

However, in the studies and articles mentioned above, most of them either discussed the reasons and countermeasures concerning the trend of not eating rice or conducted

questionnaire surveys as an approach for their research. None of them investigated their data further, using Cramer's V and Correspondence Analysis, to clarify the characteristics of those who tend not to eat rice, as we did in this study. Furthermore, as this study uniquely targets the young generation (aged 15 to 24), it should contribute to the accumulation of new knowledge. While there are many studies that use Cramer's V and Correspondence Analysis, none of them investigated the reasons for the shift away from rice consumption, to the authors' knowledge.

## III. PROPOSED CONCEPT

### A. Development of a unique questionnaire

The young generation referred to in this study is, as stated above, people aged between 15 and 24. With this population group in mind, we developed an original questionnaire to identify the reasons for eating less rice and the characteristics of people with the tendency of not eating rice. The details of this questionnaire are given in reference [21]. In this section, we will highlight some significant items and give additional descriptions.

Questions 2-1 to 4-1 are about the time of the day when respondents eat meals, and options are provided at one-hour interval. For breakfast, the options are widely ranged from 4:00 to 10:00, considering that some need to start the day early for work while others, such as students, may start relatively late. For lunch, the options are set between 11:00 and 15:00, based on the standard lunchtime on weekdays, taking into account those who missed their lunch during the designated lunchtime. For dinner, the options are set between 17:00 and 23:00 with another option of "later than 23:00" because some may eat with their families while others may eat very late due to their work, evening part-time jobs, etc.

The "bought meal" in Questions 2-2 to 4-2 refers to the behavior of buying ready-meals (bento meal box, pre-cooked food, etc.) from supermarkets, convenience stores, etc. to eat at home, at the office, etc. [22].

"Major staple food" in Questions 2-3 to 4-3 are the most important in this survey. The options for "major staple food" are "rice prepared at home," "ready-to-eat rice (instant rice, rice balls, etc.)," "bread," and "noodles." These are determined with reference to the 2014 Survey on mid-term trend of rice consumption as staple food and factor analysis report [23] as well as the diet-related website, "asken.jp" [24]. These sources were also consulted to develop the options for main and side dishes, relevant to Questions 2-5 to 4-5 and 2-6 to 4-6, respectively. Questions 2-4 to 4-4 also come with a prompt to select the reason for choosing an option other than "rice prepared at home." The options for the reasons were set by reference to Shirai et al. [17].

### B. Conducting questionnaire

The questionnaire developed as above was then conducted as outlined in Table 1. A total of 109 people completed the questionnaire. This study analyzed the data taken from the

questionnaire, taking the approach described in the following sections.

TABLE I. OVERVIEW OF QUESTIONNAIRE

No	Item	Description
1	Period	From March to June 2017
2	Method	Online survey using Google Forms
3	Target population	University students, working people
4	Respondents	109

### C. Cramer's V analysis

Cramer's V gives a value between " $1 \cong x \cong 0$ " and indicates the strength of association between the row and column variables. Like Mizumoto et al. [25], in this study, 0.3 or above is considered as having a correlation and 0.5 or above is construed to have a strong correlation. This time, Cramer's V was conducted with the rows taking the options for Questions 2-3 to 4-3 "Major staple food" and the columns from the questions that are found to be correlated with those questions. The formulas used in the Cramer's V analysis in this study are shown as (i) to (iv) below.

- i. Generate a cross table based on the two rows correlated with "Questions 2-3 to 4-3 Major staple food," using the pivot table function.
- ii. Obtain the Expected Frequency (EF) of each cell in the rows and columns addressed by (i), using the following formula.

$$EF = \frac{RoTF_i CoTF_i}{TF} \quad (1)$$

$i$  ... Row/Column number

$RoTF$  ... Row Total Frequency

$CoTF$  ... Column Total Frequency

$TF$  ... Total Frequency

- iii. Obtain the difference between Real Number (RN) and Expected Number (EN), by first taking a square of the difference between the cells corresponding to RN and EN, and then dividing it by EN. This is part of an operation to obtain Pearson's Chi Square ( $\chi^2$ ) whose formula is indicated below. Obtain  $\chi^2$  by adding up the differences calculated as above.

$$\frac{(RN_i - EN_i)^2}{EN_i} \quad (2)$$

$i$  ... Row/Column number

- iv. Finally, obtain Cramer's V (CV) by using the following formula, where  $n$  is Total Frequency,  $k$  is the number of rows of the cross table created in (i), and  $l$  is the number of columns of the same cross table.

$$CV = \sqrt{\frac{\chi^2}{n(\min[k,l]-1)}} \quad (3)$$

## IV. QUESTIONNAIRE DATA ANALYSIS

### A. Analysis results by simple tabulation

The basic data of the survey respondents are shown in Figs. 2 to 6 based on simple tabulation (age, occupation, gender, birthplace, household type, and the number of meals a day).

As this study targeted young people, many of the respondents were students of teenage or in their early 20s, as shown in Fig. 4. Despite the definition of the young generation to be the age group of 15 to 24, some respondents were aged 25 or older. However, because such number was insignificantly small, they were included in the analysis. Fig. 3 shows that approximately 78% of respondents were female, and this was partly because the study had cooperation by an all-women's college. As for Fig. 5, the majority of household styles reported was either living alone or living with parents, as many respondents were students. The birthplaces shown in Fig. 6 indicates that the majority of respondents come from the Kanto region (including Tokyo), perhaps due to the fact that many respondents were students residing in this region.

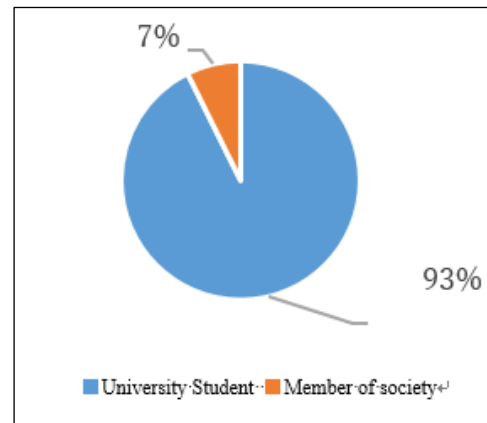


Figure 2. Occupation

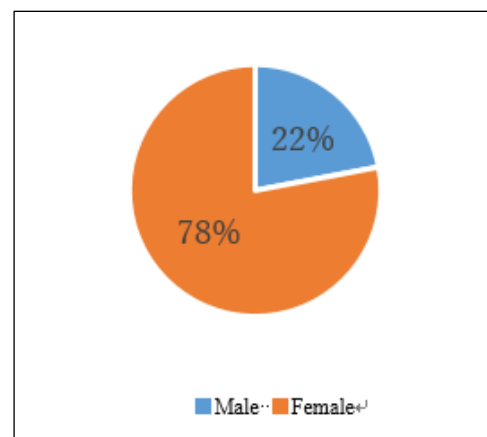


Figure 3. Gender

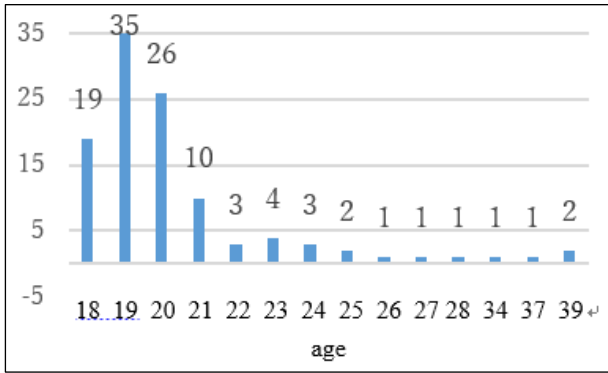


Figure 4. Age distribution

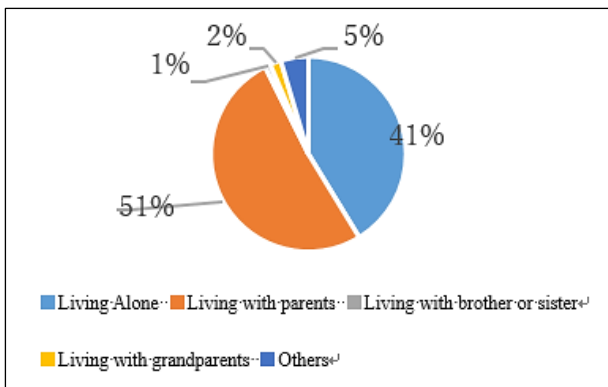


Figure 5. Household type

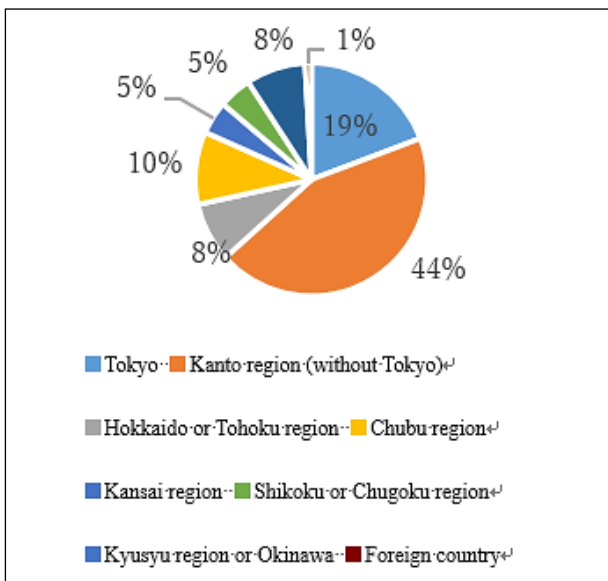


Figure 6. Birthplace

## B. Results of Cramer's V and Correspondence Analysis

### 1) Introduction

Although the questionnaire for this study was conducted using Google Forms, we took an analytical approach by using Cramer's V and Correspondence Analysis, as stated in sections 3.3 above, as Google Forms output data in the CSV format are not in quantitative data but categorical, such as "living alone" and "three meals a day."

Figs. 7 to 9 illustrate the staple food for breakfast, lunch, and dinner, respectively. Here, Figs. 8 and 9 clearly indicated that people did eat rice for lunch and dinner. Meanwhile, Fig. 7 shows that the major staple food for breakfast is bread, indicating that the trend of not eating rice is clear for breakfast. Based on these results, we will limit the analysis to breakfast from the following sections.

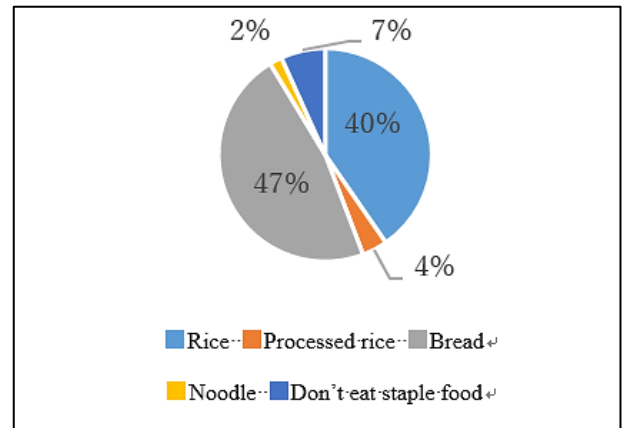


Figure 7. Staple food for breakfast

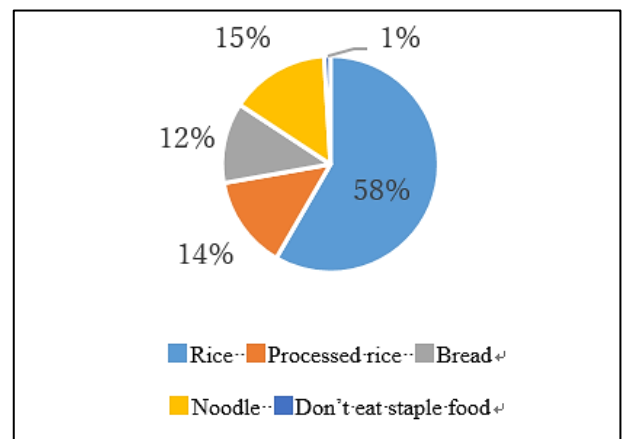


Figure 8. Staple food for lunch

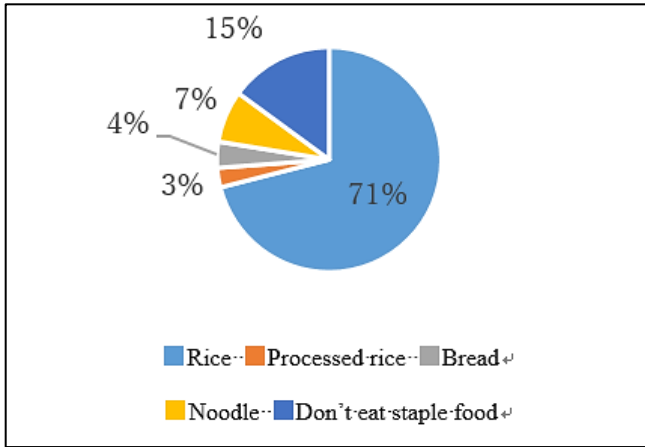


Figure 9. Staple food for dinner

### 2) Results of Cramer's V analysis

Table 2 shows the results of Cramer's V analysis between the questions most likely to be directly associated with the shift away from rice consumption (Questions 1-1 Age; 1-2 Occupation; 1-4 Household style; 1-6 Number of meals a day; 2-1 Usual [breakfast] time; 2-2 Cooked meal, bought meal, or eating out; and 2-4 Reason for not eating rice) and Question 2-3 Major staple food. As seen in Table 2, Q1-2 Occupation was the only item that scored less than 0.3 in Cramer's V analysis. Therefore, in the following sections, Correspondence Analysis is applied to all items except Q1-2.

TABLE II. CRAMER'S COEFFICIENTS OF ASSOCIATION

Question associated with Q2-3	Cramer's coefficient of association
1-1	0.63
1-2	0.15
1-4	0.38
1-6	0.31
2-1	0.32
2-2	0.40
2-4	0.76

### 3) Results of Correspondence Analysis

The six cases from the preceding section are analyzed using Correspondence Analysis, and the results are described in (i) to (vi) below.

#### (i) Correspondence between Q2-3 Major staple food and Q1-1 Age

Fig. 10 shows that ready-to-eat rice, such as instant rice and rice balls, is consumed the most by people aged 23 while noodles are consumed the most by people aged 25. Meanwhile, groups that are not having staple food or eating bread for breakfast could not be accurately identified in this figure as the marks plotted on the chart overlapped.

Instead, we used the scores of Correspondence Analysis to obtain the Euclidean distances between Q2-3 and Q1-1 and investigated the options in Q2-3 ("cooked rice," "bread," etc.) individually to identify the age group that had the shortest distance. Based on this, Table 4 presents Q1-1 Age for Row scores and Q2-3 Major staple food for Column scores. As Q2-3 has the following five options, there are five correspondence scores for each item. In Table 3, [1] and [2] indicate the first and second scores, respectively.

- Cooked rice
- Bread
- Ready-to-eat rice (instant rice, rice balls, etc.)
- Noodles
- No staple food

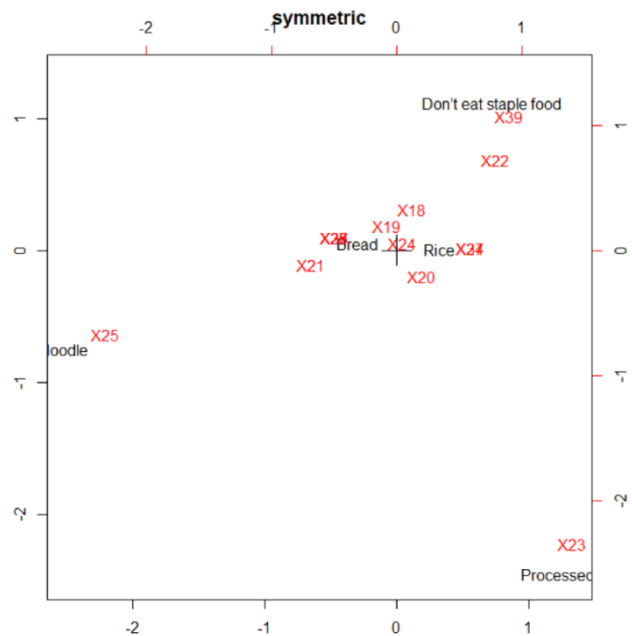


Figure 10. Results of Correspondence Analysis (between Major staple food and Age)

Calculate the first and second scores from the cumulative contribution rates (Table 4) to obtain the Euclidean distances. More specifically, give the first and second scores of Q1-1 ([1] and [2] scores in Row scores of Table 4) as 1-11 and 1-12 while the first and second scores of Q2-3 ([1] and [2] scores of Column scores of Table 4) as 2-31 and 2-32, and the Euclidean distance  $d(Q2-3, Q1-1)$  is obtained as follows:

$$d(Q2-3, Q1-1) = \sqrt{(2-3_1 - 1-1_1)^2 + (2-3_2 - 1-1_2)^2} \quad (4)$$

Table 5 shows the Euclidean distances calculated by Formula (4). Table 6 is a list for Q1-1 (Age), which is the question closest to the options for Q2-3 in terms of the Euclidean distance. As we can see in Table 6, the 19-year-olds (university students) do not have the tendency to shift away from rice consumption while the young working population aged 23 to 25 tends not to eat rice as much.

TABLE III. RESULTS OF CORRESPONDENCE ANALYSIS BETWEEN Q2-3 AND Q1-1  
ROW SCORES: Q1-1

	[1]	[2]	[3]	[4]	[5]
18 y/o	-0.48	-0.44	-1.01	0.76	0.99
19 y/o	-0.24	0.38	0.42	-0.09	1.09
20 y/o	-0.21	0.42	0.61	-0.46	0.91
21 y/o	1.48	-0.26	0.11	0.24	1.11
22 y/o	-1.21	-0.27	-2.47	-1.15	1.10
23 y/o	1.17	-4.46	1.00	-0.55	0.94
24 y/o	-0.05	0.48	0.81	0.71	0.86
25 y/o	5.55	2.05	-2.66	-0.83	0.88
26 y/o	0.30	0.63	1.27	3.41	0.70
27 y/o	-0.76	0.19	-0.11	-4.68	0.69
28 y/o	0.30	0.63	1.27	3.41	0.70
34 y/o	-0.76	0.19	-0.11	-4.68	0.69
37 y/o	0.30	0.63	1.27	3.41	0.70
39 y/o	-1.43	-0.50	-3.65	0.62	0.81

COLUMN SCORES: Q2-3

	[1]	[2]	[3]	[4]	[5]
Rice (prepared at home)	-0.44	0.10	-0.05	-1.13	-1.00
Bread	0.17	0.32	0.56	0.82	-1.00
Ready-to-eat rice	1.47	-4.74	0.62	-0.11	-1.00
No staple food	6.16	1.76	-2.90	-1.22	-1.00
Noodles	-1.20	-0.61	-3.16	1.43	-1.00

TABLE IV. CONTRIBUTION AND CUMULATIVE CONTRIBUTION RATES

	[1]	[2]	[3]	[4]
Contribution rate	39.00	30.87	23.17	0.00
Cumulative contribution rate		69.87	1.00	1.00

TABLE V. EUCLIDEAN DISTANCES BETWEEN Q2-3 AND Q1-1 (THE UNDERLINE INDICATES THE SHORTEST EUCLIDEAN DISTANCE TO EACH OPTION OF Q2-3)

	Rice	Bread	Ready-to-eat rice	Noodles	No staple food
18 y/o	0.54	1.00	4.72	0.74	6.99
<u>19 y/o</u>	0.21	0.41	5.40	1.38	6.55
20 y/o	5.17	0.39	5.43	1.43	6.51
21 y/o	2.79	1.43	4.48	2.70	5.10
22 y/o	0.84	1.50	5.21	0.34	7.64
<u>23 y/o</u>	4.74	4.88	0.41	4.52	7.97
<u>24 y/o</u>	0.62	0.27	5.44	1.58	6.34
<u>25 y/o</u>	6.33	5.65	7.92	7.26	0.68
26 y/o	0.97	0.34	5.50	1.95	5.97
27 y/o	0.37	0.94	5.41	0.91	7.10
28 y/o	0.97	0.34	5.50	1.95	5.97
34 y/o	0.37	0.94	5.41	0.91	7.10
37 y/o	0.97	0.34	5.50	1.95	5.97
<u>39 y/o</u>	1.11	1.80	5.14	0.25	7.92

TABLE VI. LIST OF Q1-1 ITEMS WITH THE SHORTEST EUCLIDEAN DISTANCES WITH Q2-3 OPTIONS

Q2-3	Q1-1
Rice (prepared at home)	19 y/o
Bread	24 y/o
Ready-to-eat rice (instant rice, rice balls, etc.)	23 y/o
Noodles	39 y/o
No staple food	25 y/o

(ii) Correspondence between Q2-3 Major staple food and Q1-4 Household style

Fig. 11 reveals that those who are “living with their parents” have a strong tendency to eat rice prepared at home while those who are “living only with siblings” and “living alone” tend to eat bread more. Those who fall into other categories of household styles showed some variations in terms of their staple food. Based on the above, it is considered that those who are “living with their parents” are more likely to eat “rice prepared at home.”

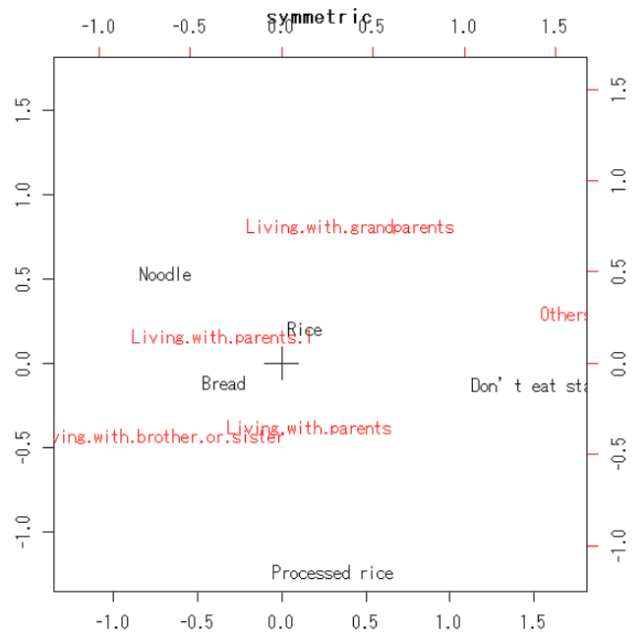


Figure 11. Results of Correspondence Analysis (between Major staple food and Household style)

(iii) Correspondence between Q2-3 Major staple food and Q1-6 Number of meals a day

Fig. 12 reveals the tendencies that those who eat “three meals a day” eat “rice prepared at home;” those who eat “two meals a day (without lunch)” tend to eat “bread;” and those who only eat “one meal a day (dinner only)” are likely to have no specific staple food.



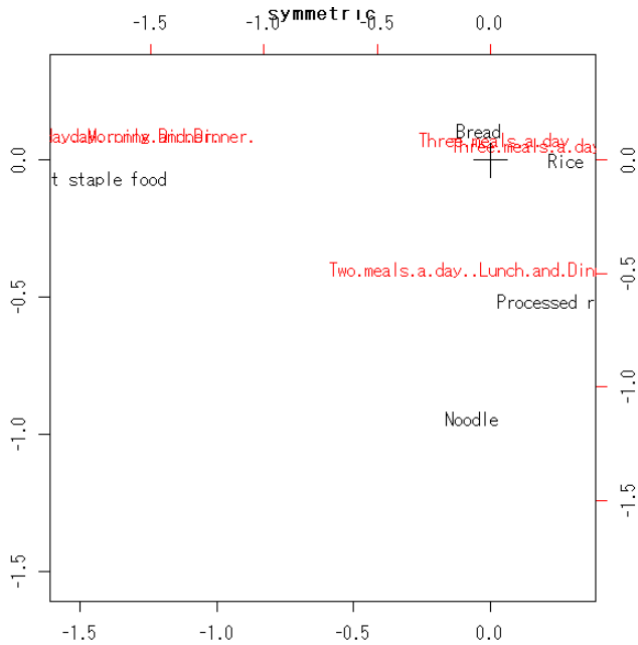


Figure 12. Results of Correspondence Analysis (between Major staple food and Number of meals a day)

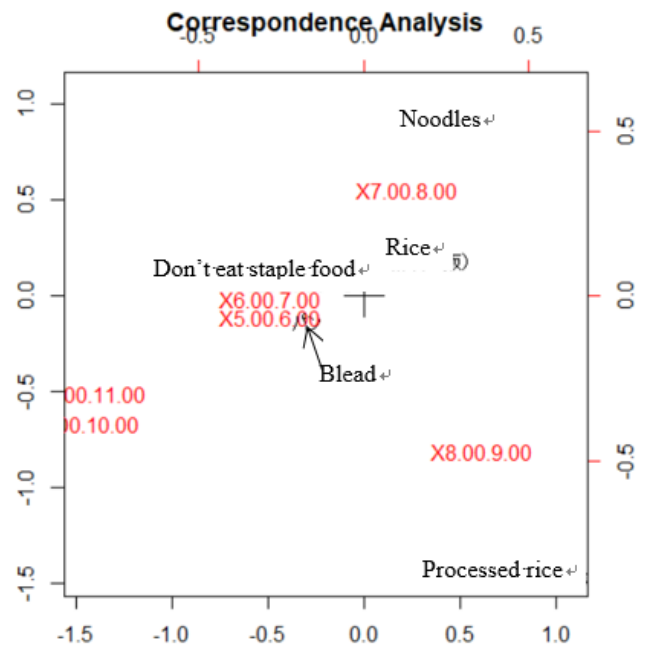


Figure 13. Results of Correspondence Analysis (between Major staple food and Usual [breakfast] time)

(iv) Correspondence between Q2-3 Major staple food and Q2-1 Usual [breakfast] time

Fig. 13 can be summarized as follows:

- Those who have breakfast between 5:00 and 6:00 a.m. have a strong tendency to eat bread
- Those who have breakfast between 6:00 and 7:00 a.m. do not have staple food
- Those who have breakfast between 7:00 and 8:00 a.m. have a strong tendency to eat rice prepared at home
- Those who have breakfast between 8:00 and 9:00 without enough time before leaving home for school/work, have a strong tendency to opt for a quick option of ready-to-eat rice such as instant rice and rice balls

In summary, supposing that school/work starts at 9:00 and that it takes about an hour (or less) for commuting, people are more likely to eat rice prepared at home if they have breakfast one hour before leaving home, and those who need to leave home earlier tend to eat bread or no staple food. A possible explanation for this is that leaving early may be due to “having a meeting/class first thing in the morning” or “leaving on a business trip early in the morning,” and they want to have a quick breakfast with bread or skip it altogether.

Furthermore, those who have little time for breakfast before leaving home for school/work may also opt for a quick option of ready-to-eat food.

(v) Correspondence between Q2-3 Major staple food and Q2-2 Cooked meal, bought meal, or eating out

Fig. 14 reveals that those who are eating “cooked meal” are more likely that they eat rice prepared at home while those who are eating “bought meal” tend to eat more bread. Similarly, those who tend to go “eating out” are found to be likely to eat “ready-to-eat rice (instant rice, rice balls, etc.)”

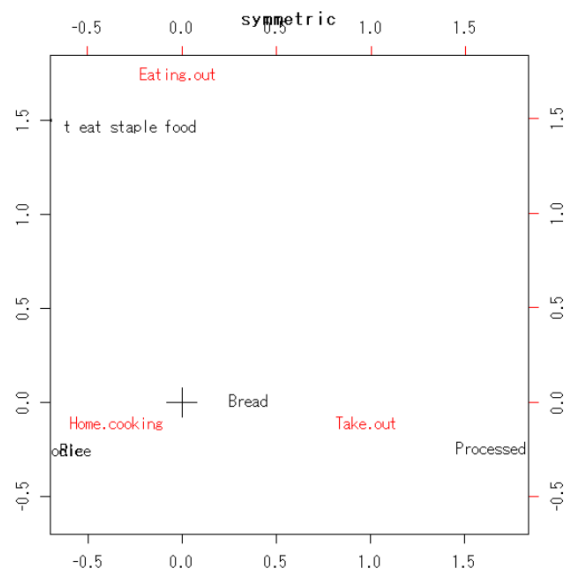


Figure 14. Results of Correspondence Analysis (between Major staple food and Cooked meal, bought meal, or eating out)

(vi) Correspondence between Q2-3 Major staple food and Q2-4 Reason for not eating rice

As seen in Fig. 15, too many options for “Q2-4 Reason for not eating rice” resulted in indecipherable plots, not allowing to identify the characteristics of the reasons. Therefore, we repeated the procedure followed in (i) to calculate the Euclidean distances between Q2-3 and Q2-4 and identified the items (reasons for not eating rice) with the shortest distances to the Q2-3 options (e.g., “bread” and “noodles”).

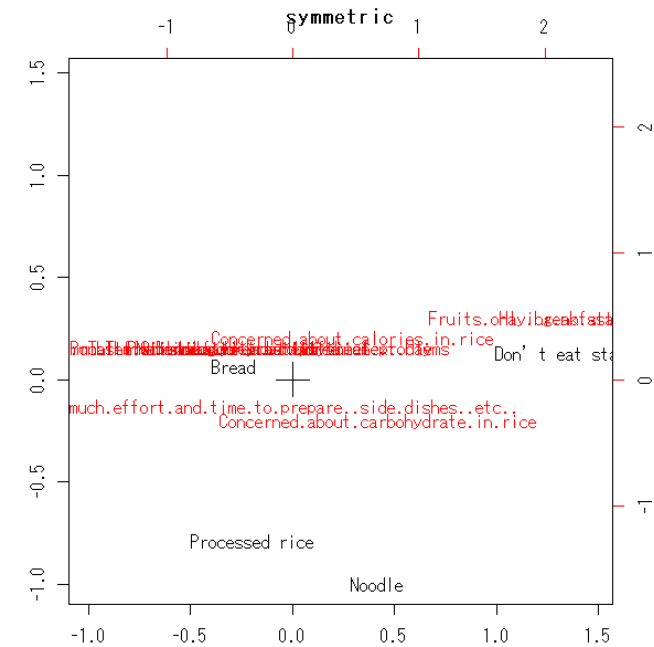


Figure 15. Results of Correspondence Analysis (between Major staple food and Reason for not eating rice)

Note that the options given in Q2-3, other than “rice prepared at home,” are the same as those indicated in (i), and the analysis shown in Table 7 excludes the “rice prepared at home” option from the Column scores because Q2-4 targets those whose staple food was not rice. Table 7 shows the scores resulting from Correspondence Analysis between Q2-3 and Q2-4. This time, there are four scores for each item because the rows include the options of Q2-3 except “rice prepared at home” as in the previous paragraph. However, we only used the values up to the first and second axes to obtain the Euclidean distances, as the score is already more than 93% at the second axis, as shown in Table 8.

TABLE VII. RESULTS OF CORRESPONDENCE ANALYSIS BETWEEN Q2-3 AND Q2-4  
ROW SCORES: Q2-4

	[1]	[2]	[3]	[4]
Concerned about calories in rice	0.30	1.06	1.06	-0.12
Concerned about carbohydrate in rice	-0.69	1.05	-2.42	-0.92
Eating granola instead	-0.26	4.66	2.45	-1.37
Other (family habits)	0.59	-0.74	0.36	-0.87
Having no staple food	-5.32	-1.34	1.62	-0.95
Preferring bread to rice	0.59	-0.74	0.36	-0.87
There is always bread at home	0.59	-0.74	0.36	-0.87
Depending on the mood	0.59	-0.74	0.36	-0.87
Too much effort to save it until the next day	0.59	-0.74	0.36	-0.87
Too much effort and time to prepare (side dishes, etc.)	0.04	-0.14	-0.19	-1.03
Heavy (on the stomach) or other physical problems	0.48	-0.06	0.63	-0.97
Problem with texture (too soft, etc.)	0.59	-0.74	0.36	-0.98
No rice cooker at home	-5.32	-1.34	1.62	-0.95
Too voluminous for breakfast	0.59	-0.74	0.36	-0.87
Needing coffee to wake up	0.59	-0.74	0.36	-0.87
Fruits-only breakfast suits me better	-0.26	4.66	2.45	-1.38
Mother deciding to serve bread for breakfast	0.59	-0.74	0.36	-0.87
Taste (dislike the taste of rice)	0.59	-0.74	0.36	-1.54
Parents' preference	0.59	-0.74	0.36	-0.87
Having no freezer, left-over rice will be wasted	0.59	-0.74	0.36	-0.87

COLUMN SCORES: Q2-3

	[1]	[2]	[3]	[4]
Bread	0.38	-0.39	0.08	-1.00
Ready-to-eat rice (instant rice, rice balls, etc.)	-3.46	-0.72	0.37	-1.00
No staple food	-0.17	2.49	0.57	-1.00
Noodles	-0.50	0.85	-5.66	-1.00

TABLE VIII. CONTRIBUTION AND CUMULATIVE CONTRIBUTION RATES

	[1]	[2]	[3]	[4]
Contribution rate	55.48	37.53	6.98	0.00
Cumulative contribution rate		93.01	1.00	1.00

The calculation manner to obtain the Euclidean distance is the same as (i). However, this time, since it is the distances between items of Q2-3 and Q2-4, the scores of the first and second axes are expressed as 2-41 and 2-42, and the same Formula (4) in (i) is used for calculation. Table 9 shows the Euclidean distances calculated by Formula (4). Table 10 is a list of items for Q2-4 (Reason for not eating rice) that have the shortest Euclidean distances with Q2-3 options.



According to Tables 9 and 10, the reasons for not eating rice include not only the properties of rice, such as calories, carbohydrate, and texture, but also factors related to home environment and lifestyles, like not having a rice cooker at home. These findings are expected to add to the knowledge that contributes to the development of future measures and policies concerning the declining rice consumption.

TABLE IX. EUCLIDEAN DISTANCES BETWEEN Q2-3 AND Q2-4 (THE UNDERLINE INDICATES THE SHORTEST EUCLIDEAN DISTANCE TO EACH OPTION OF Q2-3)

	Bread	Ready-to-eat rice	Noodles	No staple food
<u>Concerned about calories in rice</u>	1.45	4.16	0.83	<u>1.51</u>
<u>Concerned about carbohydrate in rice</u>	1.79	3.29	<u>0.28</u>	1.53
Eating granola instead	5.09	6.26	3.82	2.17
Other (family habits)	0.41	4.05	1.93	3.32
<u>Having no staple food</u>	5.78	1.96	5.29	6.42
Preferring bread to rice	0.41	4.05	1.93	3.32
There is always bread at home	0.41	4.05	1.93	3.32
Depending on the mood	0.41	4.05	1.93	3.32
Too much effort to save it until the next day	0.41	4.05	1.93	3.32
Too much effort and time to prepare (side dishes, etc.)	0.42	3.55	1.13	2.64
<u>Heavy (on the stomach) or other physical problems</u>	0.34	3.99	1.34	2.63
Problem with texture (too soft, etc.)	0.41	4.05	1.93	3.32
<u>No rice cooker at home</u>	5.78	1.96	5.29	6.42
Too voluminous for breakfast	0.41	4.05	1.93	3.32
Needing coffee to wake up	0.41	4.05	1.93	3.32
Fruits-only breakfast suits me better	5.09	6.26	3.82	2.17
Mother deciding to serve bread for breakfast	0.41	4.05	1.93	3.32
Taste (dislike the taste of rice)	0.41	4.05	1.93	3.32
Parents' preference	0.41	4.05	1.93	3.32
Having no freezer, left-over rice will be wasted	0.41	4.05	1.93	3.32

TABLE X. LIST OF Q1-1 ITEMS WITH THE SHORTEST EUCLIDEAN DISTANCES WITH Q2-3 OPTIONS

Q2-3	Q2-4
Bread	Heavy (on the stomach) or other physical problems
Ready-to-eat rice (instant rice, rice balls, etc.)	<ul style="list-style-type: none"> <li>Having no staple food</li> <li>No rice cooker at home</li> </ul>
Noodles	Concerned about carbohydrate in rice
No staple food	Concerned about calories in rice

## V. SUMMARY OF ANALYSES AND DISCUSSIONS

This section examines the analysis results obtained in Section 4. Firstly, the results shown in Figs. 2 to 4 are considered to have clarified the tendencies particular to female students at universities. The analyses then suggested the following five trends characterizing those who do not eat “rice prepared at home,” as illustrated in Table 11.

TABLE XI. TRENDS OF THOSE WHO DO NOT EAT “RICE PREPARED AT HOME”

Occupations	Young working population in their early 20s (aged 23 to 25) ((i) of 4.2.3)
Household types	People not living with their parents (e.g., living by themselves) ((ii) of 4.2.3)
Number of meals a day	Fewer than two meals ((iii) of 4.2.3)
Breakfast time	Between 5:00 and 6:00 ((iv) of 4.2.3)
Meal types	Eating bought meals or eating out ((v) of 4.2.3)

Now, here are in-depth considerations on the five trends indicated in Table 11.

Firstly, it has become apparent that it is the “young working population in their early 20s (aged 23 to 25)” that are shifting away from rice consumption while university students do not share the same tendency, as illustrated in Table 6. The details are supposedly related to the next paragraph (i.e. the second trend).

Secondly, regarding those who are “living alone or otherwise not with their parents,” they may be living alone because they are originally coming from far away from Tokyo, for instance. Such students may have part-time work and club activities in addition to studies at their universities, making it difficult for them to have well-balanced meals regularly. We suspect, as suggested in reference [26], that these people would not spend busy morning hours preparing breakfast to eat rice prepared at home, and they tend to opt for easier options for meals, such as ready-cooked food and bread for a quick breakfast.

Thirdly, regarding those who “eat less than three meals a day,” they tend not to eat rice prepared at home as a staple food, unlike people eating three meals a day (plus snacking) as shown in Fig. 13. More specifically, those who eat two meals a day mainly have bread as their staple food while those who only have one meal a day tend not to have specific staple food. Those who have three meals a day are likely to be aware of healthy diet and lifestyles [27], and perhaps eating rice prepared at home is part of their balanced diet.

Fourthly, the reason for having breakfast in the early morning between 5:00 and 6:00 may be associated with students with early-hour part-time jobs. Other factors may include that university students have irregular hours of daily activities and are not highly aware of leading healthy lifestyles. As for working young people, one of the possible factors may be that they have difficulties in managing time as they are no longer students [28].

Fifthly, regarding those who do not cook meals at home, this may be due to the fact that this study included many university students originally coming from remote regions, living in Tokyo by themselves, as illustrated in Fig. 6. These people are considered to opt for eating out or buying ready-cooked food rather than preparing their meals at home.

Finally, we examine the reasons for not eating rice (prepared at home). As shown in Fig. 11, the most frequent reasons for not eating rice were “heavy (on the stomach) or other physical problems,” “having no staple food,” “no rice cooker at home,” “concerned about carbohydrate in rice,” and “concerned about calories in rice.” As indicated in Fig. 3, many respondents were concerned about calories, carbohydrate, and other properties of rice, which can be possibly explained by the fact that approximately 80% of the respondents were female who are more aware of weight control and healthy diet. Furthermore, approximately 40% of the respondents lived by themselves, as shown in Fig. 5. This suggests that, living in a small apartment, they have a small kitchen, and perhaps many of them do not have rice cookers, using substitute utensil to cook rice [29].

To summarize all the above, through this analysis, we have identified the characteristics of those who do not eat “rice prepared at home” and the reasons for not eating rice. It is expected that this study and its findings will be valuable for considering the future measures to prevent the shift away from rice consumption and to narrow target consumer groups for these measures.

## VI. CONCLUSION

In Japan, there is a serious trend of shifting away from rice consumption. Although the national government is in pursuit of various measures, there is a remarkable decline in rice consumption among the young generations in particular. This study developed a unique questionnaire, analyzed the collected data, and revealed that people tend not to eat rice for breakfast while they do eat rice for lunch and dinner.

We used Cramer’s V to clarify the characteristics of those who do not eat rice as a staple food and the reasons for not eating rice by extracting respondents’ information and question items related to breakfast that are correlated with the questions about staple food (do or do not eat rice) and applying Correspondence Analysis to the six identified question items against the question about staple food. For some results that were difficult to interpret from the plot charts in Correspondence Analysis, we obtained the Euclidean distances between the plotted items and the questions about staple food and extracted the items with the shortest Euclidean distances for consideration.

In this study, the question items that correlate with the question about staple food were found to be age, gender, household type, breakfast time, number of meals a day, and meal types (cooked meal, bought meal, or eating out). By analyzing the correspondence with these six variables, we conclude that those who do not eat rice as a staple food are characterized to be “working young people in their early 20s

(aged 23 to 25),” those who are “living by themselves or otherwise not with their parents,” those who eat “fewer than two meals a day,” “take breakfast early in the morning,” and “do not cook meals at home.” Furthermore, we identified the main five reasons for tending not to eat rice, which are “heavy (on the stomach) or other physical problems,” “having no staple food,” “no rice cooker at home,” “concerned about carbohydrate in rice,” and “concerned about calories in rice.”

Future challenges include a further study with an extended scope of target population including male students and a wider spectrum of working population, considering that this study was largely depended on female university students. Also, if the trend of shifting away from rice consumption is happening, the causes and characteristics of those who are shifting away from rice consumption must be further revealed. The knowledge gained through this study also must contribute to the development of measures against the shift away from rice consumption.

## REFERENCES

- [1] “Why Rice Is Vanishing from Japanese Tables,” <http://www.nippon.com/ja/currents/d00046/>, Accessed on July 17, 2019. (English version: <https://www.nippon.com/en/currents/d00046/why-rice-is-vanishing-from-japanese-tables.html>)
- [2] “Reference Information Materials Concerning Rice,” Ministry of Agriculture, Forestry and Fisheries, [http://www.maff.go.jp/j/seisan/kikaku/kome\\_siryou.html](http://www.maff.go.jp/j/seisan/kikaku/kome_siryou.html), Accessed on July 17, 2019.
- [3] “Serious trend of ‘abandoning rice’ among the Japanese... consumption per head has more than halved in 50 years,” <http://news.livedoor.com/article/detail/11838944/>, Accessed on July 17, 2019.
- [4] “Family Income and Expenditure Survey,” Statistics Bureau, Ministry of Internal Affairs and Communications, <http://www.stat.go.jp/data/kakei/2.html>, Accessed on July 17, 2019. (English version: <http://www.stat.go.jp/english/data/kakei/index.html>)
- [5] Cramer, Harald, "Mathematical Methods of Statistics. Princeton", Princeton University Press, page 282(Chapter 21. The two-dimensional case), 1946.
- [6] Bergsma, Wicher, "A bias correction for Cramer's V and Tschuprow's T", *Journal of the Korean Statistical Society*, 42 (3), pp.323-328, 2013.
- [7] Akira Otsuki, "Dynamic Extraction of Key Paper from the Cluster Using Variance Values of Cited Literature", *International Journal of Data Mining & Knowledge Management Process (IJDKP)*, AIRCC, Vol. 3, No. 5, pp. 71-82, 2013.
- [8] Greenacre, Michael, "Correspondence Analysis in Practice, Second Edition. London", Chapman & Hall/CRC, 2007.
- [9] Sten-Erik Clausen (author), Kazuo Fujimoto (translator), “Applied Correspondence Analysis: An Introduction,” Ohmha, 2015.
- [10] Correspondence Analysis, <https://www.pref.miyagi.jp/uploaded/attachment/617759.pdf>, Accessed on July 17, 2019.
- [11] R and Correspondence Analysis, [https://www1.doshisha.ac.jp/~mjjin/R/Chap\\_26/26.html](https://www1.doshisha.ac.jp/~mjjin/R/Chap_26/26.html), Accessed on July 17, 2019.
- [12] United Nations Information Centre, [http://www.unic.or.jp/activities/economic\\_social\\_development/social\\_development/integration/youth/](http://www.unic.or.jp/activities/economic_social_development/social_development/integration/youth/), Accessed on July 17, 2019.
- [13] “Reference materials concerning youth employment,” Ministry of Health, Labour and Welfare, [http://www.mhlw.go.jp/file/05-Shingikai-12602000-Seisakutoukatsukan-Sanjikanshitsu\\_Roudouseisakutantou/0000058032.pdf](http://www.mhlw.go.jp/file/05-Shingikai-12602000-Seisakutoukatsukan-Sanjikanshitsu_Roudouseisakutantou/0000058032.pdf), Accessed on July 17, 2019.

- [14] "Situations concerning food in Japan and new basic plan," Ministry of Agriculture, Forestry and Fisheries, [http://www.maff.go.jp/j/keikaku/k\\_aratana/pdf/point12.pdf](http://www.maff.go.jp/j/keikaku/k_aratana/pdf/point12.pdf), Accessed on July 17, 2019.
- [15] Shuichi Watanabe, Toshiko Nakamura, Hitoko Endo, Emi Honma, Mitsuko Hiramatsu, Yumiko Matsuzawa, Chiemi Ogi, "Investigations on Taking of Rice by Women's Junior College Students," *The Journal of Tokai Women's Junior College* Vol. 13, pp. 27-34, 1987.
- [16] (Jun) Yamada's seminar, Faculty of Economics, University of Toyama, "Rice Strategies-for future growth," <https://slidesplayer.net/slide/11195014/>, Accessed on July 17, 2019.
- [17] Kazu Shirai, Yumi Nakatani, Shota Nagamura, Takuma Nishida, Yuto Hosokoshi, Minaho Yodo, "Why Japanese no longer eat rice? factor analysis on the declining rice consumption," [https://www.kwansei.ac.jp/s\\_economics/attached/0000108555.pdf](https://www.kwansei.ac.jp/s_economics/attached/0000108555.pdf), Accessed on July 17, 2019.
- [18] "The Japanese eating less rice is quite a problem," Naver website, <https://matome.naver.jp/odai/2147010950204116601>, Accessed on July 17, 2019.
- [19] "Serious problem with the young generations and decline of rice consumption: 20% of men in their 20s 'have not eaten rice for the last 1 month' (MAFF research)," <http://girlschannel.net/topics/700020/>, Accessed 2019, July 17.
- [20] "Eating less rice (accelerating decline of rice consumption among the Japanese)," *The Japan Agricultural News*, <https://www.ricepier.jp/%E3%81%8A%E7%B1%B3-%E9%9B%91%E7%A9%80%E8%BE%9E%E5%85%B8/%E3%81%8A%E7%B1%B3%E3%81%AE%E7%8F%BE%E7%8A%B6/>, Accessed on July 17, 2019.
- [21] "Survey on staple food," <https://goo.gl/forms/88ZuKAhde02Pr70s1>, Accessed on July 17, 2019.
- [22] "Eating out, eating home and in-between," <http://kinkiagri.or.jp/library/foods/gai-naka-shoku.htm>, Accessed on July 29, 2019.
- [23] "2014 Survey on mid-term trend of rice consumption as staple food and factor analysis report 'III. Web-based consumer survey,'" Ministry of Agriculture, Forestry and Fisheries, <http://www.maff.go.jp/j/seisan/kokumotu/pdf/3.pdf>, Accessed on July 17, 2019.
- [24] Asken.jp, <http://www.asken.jp/info/187>, Accessed on July 17, 2019.
- [25] Atsushi Mizumoto and Osamu Takeuchi, "Basics and Considerations for Reporting Effect Sizes in Research Papers," *Study in English Language Teaching* 31, pp. 57-66, 2008.
- [26] "The true reason for declining rice consumption," <http://news.livedoor.com/article/detail/14646858/>, Accessed on July 17, 2019.
- [27] "How to eat rice properly: three meals a day and still lose weight," <https://dime.jp/genre/397386/>, Accessed on July 17, 2019.
- [28] "A sharp increase of people who skip breakfast," <http://evememory.jp/breakfirst-460>, Accessed on July 17, 2019.
- [29] "[Kitchen Journalist Interview] No more rice cookers? 'Cooking rice in a saucepan' helps with kitchen design!," <https://tg-uchi.jp/topics/3165>, Accessed on July 17, 2019.

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