# Relationship between Meal Configuration and Food Groups/ Nutrition Intake in Adult Males Residing in Greater Tokyo

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## 1. Preface

In Japan, the mortality rate due to lifestyle-related diseases that stem from living habits such as an imbalanced diet and lack of exercise have remained at a high level. According to the "2016 Vital Statistics of Japan" survey conducted by the Ministry of Health, Labour and Welfare ("MHLW"), the top four causes of death were dominated by items with a strong connection to lifestyle-related diseases, those items being malignant neoplasm, heart diseases, pneumonia and cerebrovascular diseases. Facing such a situation, in its "Health Japan 21 (The Second Term)" the MHLW established targets such as "increase in consumption of vegetables and fruits" and "decrease in sodium chloride intake" in its aim to "increase the number of people whose diet reflects appropriate quantities and quality." In particular, it has been confirmed that the dietary habits of adult males tend to be imbalanced as seen in their foregoing breakfast and eating out with considerable frequency, as well as that the vegetable and fruit intake of adult males is low. Improving their dietary habits therefore constitutes a challenge. In making those improvements, one could conclude that it is important to verify the relationship that nutrition intake has with the manner of eating ("meal configuration") in the form of eating in meals prepared with ingredients at home and consuming home-meal replacements or eating out, of which bento lunch boxes and prepared foods are examples.

Given that, through this research, the causal relationship between meal configuration and nutrition intake in adult males was verified using the method of path analysis that assumes a causal and mutual relationship between multiple variables. Note that this research was recognized with the Academic Journal Award for 2020 by the Food System Research Association of Japan.

## 2. Data and Methods Used

For data, the results of an online questionnaire survey administered through "My Voice" in July 2017 was used. The survey, which targeted 1,500 males residing in Greater Tokyo between the ages of 20 and 64, was administered in groups of 150 individuals according to whether they lived single-person households or households with two or more members and according to their age group (in increments of ten years of age). Food intake and nutrition intake used in analysis were evaluated with the use of "Brief-Type Self-Administered Diet History Questionnaires" (BDHQ). For applicable foods and nutrients in this survey, using the nutrition and dietary habit target items in the aforementioned "Health Japan 21 (The Second Term)" by the MHLW that indicate specific foods and nutrients, namely "decrease in sodium chloride intake," "increase in consumption of vegetables and fruits" and "increase in registered corporations and restaurants that have initiatives to reduce the amount of sodium and fat in their foods," as a reference, vegetable intake (g/1,000kcal), fruit intake (g/1,000kcal), sodium chloride equivalents (g/1,000kcal) and fat energy ratio (%E) were chosen. For specific models, in addition to the effect of individual traits such as age, number of household members and income per capita ("income") on meal configuration, the effect that individual traits and meal configuration have on the aforementioned foods groups/ nutrition intake, which is the model indicated in Figure 1, was verified.

## 3. Results

For the purposes of this paper, results are only presented for the model targeting households with two or more members for reasons attributable to assigned space (See Table 1). The letters of the alphabet in Table 1 correspond to the letters shown in Figure 1. For example, in the vegetables and fruits model shown in the upper-left of the table, the value of "age→eating-in frequency" is given as 0.167. Because the correspondence in this case is positive,it indicates that the older one is, the more frequently they eat in. Conversely, the value of "age→home-meal replacement frequency" is given as -0.099. Because the correspondence in this case is negative, it indicates that the older one is, the less frequently they eat home-meal replacements. Additionally, the "*" mark indicates statistical significance. In particular, the following information can be taken from the table with respect to determinants of food groups and nutrition intake.

Firstly, with respect to vegetables, all arrows from age, income and eating-in frequency to vegetable intake are statistically significant with positive correspondence, indicating that the higher age, income and eating-in frequency are, the higher vegetable intake is. With respect to fruits, the arrows from age are positive and statically significant, suggesting that the higher one's age is, the greater tendency they have to frequently consume fruit. With respect to sodium chloride equivalents, arrows from eating-in frequency are statistically significant with negative correspondence. Relative to fat energy ratio, all arrows from income, eating-in frequency, home-meal replacement frequency and eating-out frequency are all are statistically significant with positive correspondence. One could conclude that the positive effect that eating-in, home-meal replacement and eating-out frequency all exert is possibly due to increased

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opportunities to forego meals creating greater imbalance in dietary habits, resulting in dietary habits that favor carbohydrates such as quick and easy bread, noodles and rice balls.

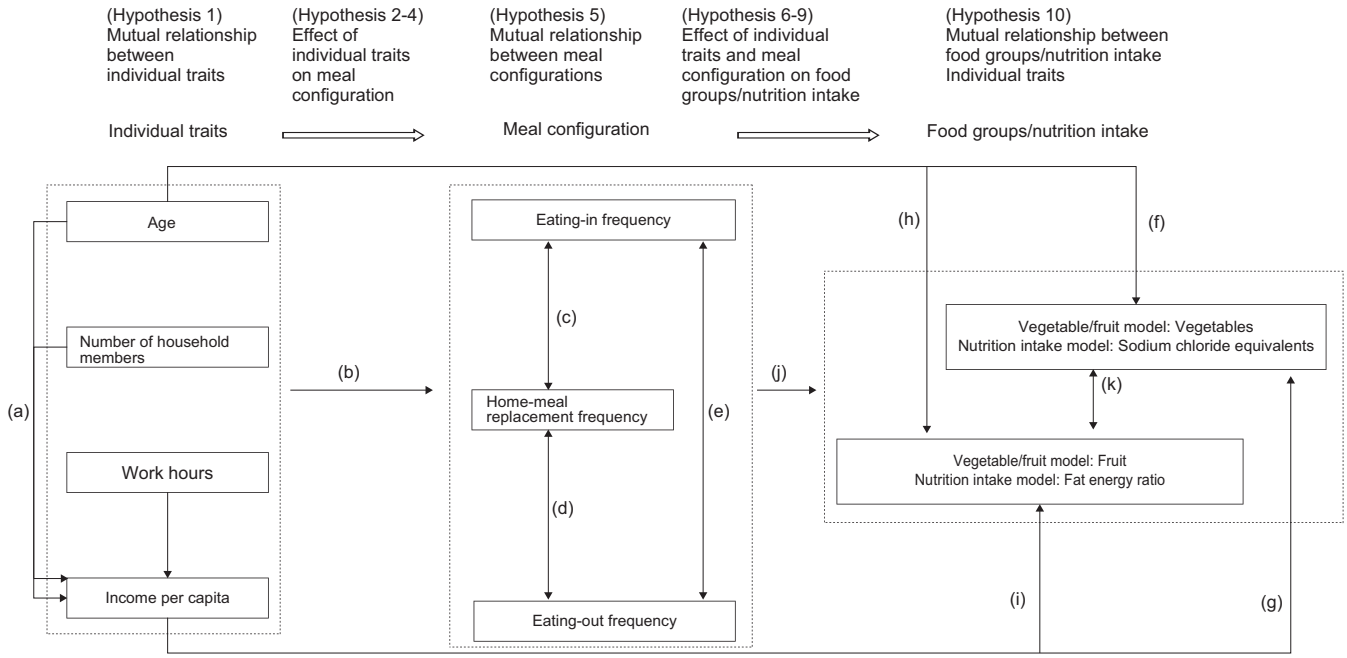


Figure 1. Outline Figure of Hypothetical Model for Determinants of Food Groups/Nutrition Intake

Note: Estimates have been made with vegetables and fruits as one model and sodium chloride equivalents and fat energy as one model.

## 4. Conclusions

As shown above, in this research, focus was placed on factors such as individual traits and meal configuration, and a verification of the effect of those factors on specific food groups and nutrition intake was performed. More specifically, implications in the below vein were successfully obtained.

Firstly, it was confirmed that individuals in the elderly age bracket tended to have greater vegetable and fruit intake. As observed above, younger individuals have limited vegetable and fruit intake, and as such are being called upon to improve their dietary habits. Income exerted a positive effect on vegetable intake and fat energy ratios and a negative effect on sodium chloride equivalents. That is to say, it is assumed that individuals in lower income brackets tend to have dietary habits that reflect limited vegetable intake and a high amount of sodium chloride equivalents, indicating a need for concrete improvements to their dietary habits. In terms of meal configuration, it was confirmed that the higher eating-in frequency is, the greater vegetable intake and the fewer sodium chloride equivalents tend to be. In particular, the eating-in of meals prepared at home leading to healthier dietary habits is a key point illustrated by the results of this research. According to analysis conducted with the use of input-output tables, for meals prepared at home, a considerable ratio of ingredients used are domestically produced in comparison to processed foods or meals eaten outside. An increase in eating-in frequency can therefore be said to be effective in terms of both nutrition and food security. To be specific, the effect of eating-in frequency and other meal configurations on nutrition intake as clarified based on estimates can be said to constitute a key contribution of this research.

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Table 1. Determinants of Food Groups/Nutrition Intake (Households with Two or More Members)

| | Food group/nutrient items | Vegetable/ fruit model | | Food group/nutrient items | Nutrition intake model |
|---|---|---|---|---|---|
| Mutual relationship between individual traits (Hypothesis 1) | | | | | |
| (a) | Age → Income | – | (a) | Age → Income | – |
| | Number of household members → Income | -0.338 ** | | Number of household members → Income | -0.332 ** |
| | Work hours → Income | 0.232 ** | | Work hours → Income | 0.229 ** |
| Effect of individual traits on meal configuration (Hypothesis 2-4) | | | | | |
| (b) | Age → Eating-in frequency | 0.167 ** | (b) | Age → Eating-in frequency | 0.161 ** |
| | Number of household members → Eating-in frequency | 0.026 | | Number of household members → Eating-in frequency | 0.024 |
| | Work hours → Eating-in frequency | -0.058 | | Work hours → Eating-in frequency | -0.057 |
| | Income → Eating-in frequency | -0.106 * | | Income → Eating-in frequency | -0.109 ** |
| | Age → Home-meal replacement frequency | -0.099 * | | Age → Home-meal replacement frequency | -0.098 * |
| | Number of household members → Home-meal replacement frequency | -0.102 * | | Number of household members → Home-meal replacement frequency | -0.107 * |
| | Work hours → Home-meal replacement frequency | 0.061 | | Work hours → Home-meal replacement frequency | 0.064 |
| | Income → Home-meal replace ment frequency | -0.006 | | Income → Home-meal replacement frequency | -0.021 |
| | Age → Eating-out frequency | – | | Age → Eating-out frequency | – |
| | Number of household members → Eating-out frequency | 0.030 | | Number of household members → Eating-out frequency | 0.033 |
| | Work hours → Eating-out frequency | 0.124 ** | | Work hours → Eating-out frequency | 0.123 ** |
| | Income → Eating-out frequency | 0.186 ** | | Income → Eating-out frequency | 0.184 ** |
| Mutual relationship between meal configurations (Hypothesis 5) | | | | | |
| (c) | Eating-in frequency ⇔ Home-meal replacement frequency | -0.143 ** | (c) | Eating-in frequency ⇔ Home-meal replacement frequency | -0.173 ** |
| (d) | Eating-in frequency ⇔ Eating-out frequency | -0.133 ** | (d) | Eating-in frequency ⇔ Eating-out frequency | -0.136 ** |
| (e) | Home-meal replacement frequency ⇔ Eating-out frequency | 0.126 ** | (e) | Home-meal replacement frequency ⇔ Eating-out frequency | 0.128 ** |
| Effect of individual traits and meal configuration on food groups/nutrition intake (Hypothesis 6-9) | | | | | |
| (f) | Age → Vegetable | 0.114 ** | (f) | Age → Sodium chloride equivalents | -0.002 |
| (g) | Income → Vegetable | 0.109 ** | (g) | Income → Sodium chloride equivalents | -0.058 |
| (j) | Eating-in frequency → Vegetable | 0.206 ** | (j) | Eating-in frequency → Sodium chloride equivalents | -0.117 ** |
| | Home-meal replacement frequency → Vegetable | – | | Home-meal replacement frequency → Sodium chloride equivalents | – |
| | Eating-out frequency → Vegetable | – | | Eating-out frequency → Sodium chloride equivalents | – |
| (h) | Age → Fruit | 0.093 * | (h) | Age → Fat energy ratio | -0.026 |
| (i) | Income → Fruit | 0.047 | (i) | Income → Fat energy ratio | 0.023 ** |
| (j) | Eating-in frequency → Fruit | – | (j) | Eating-in frequency → Fat energy ratio | 0.035 ** |
| | Home-meal replacement frequency → Fruit | – | | Home-meal replacement frequency → Fat energy ratio | 0.070 ** |
| | Eating-out frequency → Fruit | – | | Eating-out frequency → Fat energy ratio | 0.052 ** |
| Mutual relationship between food groups/nutrition intake (Hypothesis 10) | | | | | |
| (k) | Vegetable intake ⇔ Fruit intake | 0.303 ** | (k) | Sodium chloride equivalents ⇔ Fat energy ratio | 0.521 ** |
| Degree of conformance | | | Degree of conformance | | |
| | GFI | 0.996 | | GFI | 1.000 |
| | AGFI | 0.982 | | AGFI | 1.000 |
| | CFI | 1.000 | | CFI | 1.000 |
| | SRMR | 0.016 | | SRMR | 0.008 |
| | RMSEA | 0.000 | | RMSEA | 0.000 |
| Sample size | | 671 | Sample size | | 671 |

Note: All denote standardized coefficients. "→" and "⇔" indicate a single-sided and double-sided arrow, respectively. "**" and "*" indicate statical significance at a level of 1% and 5%, respectively. " ― " indicates a path that was deleted due to not being statically significant. Letters of the alphabet are linked to the paths in Figure 1.

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