Effect of lifestyle and stress on health food use among students in a registered dietitian training program

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健康食品の使用に及ぼす生活習慣およびストレスの影響について,管理栄養士養成課程の3年次生(159名)を対象として横断調査を行った。健康食品に対してもつ個人的な認知(本研究ではイメージと呼称する)についても検討した。本研究は,自記式アンケートにより,対象者の属性,健康食品(健康増進を目的としたすべての食品およびサプリメント)の使用経験,生活習慣,ストレス状況,健康食品に対するイメージ(19項目)を調査した。健康食品の使用とさまざまな要因との関連は,χ²検定,ウィルコクソン順位和検定により解析した。健康食品の使用に及ぼす生活習慣とストレスの影響は,ロジスティック回帰分析により解析した。

対象者のうち前月からの定期的な健康食品使用者は18.9%であった。最も使用の多い健康食品は,マルチビタミンとビタミンB群であった。対象者が健康食品に対してもっとイメージで最も多かったのは,「栄養素の補給」であった。イメージのうち,健康食品の使用者と非使用者との違いは「効果が疑わしい」であり,これは非使用者が多く回答した。健康食品の使用は,飲酒とストレスの増加に伴い増加した。健康食品の使用の増大は,管理栄養士としての健康食品の推奨に影響を与える可能性がある。将来,管理栄養士になった場合には,個的な経験に基づいて健康食品に関する情報を提供すべきではない。管理栄養士は医療に関する専門家として,客観的な証拠と患者のニーズに基づいた意思決定を行うように教育されるべきである。健康食品に関する大学教育と継続した生涯教育の充実が期待される。
1. INTRODUCTION

In recent years, health promotion efforts have shifted from merely emphasizing a longer lifespan to include an emphasis on improving quality of life. This trend has extended to the practice of “self-medication” to prevent or cure disease, using health food and dietary supplements. These changes have contributed to a growing market for these products. In Japan, sales of health food have risen to an estimated 1.247.5 billion yen (2018)\(^6\).

The sale of health food in Japan is regulated by the Ministry of Health, Labor, and Welfare (MHLW). According to the Japanese system, the ‘Food with Health Claims’ category (Table 1) has three subcategories: ‘Food for Specified Health Use (FOSHU)’, which are foods containing functional ingredients officially confirmed to exhibit physiological effects on the human body; ‘Food with Nutrient Function Claims (FNFC)’, which are labeled with claims of nutrient function specified by the MHLW; and the most recently formed group, ‘Food with Function Claims (FFC)’, which can be labeled under responsibility of the food business operator, with the claims of function based on scientific evidence. Despite the elaborate approval system, there is no legal definition of “health food” in Japan. Therefore, it is not easy for ordinary people to distinguish one type of health food from another.

The number of people using health foods (including dietary supplements) increases with age\(^7\). Middle-aged and older adults, who have a healthy and desirable lifestyle with healthy eating habits, take supplements\(^8\); however, health food use is also seen in young adults. Over 63\% of students and staff members at an Australian university were found to use dietary supplements\(^9\). Lieberman et al., reporting on the use of dietary supplements in American college students, found that 66\% used dietary supplements. However, among young people, those who have a good lifestyle do not consume health foods, including dietary supplements. For example, it was reported that those who smoked and consumed alcohol used more dietary supplements\(^10\). In this manner, there were differences in lifestyle and health food use among different generations. Furthermore, it was reported that those who exercised to reduce their stress levels were likely to consume multivitamins and minerals\(^11\). The relationship between stress and eating habits has also been indicated to cause inappropriate eating habits\(^12\). However, the relationship between stress and health food intake has not been fully elucidated\(^13\).

More than half the patients with access to prescription coverage through their health insurance were taking both medicine and health food products at the same time\(^14\). Although health food and medicine can interact in ways that are contraindicated, individuals do not always inform their doctor when self-medicating with health food\(^15\). One study found that participants believed that health food always provided health benefits, even if they were taking medicine\(^16\). In such a situation, it is important for health care providers, including registered dietitians (RDs), to provide appropriate information about health foods.

Wiltgren et al.\(^17\) reported that a significantly high number of clients received information about dietary supplements from health care professionals. Yet another study showed that 97\% of dietitians recommended the use of supplements to clients/patients\(^18\). In particular, RDs using health foods are more likely to recommend health foods to their clients\(^19\).

Another survey of pharmacy, dentistry, and medicine students found that more knowledgeable pharmacy students provided recommendations according to the target population. They expected that the independent predictor was previous personal use; for this reason, it was speculated that in compensating for health food knowledge, students were likely rely on their personal experience\(^20\). Although this study was conducted with pharmacy students, similar trends may occur in student dietitians who learn about health foods.

In this study, we focused on the actual situation of health food use among students enrolled in an RD training program, who were going to be RDs and thus, providers of health information. In particular, lifestyle habits and stress were investigated as factors that could influence the use of health foods. In addition, although it has been shown that the image of food may influence eating behavior\(^21\), there are few studies on the image of health food\(^22\). Therefore, we investigated the image of health foods held by the respondents. We use the word “image” to refer to personal and subjective perception, as used by Boulding in his book “The Image: Knowledge in Life and Society”\(^23\). This study reports on a survey about the patterns of health food use and its image, as well as some aspects of health food education, among students enrolled in a Registered Dietitian Training Program.

2. METHODS

Definition of health foods: In the United States and Europe, products labeled as dietary supplements are widely available in capsule and tablet form. In their research based in Europe and the United States, Chiba et al. used the category of ‘dietary supplements’ because the
Effect of lifestyle and stress on health food use among students in a registered dietitian training program

term was commonly used there\(^{35}\). However, in Japan, dietary supplements are subject to several different laws and are not distinguished from many other health food products that are widely available (Table 1). Furthermore, the Japanese commonly refer to health-enhancing foods as health foods even when they have not been officially certified as such. Several regulatory systems have existed for over 30 years in Japan\(^{36}\). Thus, in the present study, these supplements have been included in the general category of health food, and our survey used only the term “health food” to address all the food products that contribute to maintaining and promoting health, and are labeled as health foods in Japan. The FFC category was not included in this study because it had not yet been introduced at the time of the survey.

**Procedure and respondents:** The survey was conducted over two years. A self-administered questionnaire was distributed to 75 third-year student RDs in November 2011 and to 88 third-year student RDs in November 2012. Surveys from four female students (2011) were incomplete, so the number of valid responses totaled 159 (22 men, 137 women), providing a valid response rate of 98%. There were no differences in lifestyle between the two groups (\(\chi^2\) test). At the time of the survey, the subjects’ ages were 20 \(\bar{n} = 34, 21.4\%\), 21 \(\bar{n} = 119, 74.8\%\), 22 \(\bar{n} = 4, 2.5\%\), and 23 \(\bar{n} = 2, 1.3\%\).

**Research approach:** The survey interviewed respondents on the following: 1) gender, age, housing situation, and current state of health; 2) use of health food (past and current use, type of health food); 3) lifestyle habits, including breakfast, snacking, skipping meals, sleep, exercise, and stress level; and 4) images of health food (yes/no to 19 images of health food). The questions on lifestyle were prepared in terms of nutrition, exercise, and rest, which are the three major factors for maintaining health both physically and mentally. The specific items were settled with reference to the National Health and Nutrition Survey from 2009 to 2011 (Ministry of Health, Labor and Welfare, Japan). The images of health foods were based on the report by Kawai et al.\(^{22}\). These images

| Type of food | Health food | All other food |
|--------------|-------------|---------------|
| Considered to have health claims according to regulatory system | Food with Health Claims (FHC) | So-called “Health food” (according to unregulated claims that may therefore be unsupported) | Regular food |
| Type of Health Claim | Foods for Specified Health Uses (FOSHU) \(^*\) | Foods with Nutrient Function Claims | Food with function claims | No official health claims allowed |
| Type of Regulatory Review | Prior external review required by Consumer Affairs Agency, Ministry of Health, Labor, and Welfare | No external review required | No external review required | No review conducted, therefore no labeling with claims allowed |
| Types of Review System | ·Individual product approval review system conducted by the Consumer Affairs Agency (most involved review process)  
·Demonstrated reduction of disease risk (somewhat involved review process)  
·Qualified Approval (for cases with limited but convincing evidence)  
·Products with clear evidence (review process is standardized and simplified—just needs to comply with standards) | ·Notification system —Manufacturer notifies the Consumer Affairs Agency of research conducted and intent to label. Consumer Affairs Agency then checks claims.  
·Self-certification system | Terms like “health food” not allowed in labeling | None |

\(^*\) Foods for Specified Health Uses (FOSHU) is also a category under the program Food for Special Dietary Uses (FOSDU). In both cases, a preliminary review is required by the Consumer Affairs Agency before the product can be labeled and sold as a FOSDU/FOSHU.
were taken from a preliminary open-ended survey of third-year RD students (7 males and 85 females) from Josai University in 2011. We did not analyze the influence of smoking because none of the subjects in our survey smoked (to enter Josai University, they were required to declare that they would not smoke).

**Statistical Analysis:** All data were analyzed using IBM SPSS Statistics for Windows, version 21.0 (IBM Corp., Armonk, N.Y., USA). For each lifestyle habit and stress, the answers were scored from 1 to 3, depending on the frequency of increase. These scores were used as independent variables for logistic regression analysis. In the regression analysis, dummy variables were used for independent variables for logistic regression analysis. In the regression analysis, lifestyle habits (breakfast, snacking, exercise, restfulness of sleep, alcohol consumption) and stress were treated as independent variables, and health food use was the dependent variable. Sex was considered a confounding factor. Previous studies have suggested differences in lifestyles between sexes. When interpreting the results, a significant difference of \( p < 0.05 \) was used.

**Ethical considerations:** The surveys were administered in a class setting, but it was made clear that participation was voluntary. The purpose of the investigation was explained at the time of administration, as was the protection of personal information. As students had the option to not complete and return the survey, a completed survey implied consent to participate in the study. This research complied with the code of ethics of the World Medical Association (Declaration of Helsinki) and was conducted with the approval of the Josai University Life Science Ethical Review Board (approval number H21-7).

### 3. RESULTS

**Health food use:** Table 2 summarizes the respondents’ use of health food, revealing that 18.9% of all respondents had regularly used health food over the last month or more (current user), and 30.2% of respondents had reported regular use for a month or more sometime in the past (past user). However, just over half, 50.9%, had never used health foods (never user). Table 3 shows the types of health foods used by current users (multiple answers). The multi-vitamin and vitamin B groups were the most popular (9 users each) among the health foods. This was followed by collagen, iron (5 users each), soy isoflavon, black vinegar/flavored vinegar (4 users each).

**Housing situation and subjective health status:** Table 4 summarizes the respondents’ housing situations and subjective health status. Here, 59.1% of respondents, i.e., 14 current users, and 80 non-users (i.e., past users plus those who were never users) out of the 157 valid respondents lived at home with family, while 38.2% of valid respondents (a total of 15 current users and 45 non-users) lived alone. Regarding their health status, 37.7% of all respondents (a total of 15 users and 45 non-users) experienced health symptoms. There was no association between health food use and housing situation or health status.

**Association between health food use and image of health foods:** The relationship between health food use and the image of health food held by the respondents is shown in Table 5. In general, respondents did not show a strong tendency for positive images. However, they did not have strong negative images of health foods either. There was no significant relationship between health food use and a positive image of health food; however, there

| Table 2 | Health food using (n = 159) |
|---------|-----------------------------|
| Question | Response | Number (%) |
| Current use * | 30 | (18.9) |
| Health food using | Past use ** | 48 (30.2) |
| | Never use | 81 (50.9) |

* Respondents have been using health foods regularly for at least a month.
** Though respondents are not using health food regularly now, they have used health food for at least one month in the past.

| Table 3 | Types of health food used (Multiple answer) |
|---------|--------------------------------------------|
| Types of health food | n* |
| Multi Vitamin | 9 |
| Vitamin B group | 9 |
| Iron | 5 |
| Collagen | 5 |
| Isoflavon | 4 |
| Black Vinegar/Flavored vineger | 4 |
| Turmeric | 3 |
| Calcium | 3 |
| Green vegetable juice | 3 |
| DHA/EPA | 3 |
| Amino acid | 3 |
| Blueberry extract | 2 |
| Garlic extract | 2 |
| Magnesium | 2 |
| Hyaluronic acid | 1 |
| Protein | 1 |
| Coenzyme | 1 |

* Only current users answered (n = 30).
Effect of lifestyle and stress on health food use among students in a registered dietitian training program

Table 4  Relationship between use of health food and respondents’ housing and health characteristics (n = 159)

| Question | Item                  | Current User (30) | Non-User* (129) | p value |
|----------|-----------------------|-------------------|-----------------|---------|
|          | n (%)                 | n (%)             |                 |         |
| Housing  | With family           | 14 (46.7)         | 80 (63.0)       |         |
| Situation| In an apartment       | 15 (50.0)         | 45 (35.4)       | 0.273   |
|          | Dormitory             | 1 (3.3)           | 1 (0.8)         |         |
|          | Others                | 0 (0.0)           | 1 (0.8)         |         |
|          | No answer             | 0 —               | 2 —             |         |
| Health   | Some health problems  | 15 (50.0)         | 45 (34.9)       | 0.124   |
| Status   | No health problem     | 15 (50.0)         | 84 (65.1)       |         |

* Non-user is the sum of past users and never users.

was a significant correlation between health food use and the negative image of ‘efficacy is doubtful’ (p = 0.004). Non-users had a more ‘efficacy is doubtful’ image than current users.

Association between health food use and lifestyle habits: The relationship between health food use, lifestyle habits, and stress is shown in Table 6. Health food use was significantly correlated with alcohol consumption (p = 0.037) and stress levels at score 3 (p = 0.003). No significant association was found between health food use and other lifestyle habits, such as breakfast, snacking, skipping meals, exercise, amount of sleep, and restfulness of sleep.

Regression analysis of lifestyle habits affecting health food use: Logistic regression analysis was applied to ascertain the influence of lifestyle habits and stress on the current use of health foods. The results are presented in Table 7. The significance of the model was confirmed by the log of the likelihood ratio (χ² = 22.55; df = 10; p = 0.013). The goodness of fit of the model was determined using the Hosmer-Lemeshow test (χ² = 6.132; df = 8; p = 0.632). Among the lifestyle habits, skipping meals and amount of sleep were eliminated because these items had strong correlations with breakfast (correlation coefficient = -0.651, p < 0.001) and restfulness of sleep (correlation coefficient = 0.312, p < 0.001) by Spearman correlation, respectively. Alcohol consumption (odds ratio = 3.715) and stress level at score 3 (odds ratio = 8.181) were significantly positively correlated with the use of health food.

The influence of alcohol consumption and stress on health food use was calculated using the results of logistic regression analysis and applying the numerical value of the log odds (logit) to the relative risk (RR) formula. The odds showed the impact of the effects of alcohol consumption and stress, taking into account the effects of each factor used in the regression analysis. In contrast, the RR can describe the influence of each factor more explicitly. RR can be calculated with the ratio of the highest score (3) to the lowest score (1) for each target factor (alcohol consumption and stress level). Using this calculation, the influence of alcohol consumption and stress levels could be determined. Based on the results of the logistic regression analysis (Table 7), the RR for alcohol consumption and stress was calculated. For the RR computation of alcohol consumption, the lowest score (1) and highest score (3) were used. At the same time, stress that correlated significantly in the logistic regression analysis, the highest value (score 3, dummy 1 in the regression analysis) was included in the RR computation. The respondents most frequently answered with “High stress (score 3”).

logit = -7.276 + 1.312 × (alcohol consumption: score 1) + 2.102 × (stress: dummy 1) = -3.862

\[
\frac{P}{1-P} = e^{-3.862} = 0.0210
\]

\[
P_1 = 0.0206
\]

logit = -7.276 + 1.312 × (alcohol consumption: score 3) + 2.102 × (stress: dummy 1) = -1.238

\[
\frac{P}{1-P} = e^{-1.238} = 0.2900
\]

\[
P_3 = 0.2248
\]

\[
RR = \frac{P_3}{P_1} = 0.2248 \div 0.0206 = 10.91
\]

Where P is the rate of health food use; P₁ is the rate of health food use when alcohol consumption was “less than 1 time/week or no drinking” (score 1); and P₃ is the rate of health food use when alcohol consumption was “more

(7) 7
Table 5  Relationship between images of health food and use of health food \((n=159)\)

| Do these images regarding health foods apply to you? | Current User (30) | Non-User * (129) | \(p\) value ** |
|-----------------------------------------------------|-------------------|-----------------|----------------|
|                                                     | \(n\)             | \(n\)           |                |
|                                                     | (%)               | (%)             |                |
| Positive                                            |                   |                 |                |
| Supplies nutrients                                   | Yes               | 18 (60.0)       | 68 (52.7)      | 0.471          |
|                                                     | No                | 12 (40.0)       | 61 (47.3)      |                |
| Good for health                                     | Yes               | 14 (46.7)       | 53 (41.1)      | 0.577          |
|                                                     | No                | 16 (53.3)       | 76 (58.9)      |                |
| A variety of types                                  | Yes               | 15 (50.0)       | 52 (40.3)      | 0.333          |
|                                                     | No                | 15 (50.0)       | 77 (59.7)      |                |
| For beauty treatment                                | Yes               | 14 (46.7)       | 39 (30.2)      | 0.085          |
|                                                     | No                | 16 (53.3)       | 90 (69.8)      |                |
| Helps reduce weight                                 | Yes               | 9 (30.0)        | 31 (24.0)      | 0.497          |
|                                                     | No                | 21 (70.0)       | 98 (76.0)      |                |
| Be healthy                                          | Yes               | 8 (26.7)        | 18 (14.0)      | 0.090          |
|                                                     | No                | 22 (73.3)       | 111 (86.0)     |                |
| Prevents disease                                    | Yes               | 7 (23.3)        | 15 (11.6)      | 0.094          |
|                                                     | No                | 23 (76.7)       | 114 (88.4)     |                |
| Easy to buy                                         | Yes               | 2 (6.7)         | 14 (10.9)      | 0.384          |
|                                                     | No                | 28 (93.3)       | 115 (89.1)     |                |
| Be active                                           | Yes               | 1 (3.3)         | 15 (11.6)      | 0.152          |
|                                                     | No                | 29 (96.7)       | 114 (88.4)     |                |
| Safe                                                | Yes               | 0 (0.0)         | 2 (1.6)        | 0.657          |
|                                                     | No                | 30 (100.0)      | 127 (98.4)     |                |
| Negative                                            |                   |                 |                |
| Effectiveness is unknown                            | Yes               | 12 (40.0)       | 36 (27.9)      | 0.194          |
|                                                     | No                | 18 (60.0)       | 93 (72.1)      |                |
| Expensive                                           | Yes               | 9 (30.0)        | 40 (31.0)      | 0.914          |
|                                                     | No                | 21 (70.0)       | 89 (69.0)      |                |
| Efficacy is doubtful                                | Yes               | 2 (6.7)         | 39 (30.2)      | 0.004          |
|                                                     | No                | 28 (93.3)       | 90 (69.8)      |                |
| Scary                                               | Yes               | 2 (6.7)         | 23 (17.8)      | 0.103          |
|                                                     | No                | 28 (93.3)       | 106 (82.2)     |                |
| Unnecessary                                         | Yes               | 0 (0.0)         | 5 (3.9)        | 0.346          |
|                                                     | No                | 30 (100.0)      | 124 (96.1)     |                |
| Tastes bad                                          | Yes               | 0 (0.0)         | 3 (2.3)        | 0.532          |
|                                                     | No                | 30 (100.0)      | 126 (97.7)     |                |
| Others                                              |                   |                 |                |
| Mail order/Internet                                 | Yes               | 5 (16.7)        | 27 (20.9)      | 0.405          |
|                                                     | No                | 25 (83.3)       | 102 (79.1)     |                |
| Pharmacy/drug store                                 | Yes               | 2 (6.7)         | 9 (7.0)        | 0.656          |
|                                                     | No                | 28 (93.3)       | 120 (93.0)     |                |
| TV Commercial/promotion                             | Yes               | 5 (16.7)        | 30 (23.3)      | 0.433          |
|                                                     | No                | 25 (83.3)       | 99 (76.7)      |                |

* Non-user is the sum of past users and never users.

** \(\chi^2\) test analysis applied for comparing current user and non user.
than 5 days/week (score 3). The results revealed that the risk of health food use increased by 10.91 times when the highest score of alcohol consumption was compared with the lowest.

The RR for the highest stress level (score 3, dummy 1) was calculated using the same formula, using the mean value (1.25) of alcohol consumption. The results revealed that the risk of health food use increased by 7.98 times when the highest stress level score was compared with the lowest.

4. DISCUSSION

In Japan, the term "health food" is widely recognized as referring to food that contributes in a broad sense to the

Table 6 Relationship among lifestyle habits, stress and use of health food (n = 159)

| Item                 | Score | Current User (30) | Non-User * (129) | p-value ** |
|----------------------|-------|-------------------|------------------|------------|
|                      | n (%) | n (%)             |                  |            |
| Breakfast            |       |                   |                  |            |
| Eat everyday         | 3     | 21 (70.0)         | 85 (66.4)        |            |
| Skip 2-5 times / week| 2     | 3 (10.0)          | 22 (17.2)        | 0.854      |
| Skip more than 6 times / week | 1   | 6 (20.0)          | 21 (16.4)        |            |
| No answer            | 0     | —                 | 1 —              |            |
| Snacking             |       |                   |                  |            |
| 2 times or more / day| 3     | 4 (13.3)          | 21 (16.4)        |            |
| 2 - 7 times / week   | 2     | 21 (70.0)         | 91 (71.1)        | 0.511      |
| Less than 2 times / week or no snacking | 1 | 5 (16.7)          | 16 (12.5)        |            |
| No answer            | 0     | —                 | 1 —              |            |
| Skipping meals       |       |                   |                  |            |
| Skip 1 or more / day | 3     | 4 (13.3)          | 20 (15.6)        |            |
| Skip 2 - 6 times / week | 2   | 6 (20.0)          | 34 (26.6)        | 0.413      |
| Less than 2 times / week or no skipping | 1 | 20 (66.7)         | 74 (57.8)        |            |
| No answer            | 0     | —                 | 1 —              |            |
| Alcohol Consumption  |       |                   |                  |            |
| More than 5 days / week | 3   | 2 (6.7)           | 0 (0.0)          |            |
| 1 - 4 days / week    | 2     | 9 (30.0)          | 25 (20.0)        | 0.037      |
| Less than 1 time / week or no drinking | 1 | 19 (63.3)         | 100 (80.0)       |            |
| No answer            | 0     | —                 | 1 —              |            |
| Restfulness of Sleep |       |                   |                  |            |
| Well rested          | 3     | 4 (13.3)          | 12 (9.6)         |            |
| Fairly rested        | 2     | 13 (43.3)         | 71 (56.8)        | 0.547      |
| Seldom or never rested | 1   | 13 (43.3)         | 42 (33.6)        |            |
| No answer            | 0     | —                 | 4 —              |            |
| Amount of Sleep      |       |                   |                  |            |
| More than 7 hours    | 3     | 5 (16.7)          | 11 (8.8)         |            |
| 5 to 7 hours         | 2     | 15 (50.0)         | 92 (73.6)        | 0.411      |
| Less than 5 hours    | 1     | 10 (33.3)         | 22 (17.6)        |            |
| No answer            | 0     | —                 | 4 —              |            |
| Exercise †           |       |                   |                  |            |
| Yes                  | 2     | 6 (20.0)          | 21 (16.4)        | 0.639      |
| No                   | 1     | 24 (80.0)         | 107 (83.6)       |            |
| No answer            | 0     | —                 | 1 —              |            |
| Stress Level         |       |                   |                  |            |
| High stress          | 3     | 17 (56.7)         | 34 (27.2)        |            |
| Medium stress        | 2     | 10 (33.3)         | 61 (48.8)        | 0.003      |
| Low or no stress     | 1     | 3 (10.0)          | 30 (24.0)        |            |
| No answer            | 0     | —                 | 4 —              |            |

* Non-user is the sum of past users and never users.
** χ² or Wilcoxon test analysis applied for comparing current user and non user.
† More than 2 times / week and more than 30 minutes / time.
§ All the items count with a score of 1 to 3 or 1 to 2.
maintenance and/or improvement of health. For this reason, this study considered “health food” to be not just officially-certified ‘Foods with Health Claims’, but also so-called health food (unofficial) products that have not undergone the necessary efficacy testing or certification process.

The use of current and past health food together were reported by 49.1% of the respondents in this survey. It was lower than that found in the general adult population (over 40 years)\(^5\). However, the current users (18.9%) did not show significantly different results from the Japanese college students (16.8%)\(^5\). In contrast, the use of dietary supplements was lower in the present study than in one on American college students (66%)\(^9\). The subjects in the American study reported taking certain dietary supplements such as protein and amino acids, whereas our subjects seldom used these supplements.

The health foods used by the subjects were mainly multivitamins and vitamin B groups, which were similar to the results of previous studies\(^3,9,30\). Iron and calcium intake were consistent with previous reports\(^9\). Isoflavone is widely known to act as a female hormone, and collagen is a substance that prevails as an anti-aging agent for the skin. Therefore, the reason for their use in this study could be due to the large number of female respondents. Turmeric and green juices, which are widely distributed in Japan, were also found in this study. However, the number of protein and amino acid users was lower. This is because most of the respondents were not very involved in athletics.

A previous study of adults found that the motivation for using health food was to improve and maintain health\(^2,31\); however, our study found, as in other reports\(^3,31\), that the purpose of using health foods was to maintain health and

| Independent variable | Regression coefficient | Standard error | Odds ratio (95%CI) | p-value |
|----------------------|------------------------|----------------|-------------------|---------|
| Breakfast\(^1\)      | 0.160                  | 0.304          | 1.174 (0.646-2.131) | 0.599   |
| Alcohol Consumption\(^1\) | 1.312                | 0.472          | 3.715 (1.474-9.361) | 0.005   |
| Exercise\(^1\)       | 0.318                  | 0.599          | 1.374 (0.424-4.447) | 0.596   |
| Snacking\(^1\)       | Less than 2 times/week or no snacking | Reference |                 |         |
| 2 - 7 times / week   | 0.541                  | 0.689          | 1.718 (0.445-6.629) | 0.432   |
| 2 times or more / day| 0.205                  | 0.859          | 1.228 (0.228-6.612) | 0.811   |
| Restfulness of Sleep\(^1\) | Seldom or never rested | Reference |                 |         |
| Fairly rested        | 0.333                  | 0.489          | 0.716 (0.275-1.867) | 0.495   |
| Well rested          | 0.513                  | 0.776          | 1.671 (0.365-7.640) | 0.508   |
| Low or no stress     | Reference               |                 |                   |         |
| Medium stress        | 0.531                  | 0.747          | 1.700 (0.394-7.346) | 0.477   |
| High stress          | 2.102                  | 0.756          | 8.181 (1.858-36.019) | 0.006   |
| Stress Level\(^1\)  | Low or no stress        | Reference       |                   |         |
| Medium stress        | 0.531                  | 0.747          | 1.700 (0.394-7.346) | 0.477   |
| High stress          | 2.102                  | 0.756          | 8.181 (1.858-36.019) | 0.006   |
| Sex\(^*\)            | 1.034                  | 0.826          | 2.813 (0.557-14.302) | 0.211   |
| Constant             | -7.276                 | 2.323          | 0.002             |         |

The use of health food is as dependent variable for logistic regression analysis.

* Confounding variable.
\(^1\) The score of each life habits, which is used as independent variable, are shown in Table 6.
\(^*\) Dummy variable was used for items its linearity could not be confirmed.
for nutrient supplementation (data was not shown). It is possible that because the university students in our study were healthy (as is generally true of young adults), they did not focus on using health food for disease prevention. Although there was no significance regarding health food use, we found that 37.7% of the total respondents had health issues (Fig.4). In most cases, one respondent had more than one symptom. The most common specific symptoms were headache (7 respondents) and dizziness (7 respondents). The next most common symptoms were constipation (5 respondents) and anemia (3 respondents).

In another study, Sugiyama et al. surveyed students at a Japanese women’s college and found that respondents who reported subjective health issues were more likely to use health foods. In contrast, we found no relationship between subjective symptoms and health food use. This difference was probably due to differences in the timing of the study. The reason for this was that health food had become more popular from the days of the Sugiyama survey, which had been implemented more than 10 years ago. In other words, the respondents used health foods more casually for nutritional supplementation and other purposes, despite having had no subjective symptoms.

This study focused on the image of health food held by respondents. Boulding described, “—as each event occurs, however, it alters my knowledge structure or my image. And as it alters my image, I behave accordingly.” He mentioned that the image could be expressed like knowledge and that behavior depended on the image. Regarding the relationship between image and food intake, a survey of nursery school children revealed that their guardians reported increased intake of dairy products in children, with the positive image of guardians. We hypothesized that for a student dietitian, positive images of health food may lead to more health food use.

We have reported that general consumers tend to have a positive image, when compared to the image of medical professionals (pharmacists, registered dietitians, and midwives). However, the tendency of general consumers to use health food was less than that of medical professionals. As we did not analyze the relationship between health food use and images using statistical methods, it remains unclear.

In this study, the most common image of the respondents was nutrient supplementation. This result is consistent with that of our previous study. This may explain why respondents were studying nutrition. Although they would have probably preferred to consume the necessary nutrients in their normal diet, they could understand the need to make up for any shortcomings by using health food. In contrast, less than half of the respondents answered with a negative image. They did not have strong negative health food images.

There was some agreement with other positive images. In addition, there was less agreement on the negative images. This is because health foods are popular in the marketplace, and the respondents in the present study would have access to them. Therefore, they would tend not to have a strongly negative image. The only difference between the current users and non-users was the negative image of ‘efficacy is doubtful’, which was higher in non-users than in current users. It was thought that even if respondents held some positive images, they might not use health food if they thought efficacy was doubtful.

The aim of this study was to clarify the relationship between lifestyle, stress, and health food use. It has been reported that young adults who use health foods tend to have habits such as smoking, alcohol consumption, high physical activity, and prescription medication use. Our results also indicated that alcohol consumption increased the rate of health food use. It was also indicated that stress also increased health food use. There was no correlation between alcohol consumption and stress, and both influenced health food use independently.

Papier et al. previously reported that college students who felt stress were likely to have worse dietary behaviors. Although we did not investigate the relationship between health food use and the pattern of food selection, it could be speculated that the respondents with poor dietary habits, including alcohol consumption, in our study used health foods to compensate for nutrient shortages. It could also be considered that individuals used health food as an anti-stress substance. These results suggest that people might use health foods to complement unhealthy behaviors in their daily activities. The results of this study suggest that lifestyle habits and stress may influence the use of health foods. Increased use of health foods through their experience might lead to the provision and recommendation of knowledge to clients.

In the future, the respondents of this survey will have become RDs, and may provide information on health foods to clients. In this case, it should not be recommended to clients based on personal experience. As healthcare professionals, RD students should be educated to make decisions based on objective evidence and clients’ needs. For this reason, an RD training program should provide the highest-quality, evidence-based health food curriculum. In the United States, alternative and complementary medicines were introduced into the RD educational curriculum.
in 1997. This curriculum change has influenced the knowledge base and attitudes of RDs, and broadened their approach to treatment, which now allows them to recommend the use of supplements.

Continuing education about supplements for RDs, as well as increased personal experience, has been found to contribute to positive attitudes toward supplements and other health foods. Marx et al. reported this finding in Australian RDs and suggested the need for continuing education for RDs\(^\text{10}\). To implement RD specialty training, a broader training curriculum is required, and for practicing RDs, improved continuing education (by the Dietetic Association and other appropriate organizations) is also required.

In the context of rapidly changing modern life, it is likely that the size of the health food market will expand, and the need for health food will also increase. Health food use may provide mental health benefits through a placebo effect. Health food use must be well-informed, and requires extensive knowledge. Nowadays, RDs are expected to inquire about clients’ use of health food and to disseminate relevant health food information. From now on, it will be necessary to enhance education related to health foods in dietitian education and to provide continuing education. In the future, as specialists in nutrition and food science, RDs should be available for consultation at hospitals, pharmacies, and other facilities.

This study had the following limitations. First, the respondents were students following an RD training program and were thus more knowledgeable about health food than students in other faculties. This knowledge may have affected their attitudes toward and images of health food. Second, the images were not fully explored in this survey. Future studies should include a wider range of images of health foods. Third, because respondents declared that they would not smoke to enroll at Josai University, we did not include the influence of smoking. Further studies including these aspects are required.

In conclusion, the trend towards the increasing use of health foods by older and young adults is likely to continue. In our study, alcohol consumption and stress were associated with increased health food use; therefore, a deeper understanding of lifestyle habits and appropriate use of health foods is needed. Furthermore, the images held by the respondents in our study were both positive and negative. As future providers of health information, student dietitians should maintain neutral images of health food. Similarly, RDs should provide accurate and impartial information on health foods to the general population. For this reason, university programs and continuing education need to include instructions on the use of health foods.

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