**KJCN**
Korean Journal of Community Nutrition

# Research Article

# Eating habits and dietary supplement utilization according to food-related lifestyle among Korean adults: a cross-sectional study

**EunJung Lee[1]**, **Jin A Jang[2]**, **Ji-Myung Kim[3],[4],†**

[1]Professor, Food and Nutrition Major, School of Wellness Industry Convergence, Hankyong National University, Anseong, Korea
[2]Professor, Wellness Food Therapy Department, Ansan University, Ansan, Korea
[3]Professor, Department of Food and Nutritional Science, Shinhan University, Uijeongbu, Korea
[4]Professor, Smart Care Food Major, Shinhan University, Uijeongbu, Korea

**†Corresponding author:**
**Ji-Myung Kim**
Department of Food and Nutritional Science, Shinhan University, Hoam-ro 95, Uijeongbu 11644, Korea
Tel: +82-31-870-3515
Fax: +82-31-870-3509
Email: kjm@shinhan.ac.kr

**Objectives:** This study investigated the association between eating habits and the utilization of dietary supplements (DSs) according to food-related lifestyle (FRL) among Korean adults.

**Methods:** This study included a total of 300 participants (150 men and 150 women) in their 20s to 60s living in Seoul and Gyeonggi Province. We identified two groups by factor and cluster analysis: an 'active pursuit' group and a 'passive pursuit' group. Differences in eating habits and DS utilization between the two groups were analyzed by chi-square test and t-test. Logistic regression analysis was used to analyze the effect of variables on DS consumption according to FRL.

**Results:** There were significant differences between the two groups in terms of age, alcohol drinking frequency, total dietary score, change in DS consumption after coronavirus disease 2019, and current DS consumption ($P < 0.05$). The proportion who perceived many health benefits of DSs was higher in the 'active pursuit' group than in the 'passive pursuit' group ($P = 0.003$). The most commonly consumed type of DSs was multivitamins & minerals for the 'active pursuit' group, and omega-3 fatty acids for the 'passive pursuit' group. The 'an active pursuit' group consumed DSs 2.93 times more (95% confidence interval [CI]: 1.44–5.97) compared to the 'passive pursuit' group, after adjusting for confounders. In the 'active pursuit' group, the health pursuit (odds ratio [OR] = 6.54, 95% CI: 1.44–29.61) and rational consumption pursuit factors (OR = 0.26, 95% CI: 0.08–0.83) were associated with DS consumption, whereas only the health pursuit factor had a significant association (OR = 5.37, 95% CI: 2.08–13.88) within the 'passive pursuit' group. However, total dietary score and DSs consumption did not show a relationship.

**Conclusions:** By understanding the consumption characteristics of DSs according to FRL, this can serve as basic data necessary for promoting health through the utilization of DSs and healthy behaviors.

**Keywords:** adults; dietary supplements; lifestyle factors

## INTRODUCTION

Dietary supplements (DSs) contain one or more dietary compounds, such as vitamins, minerals, amino acids, or other substances, which are intended to provide nutritional or physiological effects [1]. The use of DSs is steadily increasing worldwide, with approximately 50%–75% of the population worldwide taking DSs regularly and nearly half of the population in the US taking them regularly [2]. The sales of DSs increased significantly worldwide in the aftermath of the coronavirus disease 2019 (COVID-19) pandemic. At the beginning of the pandemic, sales of some DSs showed three-digit growth rates in Poland [3]. Recent reports suggested that the Korean market for DSs would exceed $4.52 billion by 2022 [4]. Depending on their age, sex, and physical condition, consumers use DSs for various reasons, including immune support, health promotion, and therapeutic purposes [5].

Social and economic changes are changing our lifestyles, which affect our diets. Improved living standards, women's advancements in society, increased numbers of single-person households, and COVID-19 have greatly impacted dietary lifestyles. Food-related lifestyles (FRLs) reflect consumers' values and consciousness, and their unique characteristics are reflected in their eating habits [2,6]. The FRL is an important marketing tool for companies, which classifies consumer groups with similar dietary needs through market segmentation [7]. Previous studies on FRL include selection attributes of home meal replacements (HMR) according to FRL in single-person households [8], beef consumption behavior among Korean women [9], agri-food consumer competency, and organic food purchase intentions [10]. The selection attributes of HMR by FRLs clustered into three groups in factor and cluster analysis: "utilitarians" (19.3%), "health-conscious utilitarians" (22.2%), and "variety-seeking" (58.5%) [8]. A study on beef consumption behavior among Korean women, according to FRL, classified FRL into three groups: health, safety, quality, trend, and convenience. The health safety pursuit group had the highest score for most information [9]. In the Agri-food Consumer Competency Index, exploratory consumers had the highest score, followed by safety-seeking and passive consumers [10]. DS users

also exhibit distinct health habits and characteristics. DS users generally engage in healthier behaviors, such as regular exercise, balanced diets, and avoiding smoking and excessive alcohol consumption [11]. These individuals often have higher health awareness and are more proactive in managing their well-being. Research on FRL patterns has mainly been conducted on HMR selection attributes, beef consumption patterns, agricultural food consumer capabilities, and organic food purchases. However, there has been little research on DS consumption according to FRL patterns. We hypothesized that health-pursuit consumers will change their eating behaviors and DS usage based on their FRL.

Proper eating habits form the basis of balanced nutritional intake and are a major factor in determining an individual's health status. Irregular eating habits not only disrupt physical health but also affect psychological conditions and emotional stability [12]. As dietary choices and nutrient intake are commonly influenced by income, people with lower incomes are more likely to have lower-quality and less nutrient-dense diets [11,13]. People using DSs are characterized by health-related habits, including better dietary patterns, higher physical activity, maintenance of normal body weight, and tobacco avoidance [14]. Based on these findings, people who consume DSs appear to try to maintain good eating habits and are interested in their health.

However, despite the ever-growing market for DSs, research on the characteristics of consumers who purchase DSs is lacking, and research on the relationship between DSs and eating habits according to FRL is rare. Therefore, this study aimed to investigate the relationship between eating habits according to the FRL and the use of DSs among Korean adults.

## METHODS

### Ethics statement

The informed written consent was obtained from each participant. The study protocol was approved by the Institutional Review Board of Shinhan University (approval number: SHIRB-202305-HR-184-02).

### 1. Study design and participants
Survey participants in their 20s to 60s were recruited

from the Seoul and Gyeonggi-do regions. The questionnaire used in this study was developed through discussions with an expert group comprising three nutrition specialist based on relevant literature [10,11,15]. The main survey was conducted between June 8 and June 12, 2023, via convenience sampling. A self-administered questionnaire was used for the survey. The research participants were selected through a professional survey company in Korea (Macromill Embrain Co.), and an online survey was conducted. The purpose of the study and the research method were explained to the participants through a pre-information page before the survey, and written consent was obtained before survey initiation. The written consent form included information on the purpose of the study, participants, data collection methods, confidentiality of participants' information, and exclusion of participants from the study at any time during the survey if they wanted to opt out. Only participants who understood the purpose of the study and agreed to provide information were allowed to respond to the survey. A total of 300 responses were collected from the online survey, all of which were included in the final analyses.

## 2. Data collection and survey

A questionnaire was constructed to evaluate the use of DSs based on the results of related previous studies and preliminary surveys. In June 2023, a preliminary survey was conducted on participants ranging from their 20s to 60s, totaling 67 individuals. Following this, the survey questionnaire was extensively modified and supplemented, including allowing multiple responses, revising response options, and enhancing descriptions to ensure clarity and comprehensiveness. Changes in DSs consumption after COVID-19, current consumption status, reasons for taking DSs, place of purchase of DSs, how to get DS information, type of DSs consumed, and health effects after DS consumption were investigated. Multiple responses were allowed regarding DSs currently being consumed. In addition, satisfaction and perception of the health benefits of DSs were investigated using a five-point Likert scale (1: not at all, 5: very much).

Total dietary scores were assessed using the 20 indicators of eating habits, including "have three meals a day", "rarely eat processed food", "do not eat salty foods",

and "eat fruits > 2 times per day", etc. [15]. Questions on dietary habits were based on a five-point Likert scale (1: not at all, 5: very much). Regarding questions on dietary habits, higher scores (total dietary scores on a 100-point scale) indicated better dietary habits.

To understand the FRL of the survey participants, as described previously [10,11], the food-related life items involved the pursuit of health (six questions), convenience (four questions), gastronomy (seven questions), and rational consumption (three questions). The questionnaire consisted of 20 questions. Each item was measured using a five-point Likert scale (1: not at all, 5: very much).

## 3. Statistical analysis

SAS version 9.4 (SAS Institute Inc.) was used to perform all statistical analyses. The analyzed results are presented as means ± standard deviation or numbers (%). The combination of factor analysis and cluster analysis for FRL is an integrated approach to customer segmentation, which is useful for developing targeted marketing strategies for DS usage. To factorize the FRL of the survey participants, an exploratory factor analysis was conducted using a principal component analysis. In the factor analysis, a factor loading cut-off point of 0.50 was used for retaining items, and factors with an eigenvalue equal to or greater than 1 were retained. In the principal component factor analysis and varimax rotation used for factor analysis, the factor extraction criterion comprised 17 final items out of 20 total items. A total of four factors were extracted, which involved the patterns of 'gastronomy pursuit' (six questions), 'health pursuit' (six questions), 'convenience pursuit' (three questions), and 'rational consumption pursuit' (two questions) according to the characteristics of the composed questions. A reliability analysis, using Cronbach's alpha, was used to test the reliability and internal consistency of each food-related factor. A Cronbach's alpha coefficient value above 0.5 was considered minimum [16]. K-means cluster analysis, a type of non-hierarchical cluster analysis, was conducted using the factor scores of the four factors extracted through factor analysis. Classification into two clusters, the differences in FRL factors and dietary scores for each cluster were determined using a two-tailed independent sample t-test. A chi-square test was

conducted on the demographic information, current DSs consumption, and health behavior of each group to identify their characteristics. To analyze the factors associated with DSs consumption according to FRL group, odds ratios (ORs) and 95% confidence intervals (CIs) were calculated using logistic regression analysis. Logistic regression was employed to evaluate the impact of being in the 'active pursuit' group compared to the 'passive pursuit' group, which served as the reference group, on DS consumption. Additionally, logistic regression was used to assess the influence of continuous variable scores related to FRL on DS consumption. To analyze the association between total dietary score and DS consumption, age, sex, and alcohol drinking frequency were included as these confounding variables. Theses confounding variables were chosen based on significant differences observed between groups in terms of age and alcohol consumption frequency, as well as physiological differences such as sex. When analyzing the associations of FRL factors and groups with DS consumption, the total dietary score was added to the above confounding variables. Statistical significance was set at $P < 0.05$.

## RESULTS

### 1. Factor analysis and clustering according to the FRL group

The results of the factor and reliability analyses to classify the clusters according to the FRL of the participants in this study are presented in Table 1. The reliability analysis of the measurement concept demonstrated Cronbach's α values of 0.840 for 'gastronomy pursuit', 0.810 for 'health pursuit', 0.794 for 'convenience pursuit', and 0.551 for 'rational consumption pursuit'. The 'gastronomy pursuit' pattern attributed more importance to taste than price when choosing food and preferred tableware or kitchen utensils. Participants in this group also liked to go to new restaurants, cafés, and good restaurants, and post them on social network service online communities. The 'health pursuit' pattern involved an interest in health, such as awareness of food intake and healthy food for nutrition, health, and weight management; checking food additives and the country of origin when purchasing food; and purchasing organic food. The attributes of the 'convenience pursuit' pattern included eating instant food when busy, enjoying fast food, and frequently purchasing ready-to-eat food. The attributes of 'rational consumption' pattern included reducing the time spent preparing meals, purchasing discount products when purchasing food, and comparing price and quality when purchasing products.

K-means cluster analysis, a type of non-hierarchical cluster analysis, was conducted using the factor scores of the four factors extracted through factor analysis. All participants were classified into two groups, and the differences in FRL factors in each group were examined (Table 2). All clusters showed significant differences ($P < 0.001$). Group 1, named the 'active pursuit' group, exhibited high levels of all four FRL factor patterns, including gastronomy, health, convenience, and rational consumption pursuits. In group 2, all four FRL factor patterns—gastronomy, health, convenience, and rational consumption pursuits—were low, and the group was named the 'passive pursuit' group.

### 2. Demographic characteristics of FRL groups

Table 3 shows the demographic characteristics of the study participants according to the FRL group. The average age of the 'active pursuit' group (41.99 ± 13.19) was significantly lower than that of the 'passive pursuit' group (46.25 ± 14.00) ($P = 0.007$). There were no significant differences in other sociodemographic indicators between the two groups.

### 3. Health-related behaviors according to FRL

Table 4 shows health-related behavior status according to FRL pattern. There was a significant difference in alcohol drinking frequency according to FRL, with a lower proportion of "rarely" responses in the 'active pursuit' group (36.62%) compared to the 'passive pursuit' group (47.47%) ($P = 0.009$). The total dietary score was significantly higher in the 'active pursuit' group (62.63 ± 9.62) than in the 'passive pursuit' group (60.32 ± 10.32) ($P = 0.047$). Examination of the changes in DSs intake after COVID-19 revealed that 46.48% of the participants in the 'active pursuit' group reported an increased intake, compared to 25.32% in the 'passive pursuit' group ($P < 0.001$).

The DS consumption rate in the 'active pursuit' group

**Table 1.** Results of factor analysis for FRL

| Variable | Gastronomy pursuit | Health pursuit | Convenience pursuit | Rational consumption pursuit |
|---|---|---|---|---|
| I do not mind spending money on food | 0.519 | | | |
| I like going to restaurants that have been introduced on TV or food blogs | 0.766 | | | |
| I like going to new restaurants and cafes | 0.846 | | | |
| I like to post pictures taken at fancy restaurants or cafes on social media or other online communities | 0.773 | | | |
| I prefer a restaurant with a nice view or a nice interior | 0.816 | | | |
| I like tableware and kitchen utensils with pretty shapes and colors | 0.657 | | | |
| I tend to eat food considering nutrition and health | | 0.566 | | |
| I am very interested in health, so I tend to eat health supplements and natural foods | | 0.598 | | |
| Low (no) pesticides I tend to buy and eat antibiotic-free, organic foods | | 0.824 | | |
| When purchasing food, I check ingredients such as food additives | | 0.834 | | |
| I tend to check the country of origin when purchasing food | | 0.780 | | |
| I tend to make a list before buying groceries | | 0.545 | | |
| I like to eat fast food like hamburgers and sandwiches | | | 0.786 | |
| When I am busy, I often eat instant food meals | | | 0.796 | |
| I often buy ready-to-eat food from supermarkets, online stores, and department stores | | | 0.786 | |
| When shopping for groceries, I tend to buy discounted products first | | | | 0.773 |
| I shop around and compare different stores or products before buying | | | | 0.545 |
| Cronbach's α | 0.840 | 0.810 | 0.794 | 0.551 |
| Eigen value | 3.511 | 3.440 | 2.273 | 1.679 |
| Variance (%) | 21.14 | 18.23 | 8.74 | 6.40 |
| Accumulated variance (%) | 21.14 | 39.37 | 48.11 | 54.51 |

Factor loadings are only displayed for values ≤ −0.50 or ≥ 0.50.
FRL, food-related lifestyle.

(90.14%) was significantly higher than that in the 'passive pursuit' group (77.22%) ($P = 0.003$).

## 4. Types of DS consumption

Table 5 shows the proportion of the top 5 DSs consumed according to FRL. An 'active pursuit' group's DS consumption ranked first in multivitamin & minerals (MVM) (17.46%), followed by omega-3 fatty acid (16.46%), probiotics (13.22%), vitamin C (12.22%), and vitamin A & lutein (6.98%) appeared in that order, and their cumulative ratio accounted for 66.33%. On the other hand, the top DS consumption in the 'passive pursuit' group is omega-3 fatty acid (16.08%), followed by MVM (15.79%), probiotics (14.33%), vitamin C (11.11%), and vitamin D (7.89%) appeared in that order, and their cumulative ratio accounted for 65.20%. The list of major DSs consumed was different according to FRL.

Table 6 shows the characteristics of DS utilization according to FRL. There was a difference in the perceived health benefit of DSs according to the FRL, with the percentage of respondents answering "much" regarding the perceived benefit of DSs in the 'active pursuit' group (57.81%) being significantly higher than the 'passive pursuit' group (45.90%) ($P = 0.003$).

## 5. Factors associated with DS consumption according to FRL

Table 7 shows the relationships between the factors associated with DS consumption according to FRL. Compared with the 'passive pursuit' group, the 'active

**Table 2.** Result of cluster analysis for FRL

| Variable | Active pursuit (n = 142) | Passive pursuit (n = 158) | P-value[1] |
|---|---|---|---|
| Gastronomy pursuit | 3.01 ± 0.81 | 2.74 ± 0.74 | 0.003 |
| Health pursuit | 3.39 ± 0.58 | 2.78 ± 0.72 | < 0.001 |
| Convenience pursuit | 3.42 ± 0.67 | 2.59 ± 0.76 | < 0.001 |
| Rational consumption pursuit | 3.82 ± 0.65 | 3.28 ± 0.65 | < 0.001 |

Mean ± SD.
FRL, food-related lifestyle.
[1]The P-values were estimated using t-test.

**Table 3.** Sociodemographic characteristics of the participants according to FRL

| Variable | Active pursuit (n = 142) | Passive pursuit (n = 158) | P-value[1] |
|---|---|---|---|
| Age (year) | 41.99 ± 13.19 | 46.25 ± 14.00 | 0.007 |
| Sex | | | 1.000 |
| Male | 71 (50.00) | 79 (50.00) | |
| Female | 71 (50.00) | 79 (50.00) | |
| Education | | | 0.839 |
| High school | 25 (17.61) | 32 (20.25) | |
| College | 99 (69.72) | 106 (67.09) | |
| Graduated school | 18 (12.68) | 20 (12.66) | |
| Household income (ten thousand won) | | | 0.736 |
| < 200 | 11 (7.75) | 13 (8.23) | |
| 200–400 | 37 (26.06) | 50 (31.65) | |
| 400–600 | 48 (33.80) | 49 (31.01) | |
| ≥ 600 | 46 (32.39) | 46 (29.11) | |
| Occupation | | | 0.344 |
| Student | 12 (8.45) | 9 (5.70) | |
| Worker | 106 (74.65) | 111 (70.25) | |
| Housewife | 15 (10.56) | 27 (17.09) | |
| Non-worker | 9 (6.34) | 11 (6.96) | |
| Marital status | | | 0.083 |
| Married | 74 (52.11) | 98 (62.03) | |
| Single | 68 (47.89) | 60 (37.97) | |
| Family type | | | 0.456 |
| 1-person household | 19 (13.38) | 26 (16.46) | |
| Multi-person household | 123 (86.62) | 132 (83.54) | |

Mean ± SD or n (%).
FRL, food-related lifestyle.
[1]The P-values were estimated using the t-test or $\chi^2$ test.

pursuit' group demonstrated a 2.70-fold higher possibility of DS consumption (Model 1: 95% CI 1.39–5.25) and a 2.93-fold higher possibility after adjusting for confounding variables (Model 2: 95% CI 1.44–5.97). In the total subjects, among the four FRL factors, only the 'health pursuit' factor consistently demonstrated a significant relationship with DS consumption before and after adjusting for confounding variables (Model 1:

OR 2.96, 95% CI 1.90–4.62, $P < 0.001$; Model 2: OR 5.91, 95% CI 2.96–11.78, $P < 0.001$). As for FRL factors related to DS consumption, when adjusted for confounding variables, the 'health pursuit' factor (Model 2: OR 6.54, 95% CI 1.44–29.61) and the 'rational consumption pursuit' factor (Model 2: OR 0.26, 95% CI 0.08–0.83) were shown to be associated in the 'active pursuit' group ($P < 0.05$, respectively). On the other hand, in the 'passive

**Table 4.** Health-related behaviors according to FRL

| Variable | Active pursuit (n = 142) | Passive pursuit (n = 158) | *P*-value[1] |
|---|---|---|---|
| Subjective health status | | | 0.338 |
|   Poor | 39 (27.46) | 47 (29.75) | |
|   Moderate | 69 (48.59) | 84 (53.16) | |
|   Good | 34 (23.94) | 27 (17.09) | |
| Stress level | | | 0.079 |
|   Low | 23 (16.20) | 41 (25.95) | |
|   Moderate | 57 (40.14) | 63 (39.87) | |
|   High | 62 (43.66) | 54 (34.18) | |
| Sleep quality | | | 0.904 |
|   Poor | 34 (23.94) | 37 (23.42) | |
|   Moderate | 54 (38.03) | 64 (40.51) | |
|   Good | 54 (38.03) | 57 (36.08) | |
| Alcohol drinking frequency | | | 0.009 |
|   Rarely | 52 (36.62) | 75 (47.47) | |
|   1–3 times/month | 39 (27.46) | 36 (22.78) | |
|   1–2 times/week | 38 (26.76) | 26 (16.46) | |
|   3–4 times/week | 5 (3.52) | 17 (10.76) | |
|   ≥ 5–6 times/week | 8 (5.63) | 4 (2.53) | |
| Smoking status | | | 0.082 |
|   Present smoker | 21 (14.79) | 39 (24.68) | |
|   Past smoker | 31 (21.83) | 35 (22.15) | |
|   Never | 90 (63.38) | 84 (53.16) | |
| Total dietary score | 62.63 ± 9.62 | 60.32±10.32 | 0.047 |
| Change in DSs consumption after COVID-19 | | | < 0.001 |
|   Decrease | 5 (3.52) | 7 (4.43) | |
|   No change | 71 (50.00) | 111 (70.25) | |
|   Increase | 66 (46.48) | 40 (25.32) | |
| Current DSs consumption (%) | 128 (90.14) | 122 (77.22) | 0.003 |

n (%) or Mean ± SD.
FRL, food-related lifestyle; DSs, dietary supplements; COVID-19, coronavirus disease 2019.
[1]The *P*-values were estimated using the t-test or $\chi^2$.

**Table 5.** Top 5 DSs consumed according to FRL in the participants consuming DSs[1]

| Rank | Active pursuit | | Passive pursuit | |
|---|---|---|---|---|
| | DSs | Consumption rate | DSs | Consumption rate |
| 1 | Multivitamin & mineral | 70 (17.46) | Omega-3 | 55 (16.08) |
| 2 | Omega-3 | 66 (16.46) | Multivitamin & mineral | 54 (15.79) |
| 3 | Probiotics | 53 (13.22) | Probiotics | 49 (14.33) |
| 4 | Vitamin C | 49 (12.22) | Vitamin C | 38 (11.11) |
| 5 | Vitamin A & lutein | 28 (6.98) | Vitamin D | 27 (7.89) |
| | Cumulative value | 266 (66.33) | Cumulative value | 223 (65.20) |
| | Total | 401 (100) | Total | 342 (100) |

n (%).
DSs, dietary supplements; FRL, food-related lifestyle.
[1]Multi-responses.

**Table 6.** DSs utilization characteristics according to FRL in the participants consuming DSs (n = 250)

| Variable | Active pursuit (n = 128) | Passive pursuit (n = 122) | $P$-value[1] |
|---|---|---|---|
| Reason for using DSs | | | 0.546 |
| To strengthen the immune system | 61 (47.66) | 58 (47.54) | |
| Due to lack of nutrients | 19 (14.84) | 16 (13.11) | |
| For disease prevention | 17 (13.28) | 25 (20.49) | |
| To recover from fatigue | 22 (17.19) | 17 (13.93) | |
| To increase strength and muscle mass | 8 (6.25) | 4 (3.28) | |
| For cosmetic effect | 1 (0.78) | 2 (1.64) | |
| Place of purchase of DSs | | | 0.466 |
| Department store and supermarket | 9 (7.03) | 7 (5.74) | |
| Pharmacy | 15 (11.72) | 17 (13.93) | |
| Online site | 104 (81.25) | 96 (78.69) | |
| Others | 0 (0.00) | 2 (1.64) | |
| Method of information of DSs | | | 0.863 |
| People around me | 42 (32.81) | 37 (30.33) | |
| TV and radio | 10 (7.81) | 13 (10.66) | |
| SNS (e.g., Instagram, Facebook, etc.) | 24 (18.75) | 25 (20.49) | |
| Internet information | 51 (39.84) | 45 (36.89) | |
| Others | 1 (0.78) | 2 (1.64) | |
| Health effect after DS consumption | | | 0.137 |
| Increase immunity | 31 (24.22) | 22 (18.03) | |
| Weight control | 6 (4.69) | 2 (1.64) | |
| Intestinal health | 8 (6.25) | 12 (9.84) | |
| Fatigue recovery | 37 (28.91) | 27 (22.13) | |
| Others | 4 (3.13) | 9 (7.38) | |
| No effect | 42 (32.81) | 50 (40.98) | |
| Satisfaction of DSs | | | 0.307 |
| Little | 7 (5.47) | 12 (9.84) | |
| Moderately | 54 (42.19) | 55 (45.08) | |
| Much | 67 (52.34) | 55 (45.08) | |
| Perceived health benefit of DSs | | | 0.003 |
| Little | 1 (0.78) | 12 (9.84) | |
| Moderately | 53 (41.41) | 54 (44.26) | |
| Much | 74 (57.81) | 56 (45.90) | |

n (%).
DSs, dietary supplements; FRL, food-related lifestyle; SNS, social network service.
[1]The $P$-values were estimated estimated using $\chi^2$.

pursuit' group, only the 'health pursuit' factor (Model 2: OR 5.37, 95% CI 2.08–13.88) showed a significant association when adjusted for confounding variables ($P$ < 0.001). Total dietary score showed a relationship with DS consumption in the a 'passive pursuit' group (Model 1: OR 1.04, 95% CI 1.00–1.08, $P$ < 0.05), but there was no significant relationship after adjusting for confounding variables.

## DISCUSSION

This study investigated eating habits and DS utilization according to FRL. The results of this study showed that the 'active pursuit' group was more likely to consume DSs than the 'passive pursuit' group. Particularly after the outbreak of COVID-19, there was an increase in DS consumption within the 'active pursuit' group, with MVM being the primary supplements taken. Among the

**Table 7.** ORs for DSs consumption according to FRL

| Variable | Total (n = 300) | Active pursuit (n = 142) | Passive pursuit (n = 158) |
|---|---|---|---|
| DSs consumption | | | |
|   Model 1[1] | - | 2.70 (1.39–5.25)[4]** | 1.00 (ref.) |
|   Model 2[2] | - | 2.93 (1.44–5.97)** | 1.00 (ref.) |
| FRL factor | | | |
|   Gastronomy pursuit | | | |
|     Model 1[1] | 1.04 (0.70–1.53) | 0.69 (0.34–1.39) | 1.09 (0.66–1.81) |
|     Model 2[2] | 0.99 (0.66–1.48) | 0.70 (0.34–1.46) | 0.94 (0.54–1.63) |
|   Health pursuit | | | |
|     Model 1[1] | 2.96 (1.90–4.62)*** | 1.68 (0.66–4.32) | 3.13 (1.75–5.60)*** |
|     Model 2[2] | 5.91 (2.96–11.78)*** | 6.54 (1.44–29.61)* | 5.37 (2.08–13.88)*** |
|   Convenience pursuit | | | |
|     Model 1[1] | 0.91 (0.63–1.31) | 1.40 (0.61–3.24) | 0.44 (0.26–0.75)** |
|     Model 2[2] | 0.99 (0.64–1.53) | 1.10 (0.44–2.73) | 0.52 (0.27–1.01) |
|   Rational consumption pursuit | | | |
|     Model 1[1] | 0.82 (0.53–1.26) | 0.27 (0.10–0.75)* | 0.74 (0.41–1.34) |
|     Model 2[2] | 0.73 (0.45–1.18) | 0.26 (0.08–0.83)* | 0.60 (0.31–1.15) |
| Total dietary score | | | |
|   Model 1[1] | 1.02 (0.99–1.05) | 0.96 (0.90–1.01) | 1.04 (1.00–1.08)* |
|   Model 2[3] | 1.02 (0.98–1.05) | 0.96 (0.90–1.02) | 1.03 (0.98–1.08) |

Mean with 95% confidence intervals.
OR, odds ratio; DSs, dietary supplements; FRL, food-related lifestyle.
[1]Model 1: crude.
[2]Model 2: adjusted for age, sex, alcohol drinking frequency and total dietary score.
[3]Model 2: adjusted for age, sex, and alcohol drinking frequency.
[4]*$P < 0.05$, **$P < 0.01$, ***$P < 0.001$.

FRL factors, the health pursuit factor emerged as a factor influencing DS consumption.

The widespread use of DSs in adults may result from an individual's positive expectation that such product use will lead to better health outcomes. Among 21,603 adult MVM users and non-users in the 2012 National Health and Nutrition Examination Survey (NHANES), Paranjpe et al. [17] observed that MVM users self-reported 30% better overall health than non-users despite no clinically assessed differences in health. MVM users inherently had a more positive outlook on personal health regardless of their MVM use. Bailey et al.'s [18] study, including 11,956 adults in the 2007–2010 NHANES and Austin et al.'s [19] study of 5,536 Coast Guard and military personnel also found that MVM users were significantly more likely to self-report their overall health as excellent or good. Kim & Lee [20] also reported significantly higher beliefs that DSs provide health benefits or alleviate menopausal symptoms among DS consumers than among non-consumers

in a population of 745 middle-aged women in South Korea. Indeed, DSs with nutrients can benefit some at-risk groups when meeting nutrient needs from the diet alone is difficult, owing to increased requirements, dietary restrictions, or intolerance [21]. In this study as well, the 'active pursuit' group, which had higher DSs consumption, perceived the health benefits of DS to be greater compared to the 'passive pursuit' group.

DSs use is often associated with the adoption of other healthy habits that are generally encouraged as part of a healthier lifestyle [11]. The consumption of DSs in adults is associated with health-related characteristics such as low body mass index, moderate alcohol consumption, non-smoking, abstinence, private health insurance, and higher education [18,20], and in this study, it was also found to be related to the alcohol consumption. People using DSs can be characterized by theirs health-related habits, including better dietary patterns, higher physical activity, maintenance of normal body weight, and tobacco avoidance [8]. Sicinska et al. [22]

reported that DS use was associated with healthier food patterns based on higher consumption of vegetables, fruits, whole grains, pulses, fish, seafood, and lower intakes of unprocessed and processed meat, offal, cakes, and alcoholic beverages [23], as well as higher diet quality scores; i.e., the Mediterranean Diet Score [24,25], and the Healthy Eating Index [26]. Consistent with previous studies, in the present study, the total dietary score as well as DS consumption were significantly higher in the 'active pursuit' group than in the 'passive pursuit' group. However, after adjusting for age, gender, and alcohol consumption frequency, there was no association between total dietary score and DS consumption, suggesting that further research is needed regarding the relationship between dietary intake and DS consumption. In this study, among the FRL factors, the health pursuit factor emerged as a factor influencing DS consumption. On the other hand, in the 'active pursuit' group, the rational consumption pursuit factor showed an association with lower DS consumption. The results of the present study might contribute to the improvement of health by providing basic data on personalized eating habits and DS use.

In this study, the 'active pursuit' group showed a greater increase in DS consumption after COVID-19 compared to the 'passive pursuit' group. The 'active pursuit' group's DS consumption ranked first in MVM, followed by omega-3 fatty acid, probiotics, vitamin C, and vitamin A & lutein. On the other hand, the top DS consumption in the 'passive pursuit' group is omega-3 fatty acid, followed by MVM, probiotics, vitamin C, and vitamin D. DSs are used by over half (52%) of US adults, ≥ 19 years of age, with MVM supplements the most frequently consumed supplement across all adult age groups [2]. Vitamin C, vitamin D, and omega-3 fatty acids are among the most popular nutrients taken with DSs [27,28]. The use of DSs is often justified by the desire to improve immunity and overall health, prevent illness, or treat viral infections, even before the COVID-19 outbreak [22,27,29]. Vitamins D and C were the most frequently supplemented compounds, followed by zinc, which was most often supplemented from the beginning of the pandemic in both editions of the PLife-COVID-19 Studies [1]. Omega-3 fatty acids, which are more commonly used in the healthy group, have been

shown to enhance sleep quality and alleviate depression and anxiety in students [30,31]. Thus, the widespread use of DSs in adults may result from an individual's expectation that it will lead to better health outcomes [32].

The strength of this study lies in its integrated approach of combining factor analysis and cluster analysis, which not only enhances the reliability and validity of the research but also effectively segments customers based on their eating habits and DS use. This approach helps in developing targeted marketing strategies for DS usage. Additionally, because little research has been conducted on the use of DSs according to FRL in Korean adults, this study can be used as meaningful basic data in the field of public health. However, this study has several limitations, including the lack of a detailed exploration of factors related to FRL, eating habits, and DSs utilization. Additionally, since the study participants were only selected from the Seoul and Gyeonggi areas in Korea, the results may not be generalizable due to the non-representative sample. Another limitation is that the respondents were volunteers, not randomly selected, which might have introduced bias. Future research is needed to address these issues.

## CONCLUSIONS

This study explored the relationship between eating habits and DS utilization according to FRL. This study confirmed that not only did the 'active pursuit' group have better dietary habits, but also higher DS consumption. Factors that may influence DSs consumption include the health pursuit factor or the rational consumption pursuit factor. After experiencing COVID-19, increased interest in health and the perception that DSs provides health benefits seem to have increased DS consumption. By understanding the consumption characteristics of DSs according to FRL, this can serve as basic data necessary for promoting health through the utilization of DSs and healthy behaviors. Therefore, the classification of eating habits and utilization of DSs according to FRL and developing strategies for personalized nutritional management by considering each group's characteristics and DS selection attributes are needed.

## CONFLICT OF INTEREST

## FUNDING

## DATA AVAILABILITY

The participants of this study did not give written consent for their data to be shared publicly, so due to the sensitive nature of the research supporting data is not available.

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