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A pilot study of the relationship between diet and mental health in female university students enrolled in a training course for registered dietitians

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Abstract

Objective The purpose of the present pilot study was to investigate the link between diet and mental health in female university students enrolled in a training course for registered dietitians.

Subjects and methods A total of 62 female university students, with a mean age of 18.79 ± 0.45 years, participated in this cross-sectional study. Diet surveys were performed using the brief-type self-administered diet history questionnaire (BDHQ). Mental health was also evaluated using the general health questionnaire-12 (GHQ-12), which was the shortest form and clinically available. Lifestyles such as physical activity levels were also evaluated.

Results The mean energy intake was 1379 ± 575 kcal and the mean GHQ score was 3.11 ± 2.41. Among nutrients, vegetable fat and sucrose showed a weak positive correlation with the GHQ scores. Among food groups, potatoes, fats and oils, and confectioneries also showed a weak positive correlation with the GHQ scores. A multiple regression analysis showed that the confectioneries were the determining factor for the GHQ scores.

Conclusion Proper education concerning their diets and reducing confectioneries in their daily lives might be beneficial for the mental health of female university students.

Introduction

It is well known that diet, physical activity, and mental health are important in preventing future lifestyle-related diseases in university students [1, 2]. For example, improper dietary habits are linked closely to visceral fat accumulation and insulin resistance [3]. According to the National Nutrition Survey of Japan [4], 27.6 % of people in their 20 s reported that they do not have breakfast, and energy intake from fat has increased.

In regard to the mental health of university students, according to the Japan Student Services Organization, the number of consultations due to mental disorders in young adults is also increasing [5]. Poor mental health is also closely associated with lifestyle-related diseases [6]. Together, proper management and education concerning diet and mental health for university students is urgently required in Japan. However, in Japan, the link between diet and mental health in university students is not fully discussed. Students enrolled in a training course for registered dietitians were comparably more health conscious about their diets than the average students, and were thought to more accurately evaluate their dietary habits. Therefore, in this pilot study, we accurately evaluated diet and mental health, and the effect of diet on mental health, using self-questionnaires, in female university students enrolled in a training course for registered dietitians.

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Subjects and methods

Subjects

A total of 62 first year female university students, among 76 students in a training course for registered dietitians, with a mean age of 18.79 ± 0.45 years, were enrolled in this cross-sectional pilot study who met the following criteria (Table 1): (1) they underwent our survey at Mimasaka University on December 2015, (2) they completely answered the self-reported questionnaires concerning diet and mental health, and (3) they provided written informed consent.

Ethical approval was obtained from the ethical committee of Mimasaka University (27-9).

Clinical parameters

Clinical parameters such as age, diet, mental health, and physical activity level (PAL) were evaluated. The diets of these female university students were evaluated using the brief-type self-administered diet history questionnaire (BDHQ), which was recently developed from the self-administered diet history questionnaire (DHQ) as previously described [7–11]. Mental health was assessed using the general health questionnaire-12 (GHQ-12) as shown in previous reports [12]. The GHQ-12 was scored using the original (0-0-1-1) method (GHQ) [13]. Physical activity level was gauged using the National Nutrition Survey of Japan [14]. Body mass index (BMI) was calculated using the formula: body weight (kg)/[height (m)]^2.

Statistical analysis

Data are expressed as mean $\pm$ standard deviation (SD). A simple correlation analysis was used to evaluate the relationship between diet and mental health, where $p < 0.05$ was considered statistically significant. In addition, a multiple regression analysis was also used to investigate which factor had a significant effect on mental health. Statistical analysis was performed by IBM SPSS statistics 22 (IBM Japan, Tokyo, Japan).

Table 1 Characteristics of the female university students

	Mean $\pm$ SD	Minimum	Maximum
Age (years)	18.79 ± 0.45	18.00	20.00
Height (cm)	156.61 ± 4.99	139.80	166.00
Body weight (kg)	51.79 ± 5.61	40.00	65.00
BMI (kg/m^2)	21.09 ± 1.86	17.51	25.14
PAL	1.79 ± 0.41	1.08	2.66
GHQ score	3.11 ± 2.41	0.00	10.00

BMI body mass index, *PAL* physical activity level

Results

The clinical profiles of enrolled students were summarized in Table 1. The mean age, BMI, and physical activity level were 18.79 ± 0.45 years, 21.09 ± 1.86 kg/m^2, and 1.79 ± 0.41, respectively. The mean GHQ-12 score was 3.11 ± 2.41.

The measurements of nutrients and food groups were also summarized in Tables 2 and 3. Among nutrients, the mean daily intake of energy, protein, fat, and carbohydrates were 1379 ± 575 kcal, 49.0 ± 24.5, 42.6 ± 21.7 and 194.5 ± 85.8 g, respectively. The mean daily intake of sucrose was 10.5 ± 7.8 g (Table 2). Among food groups, the daily intake of confectioneries was 40.4 ± 35.8 g (Table 3).

We evaluated the relationship between nutrients and GHQ-12 scores (Table 4). Vegetable fats and oils ($r = 0.2800$, $p = 0.0274$) and sucrose ($r = 0.2600$, $p = 0.0413$) showed a weak positive correlation with the GHQ scores. However, there were no significant relationship between other nutrients and the GHQ scores. In addition, as shown in the relationship between food groups and GHQ-12 scores (Table 5), potatoes, fats and oils, and confectioneries also showed a weak positive correlation with the GHQ-12 scores.

Using a multiple regression analysis, we used the GHQ-12 scores as dependent variables and BMI, PAL, energy and sucrose as independent variables because that these variables were thought to be clinically important and sample size of statistical limitations. We then found that only sucrose was the determining factor for the GHQ-12 scores (Table 6). We also used the GHQ-12 scores as dependent variables and BMI, PAL, cereals and confectionaries as independent variables. We also found that only confectioneries were the determining factor for the GHQ-12 scores (β: 0.160, $p = 0.042$).

Discussion

In this pilot study, using the BDHQ, we accurately evaluated the link between diet and mental health in female university students enrolled in a training course for registered dietitians in Japan. The intake of sucrose and confectioneries was closely associated with mental health.

Some studies describing the relationship between diet and mental health already exist [15–19]. Jacka et al. reported that the intake of magnesium, folate, and zinc was associated with mental health using the validated food frequency questionnaire and the GHQ-12 [15]. Mishra et al. showed that low dietary vitamin B$_{12}$ intake was also associated with higher psychological distress [16]. In Japan, Miki et al. reported that the intake of magnesium,

Table 2 Daily intake of energy and nutrients measured using the BDHQ

	Mean ± SD	Minimum	Maximum
Energy (kcal)	1379 ± 575	346	3002
Protein (g)	49.0 ± 24.5	9.2	124.8
Fat (g)	42.6 ± 21.7	7.0	113.4
Animal fat (g)	18.3 ± 11.1	2.8	58.0
Vegetable fat and oil (g)	24.3 ± 12.8	3.8	66.4
Carbohydrates (g)	194.5 ± 85.8	52.6	553.3
Sodium (mg)	3034 ± 1283	856	6281
Calcium (mg)	340 ± 186	48	1129
Iron (mg)	5.4 ± 2.8	0.9	14.0
Vitamin A (retinol activity equivalents) (μg)	481 ± 308	45	1336
Vitamin B_1 (mg)	0.57 ± 0.32	0.08	1.64
Vitamin B_2 (mg)	0.84 ± 0.38	0.13	1.79
Vitamin C (mg)	80 ± 49	2	217
Total dietary fiber (g)	8.6 ± 4.8	1.1	24.1
Salt equivalents (g)	7.7 ± 3.2	2.2	15.8
Sucrose (g)	10.5 ± 7.8	1.4	32.0

Table 3 Daily intake of food groups measured using the BDHQ

	Mean ± SD	Minimum	Maximum
Cereals (g)	340.4 ± 189.1	75.9	1308.3
Potatoes (g)	45.8 ± 52.5	0.0	280.0
Sugars and sweeteners (g)	3.5 ± 2.9	0.0	13.0
Pulses (g)	44.6 ± 44.3	0.0	211.6
Green and yellow vegetables (g)	68.9 ± 62.9	0.0	313.5
Other vegetables (g)	110.7 ± 90.9	0.0	438.0
Fruits (g)	64.6 ± 62.2	0.0	290.7
Fish and shellfishes (g)	40.2 ± 36.6	0.0	142.5
Meats (g)	61.7 ± 65.2	0.0	364.5
Eggs (g)	28.1 ± 21.8	0.0	118.8
Milks (g)	73.2 ± 81.8	0.0	447.9
Fats and oils (g)	9.7 ± 7.3	0.0	30.8
Confectioneries (g)	40.4 ± 35.8	0.0	175.7
Beverages (g)	253.0 ± 200.5	0.0	773.3
Seasonings and spices (g)	216.8 ± 169.8	2.2	1070.4

calcium, iron, and zinc was negatively correlated with symptoms of depression [17]. Among food groups, the consumption of vegetables, fruits, mushrooms, and soy products was negatively correlated with GHQ scores [18]. In addition, subjects with proper and regular diets had better mental health parameters [19].

In this study, the score of the GHQ-12 was 3.11 ± 2.41. 76 % of psychiatric patients was reported to be over 4 points ($\geqq$4), and 91 % of healthy subjects were also reported to be under 3 points ($\leqq$3) [20]. Therefore, mental health of enrolled students was apparently healthy, and we found that some nutrients and food groups were associated with student mental health, which was evaluated using the GHQ-12. It is especially noteworthy that sucrose and

confectionaries were the determining factor for mental health scores according to our multiple regression analysis. Al'Absi et al. also reported that the intake of sucrose was closely associated with mental health. Although they speculated that lower mental health parameters induce dysgeusia [21], healthy lifestyles, including dietary intake, were closely associated with proper mental health [22]. In addition, improper dietary habits were also recently investigated in the National Nutrition Survey of Japan [4]. In fact, although underestimation due to self-questionnaire, lower calorie intake was found in this BDHQ survey. Together, proper education and diet, especially reducing sucrose intake due to confectionaries, would be beneficial for maintaining and improving mental health in female

Table 4 Simple correlation analysis between GHQ-12 scores and nutrients

	r	p
Energy (kcal)	0.0919	0.4776
Protein (g)	0.1417	0.2721
Fat (g)	0.2450	0.0550
Animal fat (g)	0.1559	0.2261
Vegetable fat and oil (g)	0.2800	**0.0274**
Carbohydrates (g)	−0.0200	0.8775
Sodium (mg)	0.1529	0.2354
Calcium (mg)	0.1660	0.1972
Iron (mg)	0.1155	0.3712
Vitamin A (Retinol activity equivalents) (μg)	−0.0545	0.6741
Vitamin B_1 (mg)	0.1719	0.1815
Vitamin B_2 (mg)	0.1559	0.2263
Vitamin C (mg)	0.0950	0.4629
Total dietary fiber (g)	0.0600	0.6434
Salt equivalents (g)	0.1537	0.2330
Sucrose (g)	0.2600	**0.0413**

Bold values indicate statistically significant ($p < 0.05$)

Table 5 Simple correlation analysis between GHQ-12 scores and food groups

	r	p
Cereals (g)	−0.1526	0.2364
Potatoes (g)	0.2690	**0.0348**
Sugars and sweeteners (g)	−0.0516	0.6903
Pulses (g)	0.2348	0.0662
Green and yellow vegetables (g)	−0.0772	0.5511
Other vegetables (g)	0.1298	0.3147
Fruits (g)	−0.0240	0.8534
Fish and shellfishes (g)	0.1554	0.2278
Meats (g)	0.1124	0.3842
Eggs (g)	−0.0580	0.6543
Milks (g)	0.1297	0.3151
Fats and oils (g)	0.2830	**0.0259**
Confectioneries (g)	0.3390	**0.0070**
Beverages (g)	0.0907	0.4833
Seasonings and spices (g)	−0.1085	0.4011

Bold values indicate statistically significant ($p < 0.05$)

Table 6 Multiple regression analysis between GHQ-12 scores and nutrients

	β	p
Dependent variables: GHQ12 scores		
Independent variables		
BMI	0.068	0.692
PAL	−0.746	0.321
Energy	0.000	0.482
Sucrose	0.106	**0.048**

BMI body mass index, *PAL* physical activity level

$R^2 = 0.090$, $p = 0.252$

Bold value indicates statistically significant ($p < 0.05$)

university students enrolled in a training course for registered dietitians in clinical practice.

Potential limitations still remain in this study. First, this was a pilot and cross-sectional study, but not a longitudinal study. The relationship between sucrose intake and mental health was obtained by cross-sectional analysis and the cause and result could not be proved. There is a possibility that the sucrose intake might be a result due to lower mental health conditions. Therefore, it is only speculation that reducing sucrose intake might induce improving mental health. Second, the students participating in this study were thought to be more health conscious than average students. Third, we could not evaluate the relationship between diet and mental health in male students. Fourth, we could not confirm the mechanism involved in the link between diet and mental health, and we could not understand the reason why there was a weak association between vegetable fats and oils and GHQ-12 scores. Nevertheless, it is noteworthy that the intake of sucrose and confectioneries was closely linked to mental health. Therefore, proper education and strategies for reducing confectionary intake would be beneficial for student mental health. Further ongoing and large sample investigation studies are required to prove such a link.

Compliance with ethical standards

Conflict of interest All authors declare that there are no conflicts of interests.

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