

ORIGINAL ARTICLE

THE RELATIONSHIP BETWEEN FREQUENCY OF FERMENTED FOOD CONSUMPTION AND DEPRESSIVE SYMPTOMS

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Abstract In the present study, the relationship between the consumption of dietary fiber or fermented foods and depressive symptoms was investigated. The degree of depressive symptoms was measured by the Center for Epidemiologic Studies Depression (CES-D) scale, and consumption of foods was measured by a self-administered diet history questionnaire. Participants scoring less than 16 were considered as the low CES-D score group, and those scoring 16 or higher were considered as the high CES-D score group. The total intake of dietary fiber from potatoes, pulses, fungi, vegetables, and fruits was not significantly different between the low and high CES-D score groups, but was significantly different for the frequency of the consumption of yogurt or fermented soybeans. Additionally, no participant who had eaten fermented soybeans daily was in the high CES-D score group. In conclusion, the frequency of the consumption of yogurt or fermented soybeans may be negatively associated with depressive symptoms. Furthermore, the habit of eating fermented soybeans daily may be associated with scoring less than 16 on the CES-D scale in Japanese adults.

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Key words: fermented soybeans; yogurt; depressive symptoms.

Introduction

Depression is associated with high mortalities for cancer, pneumonia and suicide¹, and the economic burden of depression in Japan is high². The Center for Epidemiologic Studies Depression (CES-D) scale is currently used to screen for depressive states³, and a CES-D score of 16 or higher is defined as depression. The prevalence of depression evaluated by the CES-D scale in Japanese adults was 29.9 %⁴. Therefore, it is important to find preventive measures.

In a recent study in mice, a diet deficient in dietary fiber was associated with an increase in depression-like behavior⁵. Changes in diet, especially the consumption of dietary fiber from fruits, vegetables, and other plants was associated with changes in intestinal microbiota⁶. On the other hand, fermented foods may also influence intestinal microbiota. The

frequency of yogurt consumption was positively associated with *Lactobacillus* and *Lactobacillus gasseri* in feces⁷. In dairy cows, fecal *Clostridium* sp. decreased and *Bifidobacterium* increased after supplementation with *Bacillus subtilis natto*⁸.

Furthermore, the administration of *Lactobacillus helveticus* R0052 and *Bifidobacterium longum* R0175 significantly reduced anxiety-like behavior in rats and alleviated psychological distress in healthy human volunteers⁹.

The aim of the present study was to clarify whether the consumption of dietary fiber or fermented foods was associated with the depressive symptoms evaluated by the CES-D score in Japanese adults.

Method

Subjects

Subjects in the present study were 389 peo-

Table 1. Total intake of dietary fiber from potatoes, pulses, fungi, vegetables, and fruits (grams)

	Low CES-D score group (n=58)	High CES-D score group (n=8)	<i>P</i> -value ^a
Median	215.7	192.0	
Minimum	35.5	66.8	0.432
Maximum	792.7	665.8	

^a The Mann-Whitney test was used to determine *P*-value.

ple aged 20 years or older living in Japan. The subjects were selected from the graduates list of a certain high school. Questionnaires and a description document were distributed by mail to the subjects. Ninety-five people returned the questionnaires, but 7 responses were excluded because of omissions. In addition, 22 responses were excluded because the participants take medicine for a mental disorder or take any type of supplement daily.

Procedures

The Ethics Committee of the Hirosaki University Graduate School of Health Sciences approved the study. The questionnaires were un-registered, and the description document stated that subjects who did not wish to reply could disregard the survey.

Measurements

Two kinds of questionnaires were mailed to the subjects. The degree of depressive symptoms was measured by the Japanese version of the CES-D scale¹⁰. Scores on the CES-D scale range from 0-60. A CES-D score of 16 or higher is defined as depression, and greater scores indicate higher levels of depression. Food consumption was measured by a self-administered diet history questionnaire¹¹, with a slight modification. The questionnaire consists of semi-quantitative frequency questions on selected 182 food items. The frequency ranged <1 time per month to more than or equal to 4 times per day.

Statistical analysis

A Kolmogorov-Smirnov test was performed to clarify whether the amount of dietary fiber intake conformed to the normal distribution. If the amount in either group did not conform to the normal distribution, a *P*-value was calculated by the Mann-Whitney test. The Cochran-Armitage trend test was performed to clarify whether there were differences in the frequency of the consumption of yogurt or fermented soybeans between the two groups. *P*-values of <0.05 were considered statistically significant. The Japanese version of Microsoft Excel 2007 for Windows (Microsoft Japan Co., Ltd., Japan) and Ekusel-Toukei 2012 (Social Survey Research Information Co., Ltd., Japan) were used for the statistical calculations.

Results

The age of the participants ranged from 33-72 years, and mean of age was 42.6 years. The CES-D score for 58 participants was 15 or lower, while the score for 8 participants was 16 or higher. The former group was designated "low CES-D score group," and the latter was designated "high CES-D score group."

As shown in Table 1, the total intake of dietary fiber from potatoes, pulses, fungi, vegetables and fruits was not significantly different between the low and high CES-D score groups.

The frequency of yogurt consumption was significantly different between the low and high CES-D score groups (Table 2A). The frequency

Table 2A. Comparison of percentages of the participants between low and high CES-D score groups

Frequencies of the yogurt consumption	Low CES-D score group (n=58)	High CES-D score group (n=8)	P-value ^a
≥1 time/day	34.5	12.5	0.0044**
≥3 times/week	13.8	25.0	
1-2 times/week	15.5	12.5	
≥3 times/month	8.6	0.0	
1-2 times/month	1.7	12.5	
<1 time/month	25.9	37.5	

^aThe Cochran-Armitage trend test was used to determine P-value.

*P<0.05; **P<0.01.

Table 2B. Comparison of percentages of the participants between low and high CES-D score groups

Frequencies of the consumption of fermented soybeans	Low CES-D score group (n=58)	High CES-D score group (n=8)	P-value ^a
≥1 time/day	17.2	0.0	0.0046**
≥3 times/week	15.5	12.5	
1-2 times/week	22.4	25.0	
≥3 times/month	19.0	37.5	
1-2 times/month	22.4	12.5	
<1 time/month	3.4	12.5	

^aThe Cochran-Armitage trend test was used to determine P-value.

*P<0.05; **P<0.01.

of fermented soybeans consumption was also significantly different between the two groups (Table 2B). The rate of participants who eat yogurt or fermented soybeans daily was higher in the low CES-D score group than in the high CES-D score group (Tables 2A and 2B).

Discussion

In the present study, the total intake of dietary fiber from potatoes, pulses, fungi, vegetables, and fruits was not associated with depressive symptoms. The result is similar to a part of the other study. In the study, it has been showed that dietary intake of total fiber was not associated with depressive symptoms¹²⁾.

On the other hand, the frequency of consump-

tion of yogurt or fermented soybeans tended to be higher in the low CES-D score group than in the high CES-D score group. In a previous study, the consumption of yogurt or fermented soybeans was not significantly associated with a Kessler 6-item psychological distress scale (K6) score of ≥13 in pregnant women¹³⁾. The results were different between the two studies probably because the participants of the previous study were pregnant women.

Fermented foods may influence intestinal microbiota. In young adults, the frequency of yogurt consumption was positively associated with *Lactobacillus* and *Lactobacillus gasseri* in feces⁷⁾. In dairy cows, fecal *Clostridium* sp. decreased and *Bifidobacterium* increased after supplementation with *Bacillus subtilis natto*⁸⁾.

Furthermore, administration of *Lactobacillus helveticus* R0052 and *Bifidobacterium longum* R0175 significantly reduced anxiety-like behavior in rats and alleviated psychological distress in healthy human volunteers⁹⁾. From previous studies and this study, it is speculated that the frequency of consumption of yogurt or fermented soybeans may be negatively associated with depressive symptoms via intestinal microbiota.

There are several limitations in the present study. As this was a cross-sectional and observational study, the causality of diet on depressive symptoms is not clear. Additionally, there were few participants in the high CES-D score group. Although there are the limitations, this study provided several interesting findings.

In the present study, there was an individual who had eaten yogurt daily in the high CES-D score group, but there were no participants who had eaten fermented soybeans daily in the high CES-D score group. Therefore, the habit of eating fermented soybeans daily may be associated with scoring less than 16 on the CES-D scale in Japanese adults.

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