Original article

Fish consumption and depressive symptoms in undergraduate students: A cross-sectional analysis

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ABSTRACT

Background: Emerging evidence suggests that fish consumption may have beneficial effects on mood disorders. However, no study has been reported on this issue in young adults to date. The aim of this study was to investigate the relationship between fish consumption and depressive symptoms in Japanese undergraduate students.
Methods: The 20-item Center for Epidemiologic Studies Depression Scale was used to measure depressive symptoms with a cut-off score of 16. A total of 4190 completed questionnaires (from 2124 men and 2066 women) were received for analysis.
Results: Multivariate logistic analysis showed that fish intake was inversely associated with risk of depressive symptoms in undergraduate students. After adjustment for possible confounders, the odds-ratios (95% confidence intervals) for fish intake 1–2 times/month, 1–2 times/week, 3–4 times/week, and almost every day (compared with "almost never") were 0.78 (0.62–0.99), 0.70 (0.56–0.87), 0.67 (0.53–0.85) and 0.65 (0.46–0.92), respectively. This association tended to be stronger in women than in men.
Conclusions: Frequent fish consumption in undergraduate students seems to moderate depressive symptoms. Further research is warranted to clarify the causality.

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1. Background

In 2012, suicide was the 15th leading cause of all deaths worldwide. Among individuals aged 15–29 years, this ranking increases to the second leading cause of death [42]. Data from the Ministry of Health, Labour and Welfare, Japan, suggests that suicide is the number one leading cause of all deaths in 5-year age groups that encompass 15–39 year olds in Japan, with 20–24 year olds showing the highest percentage (51.7%) [35]. Although suicide is known to be influenced by multiple factors, most victims were diagnosed with psychiatric problems such as depression at the time of death.

University students are often regarded as a privileged population; however, this does not mean they are immune to the suffering and disabilities associated with mental illness [17]. Although a large national epidemiologic study in the United States found no difference in the odds of developing mood or anxiety disorders between college students and their non-college-attending peers [5], this trend needs to be examined in Japan where there has been an increase in suicide mortality [35]. Furthermore, three quarters of all lifetime mental disorders are known to present by the age of 24 [19].

Growing evidence indicates that fish consumption could prevent depression. So far, 12 cross-sectional studies have been reported [1,3,4,6,8,16,23,26,33,36,37,39], of which 8 suggest beneficial effects in preventing depression [3,4,6,8,33,36,37,39]. Although three studies included young individuals, these studies were population-based surveys rather than specifically aimed at young age groups [16,23,33].

Japan is well known for its high level of consumption of fish and seafood; however, a National Health and Nutrition Survey [24,25] revealed that consumption has declined during the past decade. From 2003 to 2012, there was an average reduction of 19.3% (gram per capita per day) for the entire population, with

those aged 40–49 showing the highest reduction (35.2%) followed by those aged 15–19 (27.6%). To date, no report has analyzed the relationship between fish consumption and depressive symptoms in young adults. In this study we therefore investigated this relationship in Japanese undergraduate students.

2. Methods

2.1. Subjects

Our survey was conducted across seven faculties of one university. A total of 6398 students were registered in these seven faculties. An anonymous self-administered questionnaire survey was conducted by field workers in the teaching rooms of five faculties and via the administration office of two faculties from April to December, 2014. The study protocol was approved by the Ethics Committee of the University of Toyama (No. 25–100).

2.2. Self-report measures

Depressive symptoms were measured using the 20-item Center for Epidemiologic Studies Depression (CES-D) Scale [29], which was previously validated in the Japanese language [32]. The 20-item CES-D uses a maximum score of 60, with a recommended lower cut-off of 16 [29,32] to indicate a high level of depressive symptoms in epidemiologic studies. Only those participants who answered all 20 items on the questionnaire were included in the current analysis. We also examined use of a higher cut-off score of 22, which is reportedly the optimum cut-off for detection of severely depressed mood [7,21].

Fish consumption was scored based on customary intake frequency [43]:

- almost never;
- 1–2 times/month;
- 1–2 times/week;
- 3–4 times/week;
- almost every day.

Concerns over academic performance, friendships, and financial matters were answered dichotomously (yes or no). Smoking status fell into four categories (never, ex-smoker, sometimes, or every day), which were later re-categorized into non-smoker or smoker for further analysis. Six options were given for consumption of alcohol (never, ex-drinker, social drinker, 1 time/week, 2–3 times/week, or every day), which were later re-categorized into non-drinker or drinker for further analysis. Questions concerning physical activity were categorized into < 2 times/week or ≥ 2 times/week.

2.3. Statistical analysis

Data are expressed as means ± SD unless described otherwise. In descriptive analyses, Spearman's rank correlation test was used to calculate correlation coefficients between the frequency of fish intake (1 through 5) and age and CES-D score. An ordinal Chi^2 test for linearity was used to compare fish intake (1–5) and sex (male), number of depressive symptoms (CES-D score ≥ 16), concerns over academic performance, concerns over friendships, concerns over financial matters, smoking status, consumption of alcohol and physical activity. Logistic regression was used to estimate odds-ratios (ORs) and 95% confidence intervals (CIs) for depressive symptoms according to the frequency of fish intake. Tests for trend involved assigning categorical numbers to the levels of fish

intake (1–5) and evaluating this as a continuous variable. The models were adjusted for the following potential confounders: sex, age, concerns over academic performance, concerns over friendships, concerns over financial matters, smoking status, consumption of alcohol, and physical activity.

A total of 4490 students returned the questionnaire. Information on smoking status and alcohol use was not obtained for first- and second-year students in three faculties, because most were younger than 20, which is the legal age for alcohol consumption and smoking in Japan. As a result, there were 899 and 905 missing data points for these questions, respectively. We therefore added an extra category, indicating missingness for imputation. These imputations were used for adjustment in regression analysis only. After imputation, 300 missing data points existed with regards to age, sex, CES-D, fish intake, concerns over academic performance, concerns over friendships, concerns over financial matters, and physical activity, and were excluded from further analysis. The remaining 4190 samples were used for final analysis. Two-sided P values less than 0.05 were used to indicate statistical significance. Data were analyzed using statistical software SPSS, version 19.0 (IBM Japan, Tokyo).

3. Results

The mean ± SD age of all participants was 20.5 ± 1.8 years (range, 18–44 years). Ninety-seven percent of participants were aged < 25 years, and men (20.7 ± 2.3) were older than women (20.3 ± 1.9) ($P < 0.0001$). A total of 2103 (50%) participants had a CES-D score of ≥ 16. The prevalence of depressive symptoms (CES-D score ≥ 16) in men (50%) and women (50%) were similar. The characteristics of the 4190 undergraduate students according to the frequency of fish intake are shown in Table 1. Age was positively associated with the frequency of fish intake. No significant differences were seen between the frequency of fish intake and sex, smoking status, or alcohol use. Both CES-D score and the prevalence of depressive symptoms (CES-D score ≥ 16) were inversely associated with the frequency of fish intake. Concerns over academic performance, friendships, and financial matters were all inversely associated with the frequency of fish intake. The number of students who performed physical activity ≥ 2 times/week was positively associated with the frequency of fish intake.

Table 2 shows the ORs and 95% CIs of depressive symptoms according to the frequency of fish intake. Both multivariable model 1 (adjusted for age and sex) and model 2 (additionally adjusted for concerns over academic performance, friendships, and financial matters; smoking status; consumption of alcohol; and physical activity) showed that the risk of depressive symptoms was significantly reduced in all groups (the second through to the highest group) with a significant negative trend. When a higher CES-D cut-off score of 22 was applied, the prevalence of depressive symptoms decreased from 50.2% to 27.8%. The risk of depressive symptoms was similar to the results obtained using a cut-off score of 16: second level, 0.81 (0.64–1.03); third level, 0.66 (0.53–0.83); fourth level, 0.71 (0.55–0.91); fifth level, 0.63 (0.42–0.94); $P < 0.01$ for trend.

In the same multivariable model 2, four confounders (concerns over academic performance, friendships, financial matters, and physical activity) showed significant ORs of 1.95 (1.69–2.24), 3.03 (2.57–3.57), 1.60 (1.39–1.83), and 0.70 (0.61–0.80), respectively.

In the subanalysis, the trend tests for both men ($P = 0.022$) and women ($P = 0.019$) were also significant. The ORs and 95% CIs for the second, third, fourth and fifth levels were: 0.85 (0.62–1.17), 0.74 (0.55–0.99), 0.70 (0.50–0.97), and 0.73 (0.45–1.18) for men, respectively; and 0.74 (0.53–1.03), 0.67 (0.49–0.91), 0.66 (0.47–0.93), and 0.62 (0.37–1.02) for women, respectively.