ASSOCIATION BETWEEN FISH INTAKE AND DEPRESSIVE SYMPTOMS AMONG COMMUNITY-LIVING OLDER CHINESE ADULTS IN SINGAPORE: A CROSS-SECTIONAL STUDY

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Abstract: *Objective:* Our aim of this study was to investigate the association between fish consumption and depressive symptoms in senior ethnic Chinese residents of Singapore. *Design:* A population-based cross-sectional study. *Setting:* The Singapore Longitudinal Aging Studies (SLAS). *Participant:* The study consisted of 2,034 participants from the Singapore Longitudinal Aging Studies (SLAS) project who were at least 55 years old. *Measurements:* The presence of depressive symptoms was compared between those who self-reported eating fish at least three times a week versus those who ate fish less often. A score of 5 or greater on the 15-item Geriatric Depression Scale (GDS-15) was the cutoff for being designated as having depressive symptoms. *Results:* Fish intake was associated with a lower prevalence of depressive symptoms ([odds ratio] OR = 0.60, 95% [confidence interval] CI 0.40–0.90; P = .015) after controlling for age, sex, marital status, housing, smoking, alcohol consumption, physical exercise, social and productive activities, self-rated health, hypertension, diabetes, heart failure or attack, stroke, fruit and vegetable intake, and Mini-Mental State Examination (MMSE) scores. *Conclusion:* Our results suggest that eating fish at least three times a week is associated with a lower odds of having depressive symptoms among Chinese adults over 55 years old living in Singapore.

Key words: Fish intake, depressive symptoms, elderly persons, Chinese.

Introduction

Depressive symptoms are common among seniors, but often underappreciated. It has been estimated that 70–90% of seniors with depression may be undiagnosed or misdiagnosed, seemingly due at least in part to dismissal of symptoms as a normal part of aging (1). To date, many risk and protective factors have been linked with late-life depression. It is important to identify factors that are protective against depression, such as drinking tea (2, 3), as well as risk factors of depression, such as eating a diet high in processed food (4), to enable the development of prevention strategies that could lower the prevalence of depression.

Accumulating evidence suggests that dietary habits may influence depression. High intake of fish was reported to be associated with a lower prevalence of major depression (r = 0.77, p < .03) in a multinational study (5) and fish intake has been reported to have a protective effect on depression among the elderly (6). In the IKARIA study, frequent fish intake (>3 times/week vs. rare) was found to be inversely associated with depression symptomology, as indexed by the 15-item Geriatric Depression scale (GDS-15; odds ratio [OR] = 0.34, 95% confidence interval [CI]: 0.19–0.61) after controlling for several cofounders (7). In the Chicago Health and Aging Project, adherence to a Mediterranean diet—comprised of vegetables, fruits, whole grains, fish, and legumes—has also been found to be protective against the development of depressive symptoms in older age (mean follow-up of 7.2

years) (8). However, there have been conflicting reports. For example, in the 2005–2008 National Health and Nutrition Examination Survey in the USA (N = 10,480 adults, nationally representative sample), the frequency of fish intake reported for a 30-day period was not consistently associated with depressive symptoms (9). Likewise, no association between fish intake and depression was found in the 10/66 study of more than 15,000 older adults from seven low- and middle-income countries (10), and fish intake was not related to depressive symptoms in a study of elderly patients with a history of myocardial infarction (11). Additionally, Nanri (2013) did not observe a significant association between a high intake of fish/shellfish (or of other meat types) with the presence of depressive symptoms in Japanese workers, but did observe a protective effect of a healthy Japanese dietary pattern—characterized by plenteous vegetables, fruit, mushrooms, and soy products—against depressive symptoms (12). Interestingly, a recent longitudinal study conducted in Australia suggested that fish consumption was protective for mental health in young adult women, but not men (13).

Hence, further studies of various populations are needed to resolve the possible relationship between diet and depression. Singapore is a diverse cosmopolitan country in Southeast Asia, and Singaporean cuisine reflects a rich mixture of the country's ethnic diversity. Dietary habits vary among the ethnic Chinese residents of Singapore. The aim of this study was to investigate the impact of a high intake of fish on depression symptomatology in a large sample of older ethnic Chinese

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adults living in communities in Singapore.

Methods

Participants

The subjects of this study were selected from the Singapore Longitudinal Aging Studies (SLAS) cohort based on their first-stage data. The SLAS is a community-based epidemiologic research project that was designed to examine health in relation to aging. The recruitment and baseline assessment of SLAS participants were conducted from September 2003 to December 2005. A total of 2,331 SLAS participants' were confirmed to be at least 55 years old (at the time assessed) and to have complete depression and fish intake data. After excluding 297 participants with cognitive impairment (MMSE score < 24), the final analysis involved data from 2,034 participants. So participants who had diagnoses of mental disease or were receiving antidepressant treatment were not included in the study. All participants provided written informed consent. In the face-to-face interviews, the participants were asked whether they eat a lot of fish using the operational definition of "more than 3 times a week". The cohort data analysis was divided into two groups: fish eating (consume fish at least three times per week) and reference (consume fish two or fewer times per week) (Table 1).

Study variables

A total of 36 variables were included in the analysis, including variables related to demographics (e.g. age and education), cardiovascular risk factors (e.g. smoking and alcohol consumption), self-rated health (14-18), and lifestyle. Lifestyle was classified based on participation in activities indexed by frequency: (0 = never or less than once a month, 1 = sometimes (at least once a month but less than once a week), 2 = often (at least once a week,). Leisure activity was assessed by summing the scores of 13 activities (12 social and 1 productive), with the total score ranging from 0 to 26 (2, 3).

Assessment of depressive symptoms

The presence of depressive symptoms was determined based on the subjects' GDS-15 data. The GDS-15 is a self-report instrument consisting of 15 yes or no questions (total score range, 0–15), with higher scores indicating more depressive symptoms. The cutoff employed for designation of clinically relevant depressive symptoms was as a GDS-15 total score of 5 or higher. GDS-15 has been demonstrated previously to have good reliability and validity (2, 3, 6, 7, 19).

Statistical analysis

Frequencies and means were calculated for categorical and continuous variables, respectively, after the data were cross-classified by groups for the variables of interest. Associations between categorical variables were examined with the Chi-squared test. Independent-samples t test or Mann-Whitney

U Test were conducted to compare continuous variable data between the fish-eating group and the reference group.

Table 1
Characteristics of participants by groups of fish intake
(N = 2,034)

Variables	Group		
	Fish-eating[a] (N = 1813)	Reference[b] (N = 221)	P-value[c]
Mean age, y (SD)	65.08 (6.99)	65.00 (7.55)	.886
Females	1114 (61.4%)	142 (64.3%)	.417
Education ≥6 y	930 (51.3%)	117 (52.9%)	.644
Housing type			.155
≤3-room	503 (27.7%)	74 (33.5%)	
≥4-room	782 (43.1%)	83 (37.6%)	
private, apt, and condo	528 (29.1%)	64 (29.0%)	
Marital status			<.001
Single	98 (5.41%)	17 (7.69%)	
Married	1419 (78.3%)	147 (66.5%)	
Separated, divorced, widowed	296 (16.3%)	57 (25.8%)	
Living alone	117 (6.45%)	25 (11.3%)	.007
Current smoker	110 (6.07%)	16 (7.24%)	.498
Daily drinker	37 (2.04%)	1 (0.45%)	.069
Exercises at least once a week	750 (41.4%)	70 (31.7%)	.006
Mean social/productive activities score (SD)	7.40 (3.54)	6.57 (3.16)	<.001
Self-rated health			.159
Excellent	1068 (58.9%)	118 (53.4%)	
Fair	700 (38.6%)	94 (42.5%)	
Poor	45 (2.48%)	9 (4.07%)	
Hypertension	961 (53.0%)	116 (52.5%)	.884
Diabetes	283 (15.6%)	40 (18.1%)	.339
Heart failure or attack	102 (5.63%)	15 (6.79%)	.484
Stroke	55 (3.03%)	8 (3.62%)	.635
Eats a lot of fruits and vegetables	1736 (95.8%)	177 (80.1%)	<.001
Mean BMI (SD)	23.62 (3.48)	23.54 (3.72)	.759
Mean MMSE (SD)	27.95 (1.72)	28.01 (1.80)	.635
Mean GDS-15 score (SD)	1.73 (2.57)	2.41 (3.37)	.085

a. Eats fish ≥3 times a week; b. Eats fish <3 times a week; c. Chi-square test or Independent-Samples T test or Mann-Whitney U Test; SD, standard deviation; BMI, Body Mass Index; MMSE, Mini-Mental State Examination; GDS-15, 15-item Geriatric Depression Scale.

We fitted four multiple logistic regression models to examine the relationship between fish consumption and the presence of depressive symptoms, defined as GDS ≥ 5. Model 1 contains only the intercept and fish intake, whereas models 2 to 4 were adjusted for confounding variables. Model 1 was designated as the base model and model 4 was a fully adjusted model (Table 2).

Table 2
Cross-sectional relationship between fish intake and
depressive symptoms (N = 2034)[a]

Model[b]	OR (95% CI)	
	Reference[c]	Fish-eating[d]
1	1	0.49 (0.35, 0.70)
2	1	0.52 (0.36, 0.74)
3	1	0.61 (0.41, 0.91)
4	1	0.60 (0.40, 0.90)

a. 254 (12.49%) participants had GDS-15 score ≥5; b. 1, base model; b. 2, adjusted for demographics (age, sex, marital status, living) + 1 model; b. 3, adjusted for health/lifestyle (smoking, alcohol drinking, physical exercise, social and productive activities, self-rated health, hypertension, diabetes, heart failure or attack, stroke, fruits and vegetables) + 2 model; b. 4, adjusted for MMSE scores + 3 model; c. Eats fish ≥3 times a week; d. Eats fish <3 times a week; OR, odds ratio; CI, confidence interval

We calculated the ORs of depressive symptoms with 95%CIs. We computed the OR for fish intake with subjects who "Don't eat a lot of fish" as the reference group. All analyses were performed with SAS® version 9.2 software.

Results

Characteristics of participants grouped by fish intake

Among the 2,034 participants included, 221 (10.9%) served as the reference group (eat fish < 3 times a week) and the other 1,813 (89.1%) constituted the fish-eating group (eat fish ≥3 times a week). Relative to the reference group, the fish-eating group had a lower percentage of women, a lower percentage who completed at least primary school, a lower proportion who lived in three-room houses, lower proportions of people who were single and of people who were divorced, widowed, or separated, and lower proportions of people who lived alone, were smokers, had diabetes mellitus, and had experienced heart failure (Table 1). The fish-eating group had higher percentages of alcohol drinkers and regular exercisers (at least once a week) as well as higher social and productive activities mean score and a higher proportion of people who ate a lot of fruits and vegetables (Table 1). The fish-eating group had a lower mean GDS score than did the reference group (Table 1).

Relationship between fish intake and depression

Data describing the cross-sectional relationship between fish intake and depression are summarized in Table 2. The OR obtained with the base model indicated that the odds of depression symptoms being present in individuals in the fish-eating group were about half that of the reference group, whereas that obtained with the fully adjusted model indicated that the odds were about six tenths that of the reference group. Hence, adjusting for confounders did not change the results substantially. This analysis demonstrated a significant relationship between eating fish often and the presence of depression symptoms. Specifically, an inverse relationship

between fish intake and the presence of depression symptoms was observed in the present cross-sectional study.

Discussion

The present results provide evidence of a cross-sectional association between fish intake and clinically meaningful depressive symptoms in older adults. Among our sample of ethnic Chinese residents of Singapore aged 55 years or older, frequent consumption of fish was associated with a reduced likelihood of depression symptoms (60% likelihood vs. reference group) detected by the GDS-15. These results are consistent with a prior study (6) in which greater consumption of fish was associated with a lower prevalence (0.58 times) of depressive symptoms, also detected by GDS score threshold, in community-living elderly adults (95% CI: 0.45–0.73) with an adjusted model. Our findings are also consistent with those of study (7, 20).

Fish is a rich source of essential n-3 (a.k.a. omega-3) polyunsaturated fatty acids (PUFAs), such as eicosapentaenoic acid and docosahexaenoic acid. These PUFAs increase levels of serotonin, which has an inverse association with depressive symptoms (21). Growing evidence suggests that n-3 PUFAs play an important role in brain function and moderating depressive and anxiety disorders (22, 23). Hence, inclusion of fish in one's diet might help to attenuate depressive symptoms through elevation of serotonin levels. Furthermore, fish is a highly nutritious source of protein and maintaining a healthful diet in general should improve one's sense of wellbeing. Since we did not measure n-3 PUFA levels, the hypothesized fish-n-PUFA-serotonin pathway of depression reduction is not supported by this study per se, and should be rigorously tested in future researcher.

Yet, as mentioned in the introduction, several studies have not observed an association between fish intake and depressive symptoms (9-12). It may be that social psychological factors such as stress, personality, social support, income status, retired /working, occupation, dispositional optimism (24) and etc, may have obscured detection of this association in some studies. Indeed, in a quantitative meta-analysis study involving elderly samples, it was found that bereavement, sleep disturbances, disability, prior depression, and female gender may be important risk factors for depression that should be taken into account (25). Secondly, the association may be affected by regional and demographic factors, such as ethnic/cultural identity and socioeconomic level. In the large 10/66 study, the association between fish intake and depression varied markedly across the seven examined low- and middle-income countries (10). In the Chinese subsample of the 10/66 study, the adjusted association between fish consumption and depression inventory scores using Poisson models was not significant; however, a linear inverse association between fish consumption categories and EURO-D depression symptoms scale scores was highly significant. Interestingly, previous study (26) found that

Chinese Australians had higher levels of platelet phospholipids n-3 PUFA than their compatriots of European descent. This difference may represent a demographic variability factor in studies of the interaction between diet and depression. Thirdly, because n-3 PUFA levels vary among different fish types, the benefit of eating fish may differ between populations depending on what kinds of fish the subjects consume regularly.

The caveat that depressed persons tend to eat less food (27), including fish, should not be ignored. That is, people may eat less fish because they are experiencing symptoms of depression. Thus, additional research is needed to examine the cause-effect direction of the association of reduced depressive symptoms with consumption of particular foods such as fish and tea (2).

The data in this observational study suggest that high intake of fish may be associated with a lower odds of having depressive symptoms among Chinese adults over 55 years old living in Singapore. More evidence from prospective and interventional studies is needed to confirm the relationship between fish consumption and the presence of depressive symptoms in this population and other populations (28).

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