High fish consumption decreased the likelihood of depressive symptoms in community-living older people: a randomized-controlled trial

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INTRODUCTION

Depressive disorders are considered as a chronic or episodic condition in adolescence or early adulthood, being typically recurrent and comorbid with addiction or other mental and physical illnesses. It was revealed that 17-20% of the general population are affected by mild to severe depression, with approximately 5% of adults experiencing severe depression. Nevertheless, these figures differ from country to country, for example in Iran 36.7%.

Given the growing life expectancy across the globe, Iran in particular, the elderly population is on the rise at an unprecedented pace; thus prevalence of depressive disorders is more likely to increase remarkably. A few studies have addressed outcomes and predictors of depression in later life. In this regard, some have reported no predictors. However, advanced age may play an important role in development of depression among older adults.

Insufficient diet is one of the key features related to depression, which may cause other chronic disease, such as type 2 diabetes mellitus. On the other hand, omega-3 polyunsaturated fatty acids (PUFA) have shown positive contribution to the progress and treatment of late-life depression.

It is frequently reported that fish is considered as an indispensable component of a healthy dietary pattern. A number of observational studies (cross-sectional and cohort) have supported the great impact of fish...
consumption on the management of certain non-transmissible or psychiatric diseases, including cardiovascular disorders, Alzheimer’s disease, rheumatoid arthritis, diabetes, cancer, and so forth. There exists emerging evidence that confirms the contribution of fish and fish oils to mental health. Several cross-sectional studies have demonstrated that the lower rates of depression in Greek islands may correspond with high fish intake. Some have found no correlation between fish consumption and depression though. Iran with several ethnicities has undergone profound socioeconomic shifts over the past three decades, which, in the long run, have affected lifestyle, health, and accordingly prevalence of depressive diseases. Moreover, there is a large gap between present fish consumption and the amounts for nutritional goal (twice per week). Given lack of sufficient randomized controlled trials, status of present fish consumption and different lifestyles in Iranian aging adults, this study was intended to investigate the effectiveness of high fish consumption on the management of depressive symptoms using a randomized controlled trial among community-living older adults in Iran.

MATERIAL AND METHODS

STUDY DESIGN

This study was considered as a randomized controlled trial of three months duration, aiming to assess the impact of fish consumption on the treatment of depression. Accordingly, 96 participants were enrolled from residents of a senior housing complex, Mashhad, Iran. The recruitment was carried out from October 2011 to August 2013. The subject’s initial eligibility was evaluated based on the Beck Depression Inventory (BDI). The original BDI with 21 items concerning the subject’s condition in the previous week was used in this trial. It was translated into Persian language and validated for clinical applications. Then, they were randomly assigned into groups A (high fish consumption; four times a week) and B (control condition; two or fewer times per week). Moreover, pre- and post-test scores of depression were obtained using the 15-item Geriatric Depression scale (GDS-15) and 12-item general health questionnaire (GHQ). Therefore, the outcome measures included changes in depression symptoms through the GHQ and GDS.

INCLUSION CRITERIA

Three eligibility criteria – being 60 years old or over (at the time of assessment), being able to provide informed consent, and gaining score 24 or over on the Mini-Mental State Examination (MMSE) – were adopted to select the target population. If participants were on any psychological therapies or antidepressant medication, they were allowed to adhere to the treatment regimen for at least fortnight prior to initiation of the study. Furthermore, it was mandated that each participant must not leave the institution for more than one week during the intervention period and be physically able to eat foods as prescribed.

EXCLUSION CRITERIA

Participants with any known psychological and severe medical conditions (bipolar I or II disorder, food allergies, personality disorder) were excluded from the study.

STUDY INTERVENTION

Initially, a number of 140 cases were recruited from the institution. With 15% attrition over three months, the ultimate desired sample size resulted in 96 participants. Participants were divided into groups A (n = 54) with 480 g/week of trout fish and B (n = 42), which was provided with the less frequent fish-based diet. The subject’s common diet was actually replaced by fish so that no changes occurred in their caloric intake over three months. In this regard, all the study groups were to consume specified amounts of food according to the nutritional material combination chart (consisting of 700 different foods issued by Iranian Institute of Nutrition). Moreover, their weight was continuously measured to adjust the caloric intake. The procedure and data collection were conducted by the study nurses who were blinded to the group allocation and were not involved in the usual clinical care of the institution. Due to the small number of the participants, randomization was carried out using random number tables.

OUTCOME MEASURES

The GDS and GHQ were administered to the study groups in order to determine changes in the mean score of depressive symptoms at three months. The following baseline variables were collected via demographic questionnaire: age, sex, smoking status, BMI, marital status, physical activity, educational level, and disease prevalence. The GHQ-12 is another questionnaire used in this study to screen mental health. It was proved to have good reliability and validity in Iranian population. Cut-off point ≥ 5 denotes the presence of depressive symptoms in older adults (Costa et al., 2006). The Iranian version of the GDS-15 was developed by Malakouti et al. with the optimum cutoff score of 7/8.

STUDY INTEGRITY

The present study was approved by the Medical Research Committee affiliated to Mashhad University of
Medical Sciences, Mashhad, Iran. We obtained written informed consent from all the elderly. Moreover, the CONSORT guidelines were adopted to develop the study.

**Data analyses**

In analysis phase, a researcher blinded to the treatment conditions conducted data processing on triplicated measures. The Mann Whitney U test was performed to determine differences between the two groups’ GDS and GHQ scores (in both continuous and dichotomized forms) at three months. Adjustment for confounders was carried out through ANCOVA. In order to investigate the association of fish consumption with the improvement of depressive symptoms (GDS < 5 and GHQ < 5), four models were developed through multiple logistic regression. Moles 1, 2, 3, and 4 were respectively adjusted for four categories including demographics, lifestyle, health condition, and MMSE scores. All statistical tests were considered significant at an alpha level of 0.05 with 95% confidence intervals.

**RESULTS**

Of 140 eligible subjects in the institution, 96 met the inclusion criteria, randomized to either a control (n = 42) or a case (n = 54) group, and completed the dietary intervention of three-month duration. As indicated in Table I, both groups were comparable across a range of confounders (p > 0.05). However, there was a notable difference in disease prevalence between the two groups (p < 0.05).

The mean (SD) GDS scores at baseline in the case and control groups were 3.67(2.08) and 4.05(1.77), respectively. Following three months when the diet program completed, these values approximately resulted in 2.83(1.99) and 3.31(1.54), respectively. The result of GDS scores presented no statistically significant difference between the study groups (p > 0.05). The GHQ scores were similarly improved non-considerably (p > 0.05) (Tab. II). Even following adjustment for age, gender, and baseline values, the difference in the scores of GDS (0.17%) and GHQ (0.37) between groups A and B was not remarkable at the end of three months (p > 0.05).

Comparison of dichotomized GDS and GHQ scores less than 5 between the study groups was summarized in Table III. The proportions of the elderly obtaining GDS < 5 or GHQ < 5 at three month were 75.92% or 77.78% (group A) vs 71.43% or 69.04% (group B), respectively. Likewise, the dichotomous outcomes were higher in the case group in comparison with the control group (p > 0.05). Therefore, the influence of high fish consumption did not significantly change the dichotomized scores of depression even if adjusted for age and gender (multiple adjusted odds ratio of scoring GDS < 5 = 0.73, 95% CI: 0.28-1.87). The OR gained from GHQ < 5 established on the first adjusted model in group A was approximately 67% that of group B (Tab. II). Furthermore, the OR based on models 2, 3, and 4 revealed that adjustment for other confounders did not notably change this finding (data not shown). This also was indicative of an inverse connection between high fish consumption and the scores of depression.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Group A N = 54</th>
<th>Group B N = 42</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (SD)</td>
<td>66.31 (5.11)</td>
<td>66.81 (5.62)</td>
<td>0.876</td>
</tr>
<tr>
<td>Mean BMI (SD)</td>
<td>21.06 (3.50)</td>
<td>23.50 (4.10)</td>
<td>0.102</td>
</tr>
<tr>
<td>Males (%)</td>
<td>23 (42.59)</td>
<td>26 (61.90)</td>
<td>0.060</td>
</tr>
<tr>
<td>Education level (primary or lower) (%)</td>
<td>34 (62.96)</td>
<td>25 (59.52)</td>
<td>0.731</td>
</tr>
<tr>
<td>Marital status (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>13 (24.07)</td>
<td>14 (33.33)</td>
<td>0.562</td>
</tr>
<tr>
<td>Married</td>
<td>12 (22.22)</td>
<td>7 (16.67)</td>
<td></td>
</tr>
<tr>
<td>Other (separated, divorced, widowed)</td>
<td>29 (53.70)</td>
<td>21 (50.00)</td>
<td></td>
</tr>
<tr>
<td>Smoking (%)</td>
<td>16 (29.63)</td>
<td>15 (35.71)</td>
<td>0.527</td>
</tr>
<tr>
<td>Exercises over once a week (%)</td>
<td>28 (51.85)</td>
<td>21 (50.00)</td>
<td>0.857</td>
</tr>
<tr>
<td>Disease prevalence (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>30 (55.56)</td>
<td>12 (28.57)</td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>16 (29.63)</td>
<td>16 (38.10)</td>
<td>0.041</td>
</tr>
<tr>
<td>Heart failure</td>
<td>3 (5.56)</td>
<td>7 (16.67)</td>
<td></td>
</tr>
<tr>
<td>Stroke</td>
<td>5 (9.26)</td>
<td>7 (16.67)</td>
<td></td>
</tr>
<tr>
<td>Mean MMSE score (SD)</td>
<td>27.00 (1.69)</td>
<td>26.81 (1.57)</td>
<td>0.614</td>
</tr>
</tbody>
</table>
DISCUSSION

Along with increased incidence of late-life depression, the consumption of fatty acids either from animal or plant sources has diminished in older populations. Much more attention has drawn to a relationship between fish consumption and depression in aging people. The present study showed an interventional relationship between high fish consumption and depressive symptoms in aging adults; in other words, multiajusted analysis demonstrated that greater consumption of fish reduced the odds of developing depression (around 70% likelihood vs the control) founded on the GDS-15 and GHQ-12 after controlling across a range of behavioral and sociodemographic characteristics. This finding was confirmed by other scholars whose studies exhibited an inverse association of fish consumption with depressive symptoms in community-living seniors. However, there has some conflicting evidence against the correlation between fish intake and depressive symptomatology among the middle aged and elderly. This might be explained by the effect of confounders namely demographics, regional factors, personality, socioeconomic level, income status, ethnic/cultural identity, occupation, dispositional optimism and so forth. Indeed, it was indicated that bereavement, sleep disturbances, disability, previous depression, and gender account for risk factors of depression. The large 10/66 study showed that the association between fish intake and depression among the elderly considerably differed from one nation to another with various incomes. Moreover, male Melbourne Chinese and Caucasian presented different levels of platelet phospholipids n-3 PUFA. This implies that ethnic and demographic factors play a pivotal role in the interplay of diet and depression. In this regard, high-fish consumption was merely linked to decreased likelihood of depressive symptoms in European descent however several population-based studies in North America, South America, Asia, and Oceania failed to observe such association. Of all different dietary habits, the greatest fish consumption was observed in individuals with no or low depressive symptoms and vice versa. In a similar way, a deficit in omega-3 PUFAs leads to depression. Martin, for example, showed that an inadequate amount of omega-3 PUFAs may cause a higher frequency of depressive disorders. Some studies have indicated the contribution of omega-3 fatty acids intake to the management of depression and concluded that the content of phospholipids PUFAs in human tissues acts as an antidepressant during adulthood. On the other hand, a lack of omega-3 PUFAs causes different medical conditions such as some types of cancer, and neurological, cardiovascular, autoimmune and metabolic diseases. Furthermore, an interventional association has been reported between intakes of omega-3 fatty acids from fish and a decrease in atherosclerotic process.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Result by study group</th>
<th>Comparison between groups A and B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group A</td>
<td>Group B</td>
</tr>
<tr>
<td>Mean GDS score (SD)</td>
<td>Baseline</td>
<td>3.67 (2.08)</td>
</tr>
<tr>
<td></td>
<td>3 months</td>
<td>2.83 (1.99)</td>
</tr>
<tr>
<td>Mean GHQ score (SD)</td>
<td>Baseline</td>
<td>4.11 (2.32)</td>
</tr>
<tr>
<td></td>
<td>3 months</td>
<td>2.93 (2.13)</td>
</tr>
</tbody>
</table>

* Mann-Whitney U; ANCOVA adjusting for age, gender, and baseline measures

Table III. GDS <7 and GHQ <5 (dichotomous outcomes) as well as odds ratio for group A vs. group B with 95% confidence intervals.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Result by study group</th>
<th>Comparison between Groups A and B</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDS &lt;7</td>
<td>Group A</td>
<td>Group B</td>
</tr>
<tr>
<td></td>
<td>3 months</td>
<td>41 (75.92)</td>
</tr>
<tr>
<td>GHQ &lt;5</td>
<td>Group A</td>
<td>Group B</td>
</tr>
<tr>
<td></td>
<td>3 months</td>
<td>42 (77.78)</td>
</tr>
</tbody>
</table>

* Chi squared test; model adjusted for age and gender.
Of omega-3 PUFAs, docosahexanoic acid and eicosapentaenoic acid are highly related to the etiology of depression. An abnormal metabolism of omega-3 long chain-PUFAs was connected to depression. Additionally, fish consumption and changes in fatty acids were shown to have a relationship with the inflammatory response. The consumption of fish more than 150 g per week attenuated levels of proinflammatory markers, which, in turn, have positive impacts on depressive symptomatology. Strengths of this investigation regard the design of the study where two validated instruments were used to measure outcomes. Furthermore, control over confounders using a randomized controlled trial among community-living older adults was reduced the potential of recall bias. The present study lacks screening tools based on somatic symptoms.

In conclusion, the population of older people is on the rise across the globe and they still stand in need of more attention due to the spread of late-life depression. Concerning the influence of national and cultural parameters, this study was developed to examine the association between fish consumption and depression among Iranian older adults. It was indicated that there was an inverse connection between high fish consumption and the presence of depression symptoms. Therefore, the higher consumption of fishes as rich source of omega-3 fatty acids is useful for the treatment and management of depressive diseases. However, this improvement was not statistically significant.

Acknowledgement

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References

The effect of regular fish consumption on depression


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