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Food groups and fatty acids associated with self-reported depression: An analysis from the Australian National Nutrition and Health Surveys

Barbara J. Meyer Ph.D. [a,*], Nithin Kolanu M.D. [a], David A. Griffiths Ph.D. [b], Ben Grounds M.P.H. [a], Peter R.C. Howe Ph.D. [c], Irene A. Kreis M.D., Ph.D. [d]

[a] School of Health Sciences, Metabolic Research Centre, University of Wollongong, Wollongong, NSW, Australia
[b] Centre for Statistical and Survey Methodology, School of Mathematics and Applied Statistics, University of Wollongong, Wollongong, NSW, Australia
[c] Clinical Nutrition Research Centre, University of Newcastle, Callaghan, Australia
[d] Centre for Academic Systems and Resources (CASR), University of Wollongong, Wollongong, NSW, Australia

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ABSTRACT

Objective: The aim of this study was to explore the associations between incidence of depression and dietary intakes of foods and fatty acids in adult Australians.
Methods: Data from the 1995 Australian National Nutrition Survey (NNS), the 1995 Australian National Health Survey (NHS) and an updated fatty acid database were merged and the 24-h fatty acid intakes were calculated for the 10 986 adult participants ages 18 to 79 y in the 1995 NNS. The merged data set was used to run a logistic regression with depression as the response variable and the food groups and calculated fatty acid values, age, and sex as predictors.
Results: The regression model indicated that increased intakes per kilojoule of meat, poultry, and game; vegetables; and eicosapentaenoic acid (EPA) are associated with lower odds of having depression, whereas increased intakes of non-alcoholic beverages, milk products and dishes, and docosapentaenoic acid (DPA) are associated with an increase in the odds of having depression. The results confirm a collective effect of diet on mood. Although other studies have shown that fish consumption is associated with lower odds of depression, this study showed lower odds of depression with high meat consumption, possibly reflecting the fact that Australians consume six times more meat than fish.
Conclusion: Significant associations between food and mood identified in this study warrant further research to determine causality.

Introduction

The prevalence of depression in the United States has more than doubled over the past 10 y, and it is a major cause of morbidity and disability in the Western world [1]. Depression is among the 10 leading conditions causing disability in Australia [2]. Gender differences are well documented with a higher prevalence of depression in women [3–5].

The effect of food on mood is a complex area [6]. Some studies have shown beneficial effects from the Mediterranean diet (specifically fruit and nut consumption, monounsaturated/saturated fat ratio and legumes) [7], whereas others have shown benefits of meat and vegetable consumption on depression [3]. Some studies have shown an association between fruit and vegetables and reduced depressive symptoms [8,9], whereas energy-dense foods have been associated with increased depression [8]. These poorer food choices can become a vicious cycle because foods consumed affect mood and mood affects food choices [10].

A large cross-national study noted that fish consumption correlated negatively with the prevalence of major depression [11]. There are many more studies that have shown beneficial effects of fish consumption on depression [4,5,12–17]. Fish is a rich source of long-chain ω-3 polyunsaturated fatty acids (LC ω-3 PUFA) [17]. Recent research reflects an increasing awareness of the importance of ω-3 and ω-6 PUFA in the pathogenesis and management of depression and other mood disorders [18,19]. Some studies show the direct protective effect

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* Corresponding author. Tel.: +61 2 4221 3459; fax: +61 2 4221 5945.
E-mail address: bmeyer@uow.edu.au (B. J. Meyer).

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of LC ω-3 PUFA on depression [5], whereas other studies show that a low ω-6/ω-3 PUFA ratio is important [20]. More recently, a prospective study shows no protective effects of LC ω-3 PUFA on depression, but a high ratio of α-linolenic acid to linoleic acid is associated with a reduced risk for depression [21].

In order to elucidate the role of these fatty acids in people with depression, several randomized controlled trials of PUFA supplementation have been conducted with patients diagnosed with depression. Some of these have shown significant improvements in the condition of the patients [22–24], whereas others are equivocal [25–27]. Such inconsistency in results may have been due to a difference in the PUFA type and dose used in different studies, relatively small sample sizes, and use of non-pharmacologic interventions such as counseling in both control and intervention groups [26].

An updated meta-analysis of the effects of LC ω-3 PUFA on people diagnosed with depression concluded that there is evidence for the effect of LC ω-3 PUFA on mood, but recognizing that there is great heterogeneity among the studies [28]. Furthermore, most trials have used a combination of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) and it is unclear which is more important or if a combination is important, although a recent meta-analysis suggests that EPA may be more efficacious than DHA in treating depression but more research is warranted [29].

Given that some studies have shown the benefits of certain foods in relation to risk for depression, whereas other studies have focused on specific fatty acids in relation to risk for depression, no studies have assessed foods and fatty acids together. Therefore, the aim of this study was to determine if there was an association between food groups as well as dietary PUFA intakes and depression in an Australian population using the 1995 Australian National Nutrition and Health Surveys (NHS) together with an updated fatty acid database.

Experimental methods

Data

Data for the present study were obtained from three sources: the 1995 NHS, the 1995 Australian National Nutrition Survey (NNS) [30], and a fatty acid database (FA database) [31].

The 1995 NHS collected data about the health status, use of health services, and health-related lifestyle of 57 633 people from 21 787 households across Australia [32]. The NNS was conducted on a subset of the respondents to the NHS, and included data from 10 986 adult individuals. Trained personnel administered the NNS and collected data regarding the 24-h food intake of the participants, frequency of various food consumption, and data regarding health status [33]. The NNS and the NHS data were available in the form of a confidentialized unit record file (CURF) released by the Australian Bureau of Statistics for research purposes. No ethics approval was required or sought because the Australian Bureau of Statistics collected the data as part of its statutory obligation to collect data that does not require ethics. The data was made available to universities with conditions of use as outlined in their technical paper [34]. The FA database was the updated [35] fatty acid extension of the Australian Nutrient database from the Food Standards Australia and New Zealand. It contained updated quantities of fatty acids for different types of foods, coded with the same food codes as in the 1995 NNS.

The participants were asked about any recent illness (defined as "medical conditions during the 2 wk prior to the interview") or long-term illness (defined as "conditions that lasted at least 6 mo or which the respondent expects to last for 6 mo") that they had suffered. The responses of both recent and long-term illnesses were coded as conditions suffered according to a classification based on the ICD-10 classification of diseases [32]. Depression was one of these medical conditions. The data, therefore, included those with depression at the time of the survey or within 6 mo before.

Merging and calculation

Merging files from the three sources, calculation, and statistical analyses were conducted using Statistical Analysis Software version 9.1 [SAS; SAS Institute Inc., Cary, NC, USA].

The NNS and NHS data were merged as described in the NNS CURF technical paper [30]. Food codes were used to merge the fatty acid data from the FA database to this merged NNS–NHS data set. Subsequently, the total intake of each of the fatty acids per day for each person was calculated.

Study participants

The present study included all those participants for whom both the 1995 NNS and the 1995 NHS data were available: 10 986 adult Australians ages 18 and above were included [32].

Statistical analysis

The sex, age, certain food groups, EPA and DPA were included as predictor variables and self-reported depression was included as the response variable and logistic regression was performed using SAS 9.1 [SAS Institute Inc., Cary, NC, USA] and the odds ratios and 95% confidence intervals were estimated. A P-value < 0.05 was considered significant in this study.

Modified variables

The data covered a wide interval of ages and therefore it was presumed that modeling age as a linear predictor would be inadequate. Among various alternative approaches, including both age and its square root as linear predictors proved effective in modeling the non-linear influence of age on depression.

Stepwise elimination of non-significant variables led to a preferred model with nine predictors: sex, age, square root of age, and intake measures for four different food groups, EPA and docosapentaenoic acid (DPA). The four different food groups were non-alcoholic beverages; meat poultry, and game; milk product and dishes; and vegetable products and dishes.

Results

The population characteristics of the participants have been described elsewhere [35]. Table 1 shows the number of participants with and without depression grouped by sex and age categories, with similar representation of both sexes (48% men and 52% women). A majority of the participants (57%) belonged to the 25 to 64 y age group.

The best logistic regression model (Table 2) showed that, in addition to age ($P = 0.031$) and gender ($P < 0.0001$), intakes of the following four food groups and two fatty acids were significant predictors of depression: meat, poultry, and game products ($P = 0.002$); milk products and dishes ($P = 0.009$); non-alcoholic beverages ($P = 0.01$); vegetable products and dishes ($P = 0.015$); EPA (0.027); and DPA ($P = 0.0291$). The ω-6/ω-3 ratio was not significant and did not contribute to the regression model. The intakes of the four food groups and fatty acids are shown in Tables 3 and 4. Men with depression had 25% significantly lower intakes of meat ($P < 0.05$) and arachidonic acid ($P < 0.05$) compared with men without depression (Table 3). Women with depression had 20% significantly increased intakes of non-alcoholic beverages ($P < 0.05$) and milk products and dishes ($P < 0.05$) compared with women without depression (Table 4). There was also a 12% lower intake of vegetable products and dishes in women with depression compared with women without depression but this did not reach significance ($P = 0.062$). Alcohol and/or fish consumption did not contribute to the prediction of depression in men, women, or the whole adult population.

The data set covered a wide interval of ages and hence it was presumed that modeling age as a "linear" predictor would be inadequate. Among various alternative approaches, including both age and its square root as linear predictors proved effective in modeling the non-linear influence of age on depression. The probability of having depression was estimated using the regression equation from the best-fitting model (Table 2). Figure 1 is based on arbitrarily setting each food group and fatty acid intake to its median level and plotting the effect of change in