

# Is there an association between a high fat diet and depression: systemic review of observational studies?

## Abstract

**Background:** There are many studies on association between some biological factors and depression. However there are not too many studies showing association between depression and fatty diet. The aim of this study is to provide a systemic review on association between depression and fatty diet.

**Methods:** the systemic review focused on studies that link diet and depression with emphasis on fatty diet and depression as the outcome. Inclusion criteria for the review includes one quantitative assessed dietary variable in the analysis with depression or depressive symptoms as outcome.

**Results:** from the reviewed prospective studies, diet high in fat content (TFA) have high probability for depressive symptoms while diet rich in Omega 3 fatty acid and MUFA such as olive oil and fish have a weak inverse association.<sup>1</sup>

**Conclusion:** the relationship between fatty acids and depression has been examined in observational and experimental studies. Both studies indicate that depressive symptoms are unlikely in individuals that have lower concentration of  $\omega$ -3 fatty acid and more likely in those with higher concentration of  $\omega$ -6 fatty acid.

## Introduction

Depression affects people in all community worldwide and significantly contributes to global burden of disease. Estimate of more than 350 million people are affected by depression. It is the leading cause of disability worldwide. Diet is an important biophysiology factor that plays a central role in the overall health of an individual. Studies have shown that healthier eating pattern is associated with better health outcomes including mental health.<sup>2</sup> From preventive health perspective findings, association between fatty diet and depression can be applied in evidence-based primary care of depressive symptoms.<sup>3</sup> Recently there is emerging evidence that links nutrition pattern to risk of depression. Depression relates to biomarkers of short and long term polysaturated fatty acid intake. There are so many studies on nutrition and depressive symptoms. However there are no enough data on association between high fat diet and depression. The aim of this review is to assess if there is relationship between fat content of the diet and depression.

## Results

Author	Study Design	Subjects	Diet Assessment	Depression Assessment	Adjustment of potential confounders	Results
Akbaraly TN et al. <sup>4</sup>	Whitehall II prospective Cohort	3486 London based office staff ages 35-55years working in civil service departments	Food Frequency Questionnaire based on US Nurses' Health Study	Center of Epidemiologic studies Depression scale (CES-D)	In the fully adjusted model, age, gender, energy intake, marital status, physical activity, pre-existing medical conditions, antidepressant drugs and cognitive functions were all adjusted for	Participants with high intake of whole food were less likely to report CES-D depression: OR = 0.64 (95% CI 0.49–0.83) in contrary to those with high intake of processed food that have high odds of depression OR = 1.58 (95% CI 1.11–2.23).

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## Materials and methods

The study design compromises of cohort studies cross sectional designs and case- control study published within ten years of the review. Ten databases were searched for observational studies on the association between fatty diet and depression. The search was limited to English Language report. Search term was diet, nutrition,  $\omega$ -3 fatty acid, PUFA, MUFA and depression/depressive symptoms. Inclusion criteria for the review includes one quantitative assessed dietary variable in the analysis with depression or depressive symptoms as outcome. The study must have a validated tool for dietary assessment such as food frequency questionnaire with at least 35 validated items. Assessment of depression should be based on a standard measurement such as physician diagnosis or initiation of anti-depressant etc. Some selected articles and reviews in the references were tracked to see if they met the inclusion criteria. For articles included in the review, the following information were obtained; the author's name and publication year, setting and study design, data analysis, subject characteristics (age and sex), dietary assessment instrument, depression assessment tool, adjusted variable (if any) and the main findings.

Table Continued

Author	Study Design	Subjects	Diet Assessment	Depression Assessment	Adjustment of potential confounders	Results
Brinkworth et al. <sup>5</sup>	Prospective cohort study	118 obese Australian women with ages between 24- 64years were randomized to low carbohydrate and low fat diet.	Participants on Low fat diet were restricted to dietary profile that have less than 8% saturated fat	Beck depression inventory was used to assess outcome ( depression)		Improvement in mood including depression were observed in both LC and LF group but long term effect of this result was only sustained in LF gp but not in the LC group.
Port et al. <sup>6</sup>	Gazel Cohort study	An ongoing cohort study set up in 1989 with employees of France natural gas and electricity company. Initially constitute of 15,011 men and 5,614 women ages 35-50.	The food frequency Questionnaires was used to ascertain dietary assessment	Center of Epidemiologic studies Depression scale (CES-D)	Covariates such as age were adjusted for.	Western diet 1.36(1.18-1.57) and snacking 1.49(1.29-1.72) are more likely to have high CES-D score compared to healthy diet 0.69(0.60-0.80)
Lucas et al. <sup>3</sup>	Prospective study	54,632 Us women from the Nurse's health study ages 50-77 years who have no depressive symptoms at baseline were follow up for 10 years	The validated food frequency questionnaire was use as dietary assessment tool	Depression was assessed based on physician diagnosis of depression and regular use of anti- depressant.	The following covariate were adjusted for; age, time interval, hormonal status, race, smoking status, alcohol, physical activity,	ALA( a-linoleic acid) 0.99(0.88, 1.15) intake was associated with risk of depression however there is no protective effect from fish consumption omega 3 fatty acid intake. This could be due to limitations in assessing individual food components
Sanchez et al. <sup>7</sup>	The Sun Project: a prospective study among mediterranean population	12,059 Spanish university graduates with mean age of 37.5 were followed for 11 years.	136 validated food frequency questionnaire with was used to estimate the fat content in food	Depression was assessed based on physician diagnosis and initiation of antidepressants.	The following covariates were adjusted for; age , sex, potential lifestyle such as physical activity, smoking, total energy intake and baseline BMI	HR and 95% CI for trans unsaturated fatty acid (TFA) 1.42 (1.09-1.84) with a significant dose response relationship. There was no substantial change in the result after adjusting for potential life style and adherence to mediterranean diet. On the contrary an inverse relationship was obtained for MUFA and PUFA
Wolfe et al. <sup>8</sup> -2009 United States	National Health and Nutrition Examination Survey Epidemiology Follow-up (NHEFS). 4856 subjects: 1947 Male, 2909 female. 32-86 years.	Dietary intake of fatty acids: 24-h dietary recall at baseline	Assessed only at follow-up using the CES-D scale.	The following covariates		Saturated FA: No association with Severe Depressive Mood (SDM). Linoleic FA: Positively associated with the risk of SDM in Men .OR of SDM by intake tertiles: first tertile: 1 (Reference); second tertile: 1.64 (95% CI = 1.06-2.54); third tertile: 2.34 (95% CI = 1.41-3.87) Oleic fatty acids: Negatively associated with the risk of SDM in women. OR of SDM by intake tertiles 95% CI: first tertile: 1 (Reference); second tertile: 0.88 (95% CI = 0.56-1.38); third tertile: 0.48 (95% CI = 0.25-0.95)

Table Continued

Author	Study Design	Subjects	Diet Assessment	Depression Assessment	Adjustment of potential confounders	Results
Cross sectional designs Tanskanen et al. <sup>6</sup>	Questionnaire survey, Finland, 1999, cross-sectional design	Community residents ages 25–64 years were randomly sampled	Food frequency Questionnaire (FFQ) with 132 Validated items.	Beck Depression Inventory (BDI) 21 items, potential score of 0–63	Sex, age, marital status, education, employment status, work ability, area of living, financial status, general health, smoking, alcohol intake, coffee drinking, physical activity	Significantly lower risk of being depressed ( $BDI \geq 10$ ) in frequent than more infrequent lake-fish consumers (OR 95% CI): 0.63 (0.43, 0.944)
Sontrop et al. <sup>9</sup>	Prenatal Health Project, Canada, 2002–2005, cross-sectional design	2061 pregnant women between 10 and 22 weeks gestation	FFQ with 106 validated item	CES-D, 20 items, potential score of 0–60	Age, marital status, education, income, occupational stress, smoking status, physical activity and energy intake	68% reported fish consumption $\geq$ once/wk. Median intake of EPA+DHA: 85.1 mg/day. Mean score (SD) of CES-D: 9.9 (8.0). No relation of intake (crude) of fish or EPA+DHA with CES-D score
Case control design Browne et al. <sup>10</sup>	Survey, New Zealand, case-control design	Subjects were 80 first-time mothers (41 with postnatal depression) and 39 without postnatal depression,	Food frequency Questionnaire (FFQ) was given during pregnancy.	EPDS, 10 items, potential score of 0–30. BDI, 21-items, potential score of 0–63	Household income, current breastfeeding	No relation of consumption frequency of fish with the risk of postnatal depression

## Discussion

We reviewed six cohort studies to determine the association between fat content of diet and depression. The result shows that western diet and processed food that are rich in  $\omega$ -6 fatty acid are more likely to be associated with increased risk of depression<sup>3–8</sup>. On the contrary  $\omega$ -3 fatty acid found in fish decreases the likelihood of depressive symptoms. Although some of the studies fail to demonstrate this inverse relationship due to limitation in assessing individual food components in the food frequency questionnaire<sup>3,9,10</sup>.  $\omega$ -9 fatty acid in human diet is oleic acid, the predominant MUFA in olive oil. Studies have shown that  $\omega$ -9 fatty acid has a protective effect against various health conditions, including cancer<sup>11</sup> and cardiovascular disease.<sup>12</sup> In addition to the list, recent studies indicates that diet rich in  $\omega$ -9 fatty acid is associated with reduced likelihood of severe depressive mood.<sup>8</sup> Consumption of whole diet including high intake of fish seems to be protective against depression.<sup>1</sup> This protective effect could be attributed to its high content of long-chain  $\omega$ -3 polyunsaturated fatty acids. This is one of the main components of neuron membranes and is found to have vascular and anti-inflammatory properties.<sup>4,5</sup> Furthermore studies have shown that adding omega 3 fatty acid to antidepressant therapy could help improve mood. Conversely possible explanations that links depression to fatty diet is that these foods are implicated in inflammation and cardiovascular diseases which are both related to developing depressive symptoms.<sup>4</sup> Most studies have shown that depression like other mood disorders are directly proportional to brain neurotropic levels. High fat diet reduces neurotropic levels possibly by alteration of cortisone levels.<sup>13–30</sup>

## Conclusion

The relationship between fatty acids and depression has been examined in observational and experimental studies. Both studies

show that depressive symptoms are unlikely in individuals with lower concentration of  $\omega$ -3 fatty acid and more likely in those with higher concentration of  $\omega$ -6 fatty acid. Although the result explains the association between depression and fat content of diet, reverse causality cannot be totally ruled out. Life stressors may not only precipitate depression but also unhealthy eating lifestyles. A more likely proposed theory is that unhealthy eating could be used to ameliorate unpleasant mood. However in most of the studies when adjusted for life stressor the result still remains the same. In future more randomized trials are needed to determine role of  $\omega$ -3 fatty acid in treatment of depression.

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## Conflict of interest

Authors declare that there is no conflict of interest.

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