

# **The Role of Nutrition in Mental Health: Depression**

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## **Abstract:**

Depression is a complex mental illness that can be debilitating for those affected. Although the cause of depression can be unique to each person, symptoms often include negative self-perception, low self-esteem and suicidal thoughts. Currently, depression is often treated with a combination of therapy and medication, the latter with an inherent risk of unwanted side effects. A literature search was conducted using online databases such as Pubmed, Medline (Ovid), Web of Science, and Google Scholar to review published peer-reviewed articles that investigated a connection between dietary habits and risk of depression as well as nutritional interventions used to treat symptoms of depression. Additionally, online government and non-government websites were used to report the prevalence of depression and surveys were used to assess depression symptoms. In summary, the literature suggests a link between dietary habits and risk of depression. Studies have implicated a relatively low intake of fish, omega 3 fatty acids and fruits and vegetables as risk factors for depression. In addition, relatively high amounts of refined sugar and processed foods have shown to increase the risk of depression. Although promising, more nutrition-based intervention studies are required to firmly establish effective diet-based treatments for people diagnosed with depression.

## **Depression:**

Depression is an affective disorder that compromises an individual's ability to perform day-to-day tasks due to feelings of sadness, leading to chronic symptoms affecting everyday functioning (1). Depression is an umbrella term that includes psychotic depression, postpartum depression, seasonal affective disorder, and the most commonly diagnosed forms of depression: major depressive disorder and dysthymic disorder. Major depressive disorder presents with such symptoms as decreased mood, increased sadness and anxiety, loss of appetite, loss of interest in pleasurable activities, and more (2). Dysthymic disorder is also a form of depression, but presents with milder symptoms than major depressive disorder (1).

## **Depression in Canada:**

According to the 2002 Canadian Community Health Survey, 3.7% of men and 5.9% of women living in Canada met the Diagnostic and Statistical Manual of Mental Disorders IV (DSM IV) criteria for self-reported depression and, more specifically, 3.5% of men and 6.0% of women met these criteria in Ontario (3). In addition, approximately 8 of every 100 adult Canadians will experience major depression at some point in their lifetime (4).

## Depression, medication and nutrition:

Depression is often treated with antidepressants and other prescription medication which often lead to severe side effects and the termination of continued medication (2, 5). Recently, nutritional status has been linked to depression, and several epidemiological studies have assessed its relationship with micro- and macro-nutrient consumption. Micronutrient deficiencies in folic acid (6, 7), thiamine (6), magnesium (8), and omega 3 (n-3) fatty acids (2, 9) have been linked to the prevalence of depression. Some have attributed these deficiencies to an American (6) or Westernized diet (2) which is low in fiber, fruits and vegetables, and fish intake, and high in processed foods.

### *Depression and diet patterns*

In a 2009 study (10), the final phase included 3,486 adult men and women (age 33-55 y) who were categorized as having either a “whole food” (rich in fish, fruits and vegetables) or “processed food” (rich in processed meat, chocolates, sweet desserts, pies, condiments, fried food, refined cereals and high fat dairy products) dietary pattern. After adjusting for covariates (gender, age, energy intake, marital status, employment grade, education, physical activity and smoking habits, hypertension, diabetes, cardiovascular disease, self-reported stroke, use of antidepressive drugs and cognitive functioning), participants in the highest tertile of the ‘whole food’ dietary pattern were the least likely to be depressed (OR = 0.74, 95% CI 0.56-0.99, P = 0.04) compared to the lowest tertile based on the Center for Epidemiologic Studies- Depression Scale (CES-D scale). Dietary pattern factor scores based on the food frequency questionnaire (FFQ) revealed that participants in the highest tertile of the ‘processed food’ dietary pattern were at greater risk for depression compared to those in the lowest tertile (OR = 1.58, 95% CI 1.11-2.23, P = 0.01). These results were based on respondents, some self-identified as having depression and some not. Therefore, a diet rich in processed foods may increase the risk of depression, or those already at greater risk of depression may tend to consume more processed foods. To address this issue, the authors removed those who self-identified as having depression at phase 5. The reanalyzed data revealed that those in the highest tertile of the ‘whole food’ dietary pattern were least likely to be at risk for depression compared to those in the lowest tertile of the ‘whole food’ dietary pattern (OR = 0.73, 5% CI 0.51–1.02, P = 0.07). In addition, those in the highest tertile of the ‘processed food’ dietary pattern were found to be at greater risk of depression compared to the lowest tertile of the ‘processed food’ dietary pattern (OR = 1.69, 95% CI 1.10–2.60, P = 0.02). Although the authors concluded that the latter results (i.e. excluding individuals who self-identified as having depression at phase 5) confirm that the lower the quality of the diet the higher the risk of depression, cause and effect cannot be established because this was an epidemiological study. The role of each individual food item in the risk of depression was not assessed.

A 2008 study (11) involving elderly men and women, aged 65 y and older, found that “healthy” eaters, men who consumed higher amounts of fish and women who consumed higher amounts of fruits and vegetables, had better cognitive performance and self-related health in both sexes, as well as less depressive symptoms in women. In men, “healthy” eaters had significantly lower scores of depression (lower CES-D scores) compared to those identified as “pasta eaters” (5.0 vs 7.2, P < 0.05). In women, “healthy” eaters had significantly lower CES-D scores compared to the

“biscuits and snacking” group (8.6 vs. 10.8,  $P < 0.05$ ). Although there were relative differences between groups in this study, no group had average scores above 15 (scores of 15-21 would have indicated a low to moderate risk of depression) (12). Moreover, Sarlio-Lähteenkorva (13) showed that 6,243 middle-aged men and women with poor mental health were less likely to eat fruits and berries; this finding was independent of socioeconomic status and health behaviors. The results from the two studies above possibly demonstrate a cyclical pattern of poor eating habits leading to depression and then depression exacerbating poor eating habits.

In 2001, Allgöwer et al (14) conducted a study involving 5,529 undergraduate students (age 18-30 y) but did not find an association between fruit intake and depression. Respondents who reported eating at least one serving of fruit each day were considered “healthy eaters” and those who ate less than one serving were considered “unhealthy eaters”. The latter criterion (less than one serving of fruit each day) may have been too exclusive to determine an “unhealthy” diet as it represents an extreme of the population who eats less than an average of one serving each day, while the former criterion for a “healthy” diet is far more heterogeneous due to the wide range of servings of fruit intake (at least one serving of fruit each day), making it difficult to determine those who are truly healthy eaters compared to those who are unhealthy eaters. Alternatively, the results may indicate that vegetables are primarily responsible for the relief of depressive symptoms. Interestingly, Allgöwer et al (14) also found that men and women were at greater risk for depression if they rarely or never ate breakfast (women OR = 1.68, 95% CI 1.18-2.41,  $P = 0.004$ ; men OR = 1.85, 95% CI 1.24-2.76,  $P = 0.003$ ). There was no increased risk for depression when participants reported they did not make a conscious effort to avoid foods that contain fat and cholesterol (women OR = 1.05, 95% CI 0.91-1.21,  $P = 0.660$ ; men OR = 1.13, 95% CI 0.86-1.47 CI,  $P = 0.380$ ); this may be due in part to the limited income of the respondents (average age of 21 y) and the relatively inexpensive price of high fat, fast foods (15, 16) (Huang 1994, Shirley 1998).

Other studies have found that higher servings of fish and n-3 fatty acids have also been associated with positive effects on depression (17, 18). Edwards et al (17) found that a small sample of ten men and women (depressed patients aged  $39 \pm 10$  y; controls aged  $39 \pm 11$  y) who were diagnosed with a major depressive episode according to the DSM-IV criteria consumed 27% less n-3 fatty acids in their diet compared to healthy controls, however this difference was not statistically significant ( $P = 0.10$ ). In addition, depressed individuals had 29% less n-3 fatty acids in red blood cell (RBC) membranes compared to healthy controls ( $P = 0.02$ ). An epidemiological study (9) of 3,204 Finnish men and women (age 25-64 y) revealed that mild to severe depressive symptoms were found to be more prevalent among women who consumed fish less than once per week compared to women who consumed fish more than once per week (34.2 % vs. 27.0 %,  $P < 0.01$ ). A similar trend was found among men, however the relationship was not statistically significant (28.5 % vs. 25.9 %).

#### *Depression and omega 3 fatty acids*

Another study (19) with 20 adults (age 19-79 y) with predominantly moderate depression found that the ratio of n-6:n-3 fatty acids may be implicated in moderating the severity of depressive symptoms. A significant positive correlation was found between the ratio of n-6:n-3 fatty acids in RBC and two different rating scales of depression (linear rating scale:  $r = 0.729$ ,  $P < 0.01$ ;

Hamilton rating scale:  $r = 0.472$ ,  $P < 0.05$ ), whereby higher scores indicate greater risk of depression. A higher n-6:n-3 ratio results in overproduction of thromboxane, leukotrienes and prostacyclin (19, 20), as well as inflammatory mediators such as cytokines and interleukins, in cell membranes and other tissues (19, 21). An increase in circulating pro-inflammatory cytokines has been shown to induce a behavioral pattern known as sickness behavior, which shares some symptomatic similarities with major depression (22, 23). Sickness behavior can hinder feelings of pleasure, as well as decrease both energy intake and expenditure (22, 24), which may partially explain the nutritional deficiencies noted above.

### *Depression and refined sugar*

Although nutritional deficiencies have been associated with increased risk of depression, an excess of macronutrients, particularly refined sugar, has also been linked to depression (25). A cross-national study (25) including 6 countries (Canada, France, Germany, Korea, United States and New Zealand) established a strong, positive correlation between national sugar consumption and rates of depression ( $r = 0.948$ ,  $P = 0.004$ ).

### Discussion:

Some epidemiological studies have demonstrated that a connection exists between the risk of depression and dietary habits. Studies have linked deficiencies in micronutrients (folic acid, thiamine, magnesium) and omega 3 (n-3) fatty acids to an increased risk of depression. Other studies have found associations attributing low intake of fish, fruits and vegetables and high intake of refined sugar, desserts and processed meats to an elevated risk of depression. The literature does not consistently agree with the findings previously mentioned. More clinical trials are needed to ascertain whether correcting nutrient deficiencies or minimizing the excessive intake of certain micronutrients or foods would reduce the risk and/or the symptoms of depression. Proper nutrition may prove to be an affordable investment for people diagnosed with depression to mitigate their symptoms and improve overall health.

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