



Editorial

Depression is a major cause of disability worldwide and the impact of diet on mental health is raising increasing interest. Two studies presented in this issue have examined the relationship between dietary patterns and the presence of depressive symptoms in large samples of adults.

Both studies evidenced that dietary patterns rich in processed food, sugar and refined grains were associated with higher levels of depressive symptoms. By contrast, the British study showed that a healthy diet characterized by high intake of vegetables, fruits, and fish was associated with lower depressive symptoms, whereas no protective dietary pattern could be evidenced in the Australian study. A common limitation of these studies is their cross-sectional design which cannot rule out reverse causality.

Nevertheless, as explained in the accompanying review, these findings have biological plausibility. Depression is more prevalent among people with high plasma homocysteine. Folate and other B vitamins found in green leafy vegetables and whole grain can lower plasma homocysteine. Long-chain omega 3 polyunsaturated fatty acids found in fish play a major role in brain function and structure. Conversely, a high glycemic load diet is associated with worsening of mood.

The clear suggestion is that dietary intake of vegetables, fruits and fish, provide a set of nutrients that could contribute to improve well-being. As often noted in nutrition, the sum of the parts is greater than the whole.

Pascale Barberger-Gateau

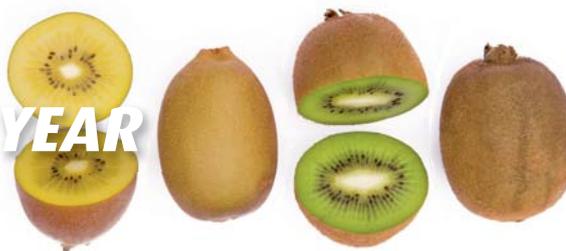
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The role of nutrition in mental health

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According to the National Institute of Mental health, the two major causes of disability worldwide are anxiety, closely followed by depression. In 2010 a meta-analysis published in JAMA¹ found that while there are substantial benefits for anti-depressant medications in those with severe depression, the benefits are either mild or non-existent for those with milder forms of the condition. Considering the human and economic costs, there is a need to find alternatives for mental health issues. As poor nutrition has been considered as a risk factor for depression, this review aims to evaluate the effects of dietary patterns in mental health.

Dietary patterns and mental health

The role of the Mediterranean diet in heart disease, cancer and life expectancy is well known². Recent data now suggests a beneficial role for this diet in mental health. Studies in the United Kingdom and Spain found that a Mediterranean diet rich in fruits, vegetables and seafood is associated with a decreased risk of depressive symptoms compared to a diet rich in meat and high-fat and sweet products³⁻⁴. Foods included in the Mediterranean diet provide rich sources of fibre, antioxidants, omega-3 polyunsaturated fatty acids, magnesium, zinc and other nutrients important for mental health.

Foods with a high glycemic index/load (refined foods and sweetened beverages) are digested quickly and cause a spike in blood sugar and insulin. This fluctuation in blood glucose has negative effects on mood⁵⁻⁶. The same is observed when skipping meals or consuming a high glycemic diet⁷.

Caffeine, consumed not only in coffee and tea but now more often with "energy" drinks, is also well known to be associated with anxiety, so that its consumption should be decreased for people with anxiety disorders.

Micronutrients and mental health

As B-vitamins play a role in plasma homocysteine concentration (B6) and in the production of neurotransmitters (B12), deficiency in these vitamins can represent a risk factor for depression, cognitive dysfunction/decline, and memory loss⁸⁻¹². Folate can

enhance antidepressant therapy¹³ so that prevention should take into account folate deficiency. Deficiency in vitamin D, found in fish, can also have an impact on executive cognitive functions and depression¹⁴.

Iron deficiency is the most common deficiency worldwide, particularly affecting women and young children¹⁵. Iron plays a role in neurotransmitter synthesis and function so that deficiency can cause fatigue, poor concentration, and serve as a risk factor for depression¹⁶⁻¹⁷.

Zinc is involved in cellular metabolism, immune function and DNA synthesis¹⁸; deficiency can cause behavioral and sleep disturbances, as well as the loss of sex drive¹⁹.

Magnesium is involved in numerous biochemical reactions in the body (nerve function, heart rhythm, blood pressure, immune response and insulin regulation)¹⁸. Deficiency is associated with anxiety, irritability and sleep disorders²⁰.

Omega 3 Fatty Acids are essential fatty acids that must be obtained in the diet. Their role in cellular function, vision and nervous system, can explain why deficiency in omega 3 fatty acids may be a risk factor for depression²¹⁻²³.

"The way we eat affects the way we feel"

This sentence sums up what is developed in this review. If dietary supplements, such as B-vitamins or omega 3 fatty acids, can help to prevent or ease depressive symptoms, dietary recommendations should be promoted to help ensure the mental health of the public. A diet rich in fruits, vegetables, whole grains and seafood, close to the Mediterranean diet, could improve nutrient status and prevent mood disorders and mental health diseases.



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Dietary pattern and depressive symptoms in middle age: the Whitehall II study

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Research on the association between diet and depression has focused primarily on isolated nutrients. Recent years have seen a move away from analyzing associations between isolated nutrients and health to consideration of the effects of dietary pattern¹. To the best of our knowledge, our study² was the first to investigate prospectively the association between dietary patterns and the occurrence of depressive symptoms five years later, assessed by the well validated CES-D scale³ (Center for Epidemiologic Studies Depression), in a large British middle aged population, by taking into account a large range of potential cofounders.

Main findings. Analyses were carried on the 3,486 participants (26.2% women, mean age 55.6 years) from the prospective Whitehall II study (WHIS), which originally included London based office workers⁴. Two dietary patterns, derived from using principal component analysis, were identified: the “whole food” heavily loaded by high intake of vegetables, fruits and fish; and the “processed food” which was heavily loaded by high consumption of sweetened desserts, chocolates, fried food, processed meat, pies, refined grains, high fat dairy products and condiments.

After adjusting for a large range of socio-demographic and socio-economic factors, health behaviors and health status factors, participants in the highest tertile of the “whole food” pattern had lower odds of CES-D depression (Odds Ratio=0.74, 95% CI:0.56-0.99) than those in the lowest tertile. By contrast, participants with a

high intake of “processed food” had higher odds of CES-D depression compared to those with the lowest intake (Odds ratio = 1.58, 95% CI: 1.11-2.23). Furthermore, no association was observed between previous reports of depression (using depression subscale of General Health Questionnaire and use of antidepressive drugs) and dietary patterns assessed 6 years later ($p=0.24$ for the “whole food” pattern and $p=0.92$ for the “processed food” pattern) suggesting that the dietary pattern - CES-D depression associations described in this study were due to an effect of diet on depression and not the reverse.

Plausible mechanisms

The association between the whole food pattern and self-reported depression can be explained by the protective effect of:

- 1) high level of antioxidants found in fruits and vegetables, as previous studies have shown higher antioxidant levels to be associated with lower risk of depression⁵.
- 2) folate found in large amounts in green vegetables and dried legumes⁶. It has been suggested that low levels of folate may reduce the availability of S-adenosylmethionine, which can result in impaired formation of myelin, neurotransmitters and membrane phospholipids, and might increase the risk of depression⁷.
- 3) fish on low incidence of depression⁸, which is traditionally attributed to its high long chain omega 3 poly-unsaturated fatty acids content⁹.

Finally, it is also possible that the protective effect of diet on depression comes from the cumulative and synergic effect of nutrients from different sources of foods rather than from the effect of one isolated nutrient.

The deleterious effect of “processed food” on self reported depression is a novel finding. Its high content of sugar can be one underlying pathway as a positive correlation between sugar consumption and the annual rate of depression¹⁰. Furthermore the “processed food” diet is very close to the “Western” pattern identified in American population¹ which has been shown to be associated with higher risk of CHD¹ and inflammation¹¹ possibly involved in pathogenesis of depression. Further studies are needed to better understand the association between “processed food” intake, the inflammation process and depression.

Conclusion

The results suggest that fruits, vegetables and fish consumption afford protection against the onset of depressive symptoms five years later, while a diet rich in processed meat, chocolates, sweet desserts, fried food, refined cereals and high fat dairy products increases vulnerability. These findings suggest that existing healthy eating policies will generate additional benefits to health and well-being, and that diet should be considered as a potential target for the prevention of depressive disorders.



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The role of nutrition in mental health

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In one of the first studies to ignite interest in the possibility of a link between diet and mental health, Joseph Hibbeln¹ demonstrated a strong, inverse correlation between national levels of fish consumption and national prevalence rates of major depression, the highest prevalence psychiatric disorder, across nine countries. In the ensuing years, a significant body of evidence was generated, suggesting a role for long-chain omega-3 polyunsaturated fatty acids. This relationship has significant biological plausibility, as these dietary-derived lipids are the predominant structural fatty acid in the grey matter of the brain². Following on from this interest, researchers in the field of psychiatry began to generate evidence regarding a role for the B-group vitamins in depression³ as these vitamins are also essential for numerous processes in the brain. More recent studies have examined nutrients that are particularly salient to inflammatory and oxidative processes, such as dietary selenium⁴ and magnesium⁵. While psychological stress is known to increase the production of pro-inflammatory cytokines, the relationship appears to be bi-directional, with inflammation, a marker of immune activation, now suggested as a direct contributor to the pathophysiology of depressive illness⁶. Inflammation is accompanied by an accumulation of highly reactive oxygen species, and increased oxidative stress is also implicated as a factor in depressive illnesses⁷. Diet and nutrition are potent modulators of inflammation and oxidative processes.

However, there are clear limits to studying individual nutrients or food components in relation to disease, given the importance of taking into account the complex combinations and synergistic interactions among nutrients, polyphenols, phytochemicals and fibre in our daily diets. Overall dietary quality, assessed using composite measures of dietary intake, is clearly associated with prevalence of, or risk factors for, many disease outcomes, such as cardiovascular disease, cancer and diabetes. However, it is only in the last 12 months that several studies have been published, in high impact scientific journals, describing relationships between overall dietary quality and the high prevalence mental disorders, depression and anxiety.

In the first of these studies, Sanchez-Villagas et al.⁸ identified that low adherence to a Mediterranean diet, long recognised as a healthful pattern of eating, increased the risk for depression over time in middle-aged Spanish adults. The second study in middle-aged public servants identified that those with higher scores on a healthful dietary pattern (vegetables, fruits and fish) were less likely, and those scoring higher on a 'western' (unhealthy foods) dietary pattern more likely, to experience depression over the follow-up period⁹. In each of these studies, the relationships between diet and depression were not explained by socio-economic factors or other health behaviours, nor by 'reverse causality' (dietary changes as a result of depressive symptoms). Similarly, our group¹⁰ has reported that women who scored higher on a dietary pattern comprising vegetables, fruits, lean red meats (predominantly grass fed in Australia), wholegrains and fish were less likely to have clinically significant depressive and/or anxiety disorders, while those scoring higher on a western dietary pattern were more likely to have a depressive disorder and higher levels of psychiatric symptoms. Results of each of these studies point to a critical role for nutrition in the mental health of the population.

Mental illness has major social, psychological, and biological consequences. Psychiatry has not investigated lifestyle modification as a preventative strategy for psychiatric symptoms and disorders, and hence lacks a coherent evidence-based public health message based on reversible lifestyle factors. Research funding also remains heavily focused on treatment rather than prevention. These recent scientific discoveries open the door to the possibility of public health messages and strategies that focus on the primary prevention of the common mental health problems, depression and anxiety. The key challenge will be to formulate such messages effectively and create environments that support an increase in the consumption of nutrient-dense foods, such as fruit and vegetables, and a decrease in the consumption of high-energy, low nutrient-density foods, at an individual and population level.



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