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Low Levels of Vitamins B12 and D Linked to Depression

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STORY AT-A-GLANCE -

- Low vitamin B12 and vitamin D levels, along with increased homocysteine, may play a role in depression among children and adolescents
- While there was no significant difference in folate levels between the depression and control groups, 11.23% of those with depression had low levels of folate
- Both vitamin B12 and folate have previously been described as antidepressant nutrients; folate is found in dark leafy greens like spinach and avocados while vitamin B12 is found only in animal foods such as grass fed meat, eggs, dairy and wild-caught seafood
- Vitamin B12 also helps regulate homocysteine levels, and increased homocysteine is linked to B12 deficiency as well as depression
- Ensuring youth are eating healthy diets rich in folate and vitamin B12, as well as optimizing their vitamin D levels, may go a long way toward bolstering mental health and avoiding conditions like depression

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Up to 2.5% of children and 8.3% of adolescents suffer from depression, a condition that's associated with significant complications later in life, including an increased risk of suicide, substance abuse, physical diseases and problems with work, academic and psychosocial functioning.[1]

It's believed that both genetic and environmental factors play a role in why some children develop depression, and increasing attention has been placed on the role of dietary factors and nutrients such as vitamin D, which is ideally obtained via sun exposure.

Further, one-carbon metabolism, which includes vitamin B12, folate and homocysteine and which plays a role in many biological processes and maintaining cellular homeostasis, has been investigated for its role in psychiatric disorders, including depression in adults.[2]

After exploring the link further, researchers from Ordu University in Turkey revealed that low vitamin B12 and vitamin D levels, along with increased homocysteine, may play a role in depression among children and adolescents.[3]

Childhood Depression Linked to Low Vitamin B12, Maybe Folate

The study involved 89 children and adolescents with depression, along with 43 subjects without depression to serve as controls. The volunteers completed testing for childhood depression and anxiety and had their levels of folate, vitamin B12, homocysteine and vitamin D measured.

While there was no significant difference in folate levels between the groups, 11.23% of those with depression had low levels of folate. Further, among the depression group vitamin B12 and vitamin D levels were "clearly low." As for how this might contribute to depression, the researchers explained:[4]

> *"One-carbon metabolism has a basic role in methylation processes of neurotransmitters, proteins, and membrane phospholipids. Additionally, it is necessary for DNA synthesis.*
>
> *With vitamin B12 and folate deficiency, methylation processes are hindered and neurotransmitter levels fall. Also linked to vitamin B12 and folate deficiency, there is an increase in the levels of the extremely neurotoxic metabolite of homocysteine."*

Both vitamin B12 and folate have previously been described as antidepressant nutrients.[5] Folate, found in dark leafy greens like spinach, avocados and other fresh vegetables, is involved in your body's production of mood-regulating neurotransmitters. In one study, people who consumed the most folate had a lower risk of depression than those who ate the least.[6]

Vitamin B12 is found only in animal foods such as grass fed meat, eggs, dairy and wild-caught seafood. As such, vegetarians and vegans are especially susceptible to B12 deficiency, and this is one likely reason why vegetarianism may be nearly twice as likely to suffer from depression as meat eaters, even after adjusting for variables like job status, family history and number of children.[7]

It's widely known that people with a vitamin B12 deficiency are at an increased risk of depression,[8] which could be, in part, due to resulting alterations in the level of DNA methylation in the brain, leading to neurologic impairment.[9] Vitamin B12 also helps regulate homocysteine levels, and increased homocysteine is linked to B12 deficiency as well as depression.

Folate, Vitamin B12 Suggested for Treatment of Depression

Considering the extensive research linking depression with low levels of vitamin B12 and folate, researchers with the MRC Neuropsychiatric Research Laboratory in Epsom, Surrey, U.K., suggested that folate and vitamin B12 should be considered in the treatment of depression.

"On the basis of current data, we suggest that oral doses of both folic acid (800 mcg daily) and vitamin B12 (1,000 mcg daily) should be tried to improve treatment outcome in depression," they noted.[10]

Folic acid is the synthetic version of folate, or vitamin B9, and while it may have a place in depression treatment, the best way to increase your levels is to eat foods rich in folate, such as asparagus, avocados, Brussels sprouts, broccoli and spinach. As for why folate and vitamin B12 are so important for mental health, they explained:[11]

> *"Folate and vitamin B12 are major determinants of one-carbon metabolism, in which S-adenosylmethionine (SAM) is formed. SAM donates methyl groups that are crucial for neurological function. Increased plasma homocysteine is a functional marker of both folate and vitamin B12 deficiency. Increased homocysteine levels are found in depressive patients."*

Depressed Children Had 'Remarkably High' Homocysteine Levels

The connection between low vitamin B12 and increased homocysteine levels is notable, as the featured study found "remarkably high" homocysteine levels in the children and adolescents with depression.

"Increased homocysteine increases the flow of calcium within cells through the NMDA [N-methyl D-aspartic acid] receptor activation pathway. Within the cell, oxidative stress increases and apoptotic signals are activated. Increased homocysteine causes DNA damage, mitochondrial dysfunction, and endoplasmic reticulum stress," the researchers noted, suggesting that this is likely one mechanism behind homocysteine's depression connection.[12]

Separate research has also linked higher homocysteine levels with increased rates of depression and anxiety among 12- and 13-year-old boys in Taiwan.[13] Higher levels of homocysteine, along with significantly lower levels of vitamin B12 and vitamin D, are also associated with other mental health conditions, including obsessive compulsive disorder, in which it's believed to play a causative role.[14]

Homocysteine is an amino acid in your body and blood obtained primarily from meat consumption. Vitamins B6, B9 and B12 help convert homocysteine into methionine — a building block for proteins. If you don't get enough of these B vitamins, this conversion process is impaired and results in higher homocysteine. Conversely, when you increase intake of B6, folate and B12, your homocysteine level decreases.

As such, checking your homocysteine level is a great way to identify a vitamin B6, folate and B12 deficiency. The researchers also noted that "vitamin deficiencies and elevated

homocysteine should be investigated in terms of cause-effect relationships" in terms of depression in youth, especially since depression may contribute to poor appetite and irregular eating habits.

Vitamin D Levels Also Low Among Depressed Youth

The Ordu University researchers also found vitamin D levels to be low among the children and adolescents with depression, a connection that's been revealed in the past. In the study, the depressed group had a median vitamin D level of 11 ng/ml, compared to 24.85 ng/ml in the control group. Both of these values are low, but 11 ng/ml is dangerously low and will radically increase the risk of rickets.

It's important to note that for optimal health and disease prevention, a level between 60 and 80 ng/mL (150 to 200 nm/L) appears to be ideal, so all of the study participants were very low by this measure. Vitamin D receptors exist in the human brain,[15] hinting at the importance of this vitamin in mental and emotional health.

It's believed that vitamin D regulates more than 200 different genes by binding to vitamin D receptors that are responsible for driving a number of biological processes.[16] Low levels of vitamin D have, in fact, been linked to a number of psychological disorders, including anxiety, depression and schizophrenia.

It likely influences psychological health in a number of ways, including by modulating inflammation, regulating proteins that fight free radicals and increasing the synthesis of brain-derived neurotrophic factor, which may play a role in schizophrenia.

Writing in the journal Children, Dr. Joy Weydert of the department of pediatrics at the University of Kansas Medical Center explained, "Vitamin D deficiency decreases the expression of the enzyme catechol-O-methyl transferase (COMT), required for dopamine and serotonin metabolism."[17] Further, adolescents with low levels of vitamin D had improved depressive symptoms after vitamin D supplementation.[18]

Vitamin D deficiency in children is "very common,"[19] and children, like adults, should obtain regular sun exposure or take vitamin D3 supplements to ensure their levels are in

the optimal range. It's important to note that vitamin D supplementation must be balanced with other nutrients, namely vitamin K2 (to avoid complications associated with excessive calcification in your arteries), calcium and magnesium.

The best way to gauge whether you might need to supplement, and how much, is to get your level tested, ideally twice a year, in the early spring and early fall when your level is at its low point and peak. Optimizing vitamin D levels may be a simple way to significantly improve mental health. As noted in Issues in Mental Health Nursing:[20]

> *"Effective detection and treatment of inadequate vitamin D levels in persons with depression and other mental disorders may be an easy and cost-effective therapy which could improve patients' long-term health outcomes as well as their quality of life."*

Once you have your vitamin D level tested you can use the Vitamin D Calculator developed by GrassRootsHealth to determine your ideal vitamin D dose.

Poor Diet Linked to Depression; Healthy Diet Fixes It

It's been proven time and again that what you eat influences mental health, and this is certainly true among teenagers. Researchers at the University of Alabama at Birmingham looked into the role two dietary factors play in symptoms of depression among adolescents, in this case African-American teens who may be at an increased risk of both unhealthy diet and depression.

They analyzed the excretion of sodium and potassium in the urine in 84 urban, low-income adolescents. Higher levels of sodium in the urine can be an indication of a diet high in sodium, such as processed fast foods and salty snacks. A low level of potassium, meanwhile, is indicative of a diet lacking in fruits, vegetables and other healthy potassium-rich foods.

As might be expected, higher sodium and lower potassium excretion rates were associated with more frequent symptoms of depression at follow up 1.5 years later.[21] Past studies have also confirmed the diet-depression link among children and teens.

When researchers systematically reviewed 12 studies involving children and adolescents, an association was revealed between unhealthy diet and poorer mental health, as well as between a good-quality diet and better mental health.[22]

Likewise, researchers from Macquarie University, Australia, studied 76 students between the ages of 17 and 35 who followed a poor diet and had moderate to high levels of depression symptoms.[23] One group of the participants was asked to improve their diets by cutting back on refined carbohydrates, sugar, processed meats and soft drinks, while eating more vegetables, fruits, dairy products, nuts seeds, healthy fats and anti-inflammatory spices such as turmeric and cinnamon.[24]

After only three weeks of healthier eating, those in the healthy diet group had significant improvements in mood and their depression scores even went into the normal range. While teens and young adults aren't always known for their healthy food choices, this is a crucial period in which lifelong healthy eating patterns are established.

Ensuring youth are eating healthy diets rich in folate and vitamin B12, as well as optimizing their vitamin D levels, may go a long way toward bolstering mental health and avoiding conditions like depression.

If a child or teen is already struggling with depression, eating real food is equally important. In addition to limiting the intake of processed foods, fast foods and sweets, including sugary beverages, increasing consumption of foods rich in omega-3 fats, such as sardines and wild-caught salmon, should be encouraged.

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