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Effect of Vitamin D on Depression

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Abstract:

Depression is a serious mental disorder in the world, it is a mental disorder w ith high morbidity, high clinical cure rate but with low treatment acceptance rate and high recurrence rate. The main features are significant, persistent depressed mood, and some may be self-harming, suicidal behavior, and may even be accompanied by psychotic symptoms such as delusions and hallucinations. Its core symptoms are persistent low mood and decreased interest in things, and among many symptoms, suicide is the most severe. Depression can take a serious toll on the depressed person, their family, and even society. Clinically, depressive disorders can be divided into mild, moderate and severe according to the number, type, severity of symptoms, respectively for different groups such as the elderly, children, mothers, etc., called geriatric depression, childhood depression, postpartum depression, etc. Treatment of depression mainly includes medication, psychotherapy and physical therapy. Medication is the mainstay of treatment, but it is important to note that all medications should be taken strictly as directed by a doctor. In addition to medication, psychotherapy can also be effective in reducing the risk of relapse. Nowadays, with advances in medicine, research on the relationship between nutrition and depression has progressed, and this article will discuss the correlation between vitamin D and depression.

Keywords: vitamin D, depression

1.Introduction

Vitamin D, a cyclopentane hydrophenanthrene compound, is fat-soluble vitamin, whose main functi on is to promote the absorpti on of calcium and phosphorus by cells of the small intestinal mucosa and to promote the growth of skin cells. Vitam in D deficiency would lead to rickets, osteomalacia, etc., and vitamin D was found in the human body in the form of mainly vitamins D2 and D3. (Approximately 90%~95% of the total amount of vitamin D in human's body). Vitamin D2 and vitamin D3 are stored in abiotic forms in the human body and need to be converted into the forms of 1,25-dihydroxyvitamin D2 and 1,25-dihydroxyvitamin D3 by the liver and kidneys in the body before they can perform their effects. The circulating form of vitamin D in the human body is mainly 25-hydroxyvitamin D, which can be used to assess the distribution of the vitamin

D receptors (VDRs) in the brain of the human[4] Neuroimaging studies have shown that several key brain regions in patients with depression, such as the cortex and inferior border regions, basal ganglia, and brainstem, may be affected,[5] Positive regulation of the glial cell line-derived neurot rophic factor synthesis improves neuronal survival, differentiation, and plasticity, while vitamin D The active form stimulates nerve growth factor synthesis in the cholinergic neurons. [6] Vitamin D can also promote the synthesis of monoamine neurotransmitters related to depression and participate in many brain processes. Vitamin D deficiency in childhood is associated with neurological and psychiatric disorders such as schizophrenia, while deficiency in adulthood can have many adverse effects on the brain, including depression, Parkinson's disease, Alzheimer's disease, and cognitive decline.

2.The role of VD

Is to inhibit the expression of tryptophan hydroxylase 1, induce the expr ession of tryptophan hydroxylase 2, and achieve the regulation of sero tonin synthesis. Therefore, VD can prevent depression by maintaining the normal seroton in levels. Therefore, when vitamin D is deficient, serotonin synthesis may be suppressed, which may increase the risk of depression. Neurotrophic Factors and VD The neurotrophic factor hypothesis for depression suggests that depression may be due to a decrease in brai n-derived growth nerve factor and other trophic factors. Nerve growth factor is mainly found in the hippocampus and neocortex and thought to beclosely related to memory and executive function. Patients with depression have reduced levels of the brain-de rived neurotrophic factor and nerve gro wth factor. There are also related mechanistic studies, vitamin D receptors and vitamin D1 monohydroxylase are widely distributed in the thalamus, cerebral cortex, thalamic vitamin D-deficient female mouse cubs have abnormal brain shape, decreased nerve gr owth factor, glial cell- derived neurotrophic factor, decreased neurological function [13] Xue et al.'s research has shown that VD deficiency is prevalent in patients with neuropsychiatric disorders such as depression and schizophrenia, and high level of VD in our body can reduce risk for certain neuropsychiatric disorders. VD can improve symptoms of certain neuropsychiatric disorders by regulating the secretion of neurotransmitters and inflammatory factors in the brain. [11]Some scholars believe that vitamin D can be used as a neuroactive steroid to regulate and participate in depression related neurophysiological processes. In cross-sectional studies, 25 (OH) D levels were found to be associated with depression. Bioactive vitamin D, vitamin D receptors, and vitamin D metabolic enzymes are present in neurons, glial cells, and brain macrophages. Vitamin D is believed to have various autocrine or paracrine effects in the brain. The occurrence of depression may be related to an imbalance of neurotransmitters, such as a decrease in important neurotransmitters such as serotonin and dopamine. Vitamin D can affect the synthesis and release of these neurotransmitters, thereby regulating the chemical balance of the brain. Vitamin D may improve symptoms of depression by promoting neuronal growth and connectivity, as well as regulating the synthesis and release of neurotransmitters. Recent studies have shown that inflammatory reactions can affect the growth and connectivity of brain neurons. Vitamin D has anti-inflammatory effects and can alleviate the impact of inflammatory reactions on the brain, thereby reducing the occurrence of depression. Vitamin D may reduce the risk of depression by inhibiting inflammatory responses and protecting brain neurons from inflammatory damage. Oxidative stress refers to the imbalance between the production and clearance of free radicals in the body. Research has shown that oxidative stress can affect the growth and connectivity of brain neurons. Vitamin D can enhance the activity of antioxidant enzymes, reduce the production of free radicals, and thus reduce the impact of oxidative stress on the brain. Vitamin D may enhance the activity of antioxidant enzymes, reduce the production of free radicals, protect brain neurons from oxidative stress damage, and thereby reduce the risk of depression.

3.The relationship of VD and depression

3.1 The relationship of neurotransmitter to VD

Increased vitamin D intake in depressed patients has made a gradual reduction in the risk of depression, the study by Zhu Daomin et al. showed that the depression scoring criteria in intervention group , lower than those that in control group. [1] Anhedonia leads to the occurrence of treatment-resistant depression, which is a residual symptom after clinical cure in some patients, in depression-related studies, antidepressant treatment can improve the depressed mood of depressed patients, but is ineffective in treating anhedonia, vitamin D is an essential neurosteroid involved in neurotransmitter synthesis is important in regulating brain development, involved in neuroimmune regulation and oxidative stress. [2] Vitamin D deficiency reduces neurotransmitters in the human brain, such as dopamine, choline, and norepinephrine, which have been linked to the development of depression. Thus, serum 25(OH)D3 levels in depression are inversely correlated

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with HAMD scores, and a decrease in serum 25(OH)D3 levels may be due to decreased serum 25(OH)D3 levels and other neurotransmitters in the human brain. [12]

3.2 Vitamin D and Postpartum Depression

Studies by Min Li et al have shown that during the puerperium, mothers can prevent postpartum depression by taking vitamin D orally or by increasing vitamin D levels with proper sun exposure. Vitamin D deficiency may increase the likelihood of postpartum depression. [3] Li et al. found that the risk factors for postpartum depression were low levels ,high IL-6 levels, with serum vitamin D levels inversely correlated with postpartum depression and IL-6 levels had the positively correlated with postpartum depression. [7] Zhang et al. found that there were many differences of vitamin D levels in patients with depression with different underlying characteristics: among the depressed patients enrolled, the proportion was higher among women (67.8%) and those with less than junior high school education (61.0%). The prevalence of vitamin D deficiency was 73 in the total sample population. 7%。 The prevalence of vitamin D deficiency was significantly higher of women (80.8%) than men (58.8%) (P <0. 001)=”“”” [8] Depression is the independent risk fact or for reduced serum 2 5-hydroxyvitamin D level in men ≥ for anxiety and somatization symptoms in women aged 45 years. It is hypothesized that the reason may be a decrease in estrogen levels in women at 45 ≥, while women with low education may have lower serum 25-hydro xyvitamin D levels due to various reasons. [9] VD also plays a vital role in maintaining impo rtant functions such as calcium homeostasis, maintaining bone integrity, and neurodevelopment. VD deficiency leads to an incre ase in intracellular Ca2+, which may increase the risk of depression, while VD supplements can maintain Ca2+ homeostasis, which can reduce the likelihood of depression by reducing inflammation, maintaining normal mitochondrial function, and regulating serotonin formation. [10]</0.>

3.3 VDBP and vitamin D

VDBP is involved in VD transport, VD is mainly the multifunctional protein synthesized by liver, which can regulate vitamin D metabolism, and the study of Liu Yang et al. showed that the serum VDBP level in patients with the first episode of adolescent depression was positively correlated with HAMD score, suggesting that VDBP and depressive symptoms may jointly affect the pathological progression of adolescent depression. [14] Results from Dai et al showed that vitamin supplementation reduced BDI scores and HAMD scores in patients with depression, and that the experimental group supplemented with vitamin D had a more significant improvement in depressive symptom scores in patients with depression. Vitamin D adjuvants are well tolerated and easily accepted by the general public, and continuous supplementation of vitamin D adjuvants can modulate neurotransmitters, enhance nerve growth factor, improve antioxidant capacity, reduce the risk of recurrence, and there are few adverse event reports.

4.Conclusion

In summary, multiple experiments have shown that VD is closely rela ted to depression, and VD can promote the developm ent of depression, which not only brings great pain and harm to individuals, but also brings serious impact and burden to families and society. Although the specific mechanism of action between vitamin D and depression is not clear, the results of related studies show that VD can still have a positive impact on the treatment of depression. VD for the treatme nt of depression h as few side effects and low cost, which is a direction worth exploring.

References

[1] Xie Tianqin. Effect of vitamin D supplementation on anhedonia in patients with depression[D]. Anhui: Anhui Medical University,2023.

[2] Feng Na, Abulahat Aizezi, Cheng Jing, et al. Clinical significance of serum vitamin B12 and 25(OH)D l evels in patients with depression and their impact on prognosis[J]. Journal of Psychiatry,2023,36(6):590- 593. DOI: 10.3969/j.issn.2095-9346.2023.06.006.

[3] Li Min, Liu Maofang, Zhou Anlian. Chinese Journal of Maternal and Child Health,2023,14(04):59-64. DOI:10.19757/j.cnki.issn1674-7763.2023.04.012.

[4] HAMZART, HAMEDAI, SALLAM M T. Vita min D status in prep ubertal children with isolated idiopathic growth hormone deficiency: Effect of growth horm one therapy[J]. J Inves- tig Med,2018,66(5):1-8.

[5] PANDYA M, ALTIN AY M, MALONE D A, et al. Where in the brain is depression? [J]. Curr Psychiatry Rep,2012,14(6):634-642.

[6] Zhang Shipan, Jin Man, Ni Aihua, et al. Modern Medicine and Health,2023,39(13):2267-2271+2277.

[7] Li Jin, Xu Huashan. China Food and Nutrition,2022 ,28(11):60-63. DOI: 10.19870/j.cnki.11-3716/ts.2022.11.004.

[8] Zhang Yu, Xie Jun, Yu Jiakuai, et al. Study on the association between vitamin D level and sleep efficiency and clinical symptoms in patients with depression[J]. Sichuan Medicine,2023,44(12):1249-1255.DOI: 10.16252/j.cnki.issn1004-0501-2023.12.004.

[9] Chen Qing, Du Wenyong, Gao Yan, et al. Gender differences in serum 25-hydroxyvitamin D in patients with

chronic insomnia[J]. Shanghai Medical,2021,44(08):601-605. DOI:10.19842/j.cnki.issn.0253-9934.2021.08.014.
[10] Chen Dan, Guo Yujin, Geng Chunmei, et al. Chinese Journal of Brain Disease and Rehabilitation (Electronic Edition),2019,9(01):48-51.)
[11] Xue Y, Jiang P, Li H, et al. Zhongnan Pharmaceutical Sciences,2014,12(09):837-840.
[12] Chen Yunzhi, Gao Jie, Chai Yihui, et al. Bibliometric Analysis of Vitamin D Deficiency and Depression Based on GoPubMed[J]. Journal of Guiyang University of Traditional Chinese Medicine,2016,38(5):32-35. DOI: 10.16588/j.cnki.issn1002-1108.2016.05.008.
[13] Yang L, Liu Yushan, Wu N, et al. Changes in serum levels of 25-hydroxyvitamin D_3 and vitamin D-binding protein in patients with first-episode depression and its clinical significance[J].Chinese Journal of Child Health Care,2023,31(03):259-262+283.