

The Role of Micronutrient for Depressed Patients

Sileshi Demelash*

Department of Psychiatry, Amanuel Mental Specialized Hospital, Addis Ababa, Ethiopia

*Corresponding author: Sileshi Demelash, Department of Psychiatry, Amanuel Mental Specialized Hospital, P.O. 1971, Addis Ababa, Ethiopia, Tel: +251911261296; E-mail: sileyeshi21@gmail.com

Receiving date: Jul 18, 2017; Acceptance date: Aug 02, 2017; Publishing date: Aug 12, 2017

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Abstract

Majority of people are not aware of the relation between nutrition and depression. Depression is mostly resulted from an imbalance in brain chemical that can be due to more typically thought of as strictly biochemical-based or emotionally-rooted. As a result, nutrition can play a key role in the onset as well as severity and duration of depression. Several micronutrient deficiencies adversely affect the brain and hence could aggravate mental disorders. It is important that proper attention to diet, and, when indicated, appropriate supplementation with vitamin C, folic acid, niacin, thiamine, iron, zinc, magnesium, potassium and sodium and omega-3 fatty acids. As the brain chemical (neurotransmitters) are made from chemical precursors, usually from an amino acid (protein) and other micronutrients (vitamin and minerals), it is clear to understand how deficiencies of these nutrients could lead to changes in the pattern of brain chemical neurotransmitter production leading to mental illness like depression.

Keywords: Depression; Vitamins; Minerals

Introduction

Depression is a common mental disorder, characterized by persistent sadness and a loss of interest in activities that you normally enjoy, accompanied by an inability to carry out daily activities, for at least two weeks. In addition, people with depression normally have several of the following: a loss of energy; a change in appetite; sleeping more or less; anxiety; reduced concentration; indecisiveness; restlessness; feelings of worthlessness, guilt, or hopelessness; and thoughts of self-harm or suicide [1]. Major depression is ranked as the leading cause of disability throughout the world, and the fourth most important cause of premature mortality. Prevalence is estimated at 2-4%, and there exists about a 20% risk of developing major depression or dysthymic disorder over the lifespan [2-10]. Depression is the leading cause of ill health and disability worldwide. More than 300 million people are now living with depression, an increase of more than 18% between 2005 and 2015 [1,2].

Depression leads a persisting impairment of social functioning and living conditions can be replicated to some extent from the point of view of the patients themselves [2]. Depression often leads to weight changes as appetite may increase or decrease. For some, overeating or comfort eating may occur and lead to weight gain. The tendency in this population to carry excess weight may be exacerbated by a preference for higher-calorie liquids and/or convenience foods as well as a sedentary lifestyle. Other individuals with depressive disorders may under eat due to feelings such as not being worthy enough to eat, lacking motivation or energy to prepare foods, or somatic delusions of not being able to eat. Reduced food intake leads to nutrient inadequacies and weight loss [3].

Majority of people are not aware of the relation between nutrition and depression. Nutrition can play a key role in the onset as well as severity and duration of depression. Many of the easily noticeable food patterns that precede depression are the same as those that occur during depression. These may include poor appetite, skipping meals,

and a dominant desire for sweet foods [4]. A notable feature of the diets of patients suffering from mental disorders is the severity of deficiency in these nutrients. Study has showed that daily supplements of vital nutrients are often effective in reducing patients' symptoms of depression [5].

Micronutrient and Brain Cell

The brain, and the rest of the nervous system, is partially constructed from billions of nerve cells, called neurons. Communication between these neurons allows the brain to work, the communication taking the form of electrical or chemical signals between brain cells. The chemicals that carry the signals are called neurotransmitters. Most neurotransmitters are made within the brain, derived from a variety of different chemical compounds known as the neurotransmitter's "precursors". If the precursor is not available, the brain will be unable to create the neurotransmitter. This will lead to the brain cell will be unable to communicate correctly. Neurotransmitters are made from chemical precursors, usually from an amino acid (protein) and other micronutrients (vitamin and minerals) [4]. As the links between neurotransmitters and nutrients are direct it is clear to understand how deficiencies of these nutrients could lead to changes in the pattern of brain chemical neurotransmitter production.

Micronutrients: Mental illness is resulted from the interaction of different factors leading to malfunction of certain brain chemicals neurotransmitters which leads to the development of mental illness. Changes in brain signal transmission at the level of chemical synapse are essential in the development of mental disorders or a change in a neurotransmitter's chemical structure, or an imbalance at any point in this complex process, may affect emotions, moods, thoughts, and behaviors [3]. Deficiencies in neurotransmitters such as serotonin, dopamine, nor adrenaline, and γ amino butyric acid (GABA) are often associated with depression [6,7].

The availability and balance of the macronutrients available for brain function are dependent on the action of enzymes and

coenzymes. Micronutrients are essential to many coenzyme systems and may be responsible for the full activation of enzymes that synthesize neurotransmitters [8]. For instance, riboflavin, vitamin B6, and iron are three of the substances needed for the synthesis of biogenic amines [9]. Subclinical deficiencies in individuals with mood disorders may be due to genetic variations in which some are more vulnerable or to historical changes in diet composition.

Effect of micronutrient on depression

Various vitamins are essential to neurotransmission. Those that have been studied in mood disorders include folate, niacin, riboflavin, thiamin, vitamin B6, vitamin B12, vitamin C, vitamin D, vitamin E, and the vitamin-like compound choline. All the vitamins are indispensable for normal functioning of the brain. However, some of them are very closely involved in the functioning of neurons and other brain cells. In fact, it is even possible to assign a specific efficacy to each vitamin for certain activities in the cognitive domain [10,11].

Several micronutrient deficiencies adversely affect the brain and hence could aggravate mental disorders like depression. It is plausible that proper attention to diet, and, when indicated, appropriate supplementation with vitamin C, folic acid, niacin, thiamine, iron, zinc, omega-3 fatty acids, vitamin D and vitamin E could lower the dosage requirement for antipsychotic drugs and reduce their adverse side effects and toxicity [12,13].

Vitamin B complex: Thiamine (Vitamin B1) deficiency has long been known to result in brain damage and reduce acting as a coenzyme in the synthesis of acetylcholine, γ -amino butyric acid (GABA), and glutamate. Nicotinic acid or niacin is crucial for oxygen utilization. Produce energy, the use of glucose by nervous tissue is facilitated by the presence of vitamin B1 in addition it also modulates cognitive performance, especially in the elderly. In addition vitamin B1 Vitamin B9 preserves brain during its development and memory during ageing. Vitamin B6 is likely to benefit in treating premenstrual depression. Vitamins B6 and B12, among others, are directly involved in the synthesis of neurotransmitters like dopamine and serotonin [9-14]. Vitamin B Nicotinamide adenine dinucleotide increases tyrosine hydroxylase activity and dopamine production in pheochromocytoma cells [12].

Laboratory evidence suggests that vitamin B6 deficiency is common in depression [15] and the underlying mechanism may be associated with decreased serotonin level of the brain. Pyridoxine or vitamin B6 is involved in the synthesis of many neurotransmitters (i.e., dopamine, serotonin, nor epinephrine, epinephrine, histamine, GABA) [14,15]. It has also a role in the synthesis of dopamine, serotonin, nor epinephrine, epinephrine, histamine, GABA. Deficiency tends to reduce production of serotonin and GABA Vitamin B6 deficiency can selectively reduce brain production of serotonin and GABA [16,17]. Cobalamine has a role in the synthesis of dopamine, serotonin, nor epinephrine, epinephrine, histamine, GABA. Deficiency tends to reduce and helps maintain myelin sheaths for nerve conductance [18].

Vitamin B12 has been linked with central nervous system processes its deficiency is more prevalent and high in admitted mentally ill patients than in the general population [19], hence adding as a food supplement of Vitamin B12 is effective in treating bipolar disorder especially of manic phase [20]. Vitamin B12 deficiency significantly reduces the reactions of

L-methylmalonyl-CoA mutase and methionine syntheses which is promoted by B12-dependent enzymes resulting accumulation of

methylmalonic acid and homocysteine, respectively. Hence, methylmalonic acid was higher in depressed patient than normal individual. This Vitamin B12 the accumulation of homocysteine leads to exo-toxic reactions and may enhance depression. In addition Vitamin B12 is also required in the synthesis of S-adenosylmethionine (SAM), which is needed as a methyl donor in many methylation reactions in the brain [21,22].

Therefore, most micronutrient deficiencies affect brain function of individuals. Folic acid deficiencies lead the development depression and slow down the response to antidepressant medication [23,24]. In some cases the first clinical manifestation of vitamin B12 deficiency is a psychiatric disorder and relatively common in old age in which mostly associated with cognitive impairments [25-27].

Vitamin B5: Changes to coenzyme A that helps convert macronutrients into energy. It also plays a role in the production of red blood cells, hormones, and nerve regulators [20]. Needed for the uptake of amino acids and acetylcholine, which combine to prevent certain types of depression and it is necessary to make Vitamin D and works closely with biotin and vitamins B1, B2, B3 and B6.

Vitamin C: Ascorbate (vitamin C) is a of the essence antioxidant molecule in the brain. On the other hand, it also has a number of other important functions, participating as a cofactor in several enzyme reactions, including catecholamine synthesis, collagen production, and regulation of HIF-1 α , neuromodulator of lutamatergic, dopaminergic, cholinergic, and GABAergic transmission and related behaviors [28-30]. Ascorbate is transported into the brain and neurons via the sodium-dependent vitamin C transporter 2 (SVCT2), which causes accumulation of ascorbate within cells against a concentration gradient [30]. Its presence is required for the transformation of neither dopamine into nor adrenaline. The biosynthesis of catecholamines occurs in tissues rich in ascorbic acid like the brain and the adrenal gland. In addition having vitamin C in the diet is associated with a reduced level of major changes in cognitive performance [31,32]. Vitamin C is involved in neuronal transmission and neurotransmitter metabolism. Long-term therapy with a multiple vitamin containing enough amounts of vitamin C improved mood in people with low plasma vitamin C concentrations [33]. Vitamin C deficiency can lead exhaustion and psychosomatic idiosyncrasy [34].

Main minerals linked with depression

Calcium: Calcium mediates vasoconstriction, vasodilatation, and nerve impulse transmission. Calcium activity has been shown to be abnormal in mood disorders and mood-stabilizing treatments may regulate calcium ion hyperactivity. Depression in particular was associated with elevated platelet serotonin-stimulated intracellular calcium mobilization [35].

Iron: Iron plays a great role in the production of serotonin, nor epinephrine, epinephrine, and dopamine. For example, iron is a cofactor in the metabolism of tyrosine to dopamine. As a result, Changes in iron metabolism has been suggested as potential pathological markers in patients with depression [36]. It is also believed to increase the binding of dopamine and serotonin to serotonin binding proteins in the frontal cortex [37].

Magnesium: Magnesium has a structural role in cell membranes, and is required for the active transport of ions like potassium and calcium, thereby affecting the conduction of nerve impulses. Magnesium deficiency is well known to produce neuro-pathologies. Magnesium is one of the most essential mineral in the human body,

connected with brain biochemistry and the fluidity of neuronal membrane. A variety of neuromuscular and psychiatric symptoms, including different types of depression, was observed in magnesium deficiency [38,39]. Magnesium is required for DNA and RNA synthesis, reproduction, and protein synthesis. Moreover, magnesium is essential for the regulation of muscular contraction, blood pressure, insulin metabolism, cardiac excitability, vasomotor tone, nerve transmission and neuromuscular conduction [40].

Potassium and sodium: Sodium and potassium-activated adenosine triphosphatase (Na⁺, K⁺-ATPase) and endogenous digitalis-like compounds (DLC) in the brain have been implicated in the pathogenesis of mood disorders. Na⁺, K⁺-ATPase activity in all cells including neurons and glia is a fundamental process that affects cell volume, electrical membrane potential, and various transport systems [40,41]. Bipolar disorder has consistently been associated with abnormalities in the Na⁺, K⁺-ATPase activity in erythrocytes [34].

Zinc: Zinc is needed for more than 200 different enzymes in the brain and body, including those involved in cell division and replication, immune system function and the building of polyunsaturated fatty acid from the essential fatty acid precursors available from vegetable sources. Zinc has a biophasic relationship with serotonin receptors [40,41] and low concentrations of both zinc [41] and serotonin metabolites have been shown to be associated with the development of depression [41,42]. It also helps in protein synthesis and structure and regulation of gene expression [42] in addition it serves in neurons and glial cells.

Conclusion

So as to improve our brain cells activity we have to adjust our feeding practice because micronutrients are building blocks of most brain chemical that is neurotransmitters. Any deficiency and excess can result in mental health as well as other problems. Deficiencies of various B vitamins have long been known to cause brain disorders. Vitamin B9 helps clinical improvement and as an augmentation of fluoxetine therapeutic effects. Vitamin B1, B6 and B12 can markedly improve the depressive symptoms and help the patient return to full work activities. Minerals like Ca, Mg, potassium and zinc improve the depressive symptoms. In general micronutrients (vitamin and mineral) play a vital role and have strong association with mental wellbeing.

Adding micronutrients that are building blocks for our brain can lead:

- Optimal mental health
- Regain mental health

And is an option to add to current medication regimen leading to more efficacious impact or may be an appropriate alternative.

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