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# Effect of Micronutrients Intake and Physical Activity on Depression and Anxiety: A Review

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## Abstract

Depression and anxiety are increasing at global and national level at the rampant rate and hence are the main reason for deterioration in mental health. This, in turn, leads to a poor physical health. With the increase in the incidence of the rate of both the disorder, it is a silent killer as well. There are many medical and non-medical treatments are available for the cure of anxiety and depression. A few nutrients such as zinc, selenium, iron, magnesium, iodine, and Vitamin A, B complex, D, and Vitamin C have also shown a beneficial role in the improvement of anxiety and depression symptoms. There is a possible role of optimal physical activity in reduction of symptoms of anxiety and depression. Very few studies are available on the role of these micronutrient intakes and physical activity on anxiety and depression. Hence more research is required in this field of study.

**Keywords:** Anxiety, Depression, Micronutrients, Physical activity, Vitamin B complex, Vitamin C, Zinc Vitamin D

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## Introduction

### Depression

Depression is a condition that affects the thinking ability of a person such as its behavior and feeling. It is a major depressive disorder (MDD) or clinical disorder and it is increasing at a rampant rate. The symptoms are very common but they are not easily identified and hence it leads to effect on the daily activities such as eating sleeping and working. Firstly it contrasts to normal sadness than it interferes with the daily activities. If the symptoms are not treated properly it will lead to significant impairment in mental health and other health issues.[1]

Depression is also known as mood disorder. The severity leads to thoughts of deaths and attempts of self-harm or suicide. A person experiences sadness during the period of grief or stressful situation. In depression, if these feelings persist over along period, i.e., more than 2 weeks it disturbs the person's daily life.[2]

### Anxiety

Anxiety is a natural response of the body to the external stress. It is a feeling of fear. A person giving speech, going for interview, etc. can lead to fearful and nervous feeling. However, if anxiety is serious and lasts more than 6 months and interferes with daily life, it is a state of anxiety disorder.[3] It is normal to feel anxious when acting as a director, giving a speech, beginning of a career, or had an examination. These types of anxiety are annoying, but encourage working with dedication and doing a better task. Everyday anxiety seems to come and go, but it does not interfere with daily life. Anxiety disorder is a state of emotional disorder and affects all age group. According to the American Psychiatric Association, female are expected more than male to be found with an anxiety disorder.[4]

## Methodology

The online questionnaire-based survey; containing revalant information and data have been collected from different publications, i.e., journals, articles, research paper etc. that are available online was used. Whatever information from relevant articles or studies available on electronic form was examined and collected and put together to review.

This review of related study includes opinion of authors, scholars, etc., and evaluates reports of research work compared to actual research proposed to examine effects of micronutrient intake and physical activity on depression and anxiety.

## Body of Content

### Symptoms of Depression

It is diagnosed when there are noticeable changes in mood, i.e, sadness, loss of interest, or pleasure in activities. Difference in symptoms can be seen in various different individuals.

If five or more symptoms are present for over a period of 2 weeks, it is indicative in nature-a diagnosis can only be made by trained mental health professional:

The symptoms include feeling low and sad most of the time, loss of interest and unable to complete or difficulty in completing daily activities, difficulty in making decisions, thinking and concentrating, loss of confidence and self-esteem, feeling guilty, and blaming self for past failures, feeling unworthy, thought of self-harm, suicide, or death.[5]

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As we have seen the symptoms of depression. There are many different ways available for its treatment.

## Treatments of Depression

Living with depression is difficult, but can improve quality of life. Treatment combines medical treatment and lifestyle therapies. Medications are prescribed by psychiatric which antidepressants, antianxiety and antipsychotic. Psychotherapy sessions with therapist can help to cope with negative feelings and also sessions with family or group are helpful. Light therapy is used in seasonal affective disorder that is known to be MDD. Exposure to dose of white light helps to regulate the mood and improves symptoms. 30 min of physical activity 3–5 days a week can increase the production of endorphins hormone in the body which improves the mood. Avoiding alcohol and drugs that is drinking or misusing drugs may make feel better for little bit. But long term intake of these substances can lead to worsening of symptoms of depression and anxiety. Natural traditional depression treatment uses a combination of prescription medication and counseling.[6]

Supplements include St. John's wort, S-adenosyl-L-methionine (SAMe), 5-hydroxytryptophan, omega-3-fatty acids. Essential oils can help in people having depression who can find relief by inhaling wild ginger will give strong scent will activate serotonin receptor in the brain. This slows the release of stress including hormone. Bergamot a citrusy essential oil is been shown to reduce anxiety in patients awaiting surgery. Other oils, such as chamomile or rose oil, have calming effect. These oils are beneficial for short-term use.

Vitamins are important for many body functions. Out of all the vitamins, two are particularly helpful in relieving symptoms of depression, i.e., Vitamin B: B-12 and B-6 are vital to brain health. Low vitamin B levels can increase the risk for developing depression. People who are depressed are more likely to have low levels of this vitamin. Many herbs, supplements, vitamins, and claims to help alleviate the symptoms of depression, but most have not shown any effect in clinical studies.[7]

Hence, more studies are required to prove the impact of these micronutrients on depression.

### Symptoms of Anxiety

Feeling of anxiety differs according to person's experience like butterflies in the stomach to racing heart. Someone might feel general feeling of fear and worry. People experience uncontrollable discomfort, panic attacks, thoughts, or memories that are painful. Some of the general symptoms include increased in heart rate, rapid breathing, restlessness, trouble in concentrating, and difficulty in falling asleep. Physical symptoms include cold or sweaty hands, dry mouth, heart palpitations, nausea, numbness or tingling in hands or feet, muscle tension, and shortness of breath. Mental symptoms include feeling panic, fear and uneasiness, nightmares, repeated thoughts or flashbacks of traumatic experiences and uncontrollable, obsessive thoughts. Behavioral symptoms include the inability to be still and calm, ritualistic behaviors, such as washing hands repeatedly and trouble in sleeping.[8]

As seen in the review above, there are many side effects on anxiety and modes of treatment and control of the same become necessary.

### Treatment of Anxiety

The anxiety disorders are mainly treated by psychotherapy, medication or both. Psychotherapy is also known as talk therapy. Cognitive Behavioral Therapy is one type of psychotherapy. It helps the patient in different forms such as their way of thinking, behaving, and reacting on the situations like fear. Medications are prescribed by the psychiatrist, primary care provider. It does not cure the disorder but relieves the symptoms. The most commonly used medications are anti-anxiety drugs i.e. benzodiazepines, antidepressants, and beta-blockers.[9]

As seen above the meaning of depression and anxiety are clear and its prevalence is working as silent killer worldwide. Much awareness is needed regarding these diseases.

## World Prevalence of Depression

A study was conducted in the year 2020 to estimate the prevalence of depression. According to the study of Global Burden of Disease (GBD) globally over 300 million people are suffering from depression i.e. equal to 4.4% of the world's population. Every year 800,000 people suicide that means 264 million people had depression. The report was estimated by World Health Organization.[10]

A study was conducted by the World Health Organization which is GBD which was published by the WHO in 2015, which included the world prevalence report of depression as well as anxiety. According to the report, the total number of people suffering from the depression in the worldwide is 322 million. Nearly half of them live in the South East Asia and Western Pacific Region which include high population countries like India and China. The total number of people living with depression has increased by 18.4% between 2005 and 2015.[10]

## National Prevalence of Depression

The population-based cross-sectional study was conducted in the year 2019 in India revealed that 15.1% of people suffered from depression i.e. 57 million. The study was done among the software professionals in Delhi. The method used was two-stage cluster sampling a predesigned, pretested, semi-structured, English questionnaire was used. The study concluded that depression is more among software professionals in Delhi. There is an association between depression and the factors such as problem alcohol use, problem substance use, multiple roles played, and mixed shift.[11]

The National Mental Health Survey (NMHS) of India was conducted in the year 2018 estimated that 23 million adults were suffering from depressive disorder. The spread of study was across 12 states in India. It was a multisite population-based cross-sectional study. It was done on 34 802 adults (>18 years). It concluded that in India 23 million adults need care to treat depressive disorder in India at any point. Since productive population is affected most, depressive disorder entails considerable socioeconomic impact at individual and family levels.[12]

A review conducted on the prevalence of depression in the elderly population in India from 1997 to 2016 estimated from a data set of 56 studies from 16 weeks. It was a community-based study which included participant's 60 years and above age group. The type of study conducted was cross-sectional and cohort study. For the screening tool geriatric depression scale was used and the questionnaire included was Public Health Questionnaire. The results concluded that 34.4% of the population suffered from

depression. The estimation was pooled using random-effects meta-analysis.[13]

## World Prevalence of Anxiety

According to the world prevalence report, people living with anxiety were 264 million in 2020. Anxiety disorders are more common in females than males. In America, 7.7% of female was suffering from anxiety as compared to 3.6% of male found suffering.[10]

According to the GBD study, the prevalence of anxiety disease in 2012 was obtained from 87 studies across 44 countries. The data revealed that the prevalence of anxiety ranged from 0.9% to 28.3%.[14]

A study was conducted in the year 2017 to study the world prevalence of anxiety problem. The results showed that across the world anxiety was present from 2.5 to 7%. Globally around 284 million people are suffering. Around 63% (179 million) females and 105 million males.[15]

## National Prevalence of Anxiety

A cross-sectional study was conducted by the National Health Survey of India (2015-16). According to the study of prevalence and determinants of anxiety disorders among adolescents, the reported prevalence of anxiety disorder was ranged from 14.4 to 56.8%.[16]

A survey was conducted by NMHS in the year 2015-2016 by the standardized method, all subjects aged 18 years above. It was conducted across the 12 states and six regions of India. The prevalence of Manipur was 19.9%, Punjab and Uttar Pradesh were having 18.1% and 8.7%, respectively.[17]

According to the World Health Organization survey, 7.5% of Indians suffer from mental disorder and it says that by end of the 2021 nearly 20% will suffer from mental illness. 38 million people suffer from anxiety disorder whereas 56 million Indians suffer from anxiety.[10]

There is projection of a steep rise in the prevalence of depression and anxiety over a period of time due to many lifestyle changes. Hence, it becomes necessary to find ways to manage the same. Many medical methods are available for the management of the same but, nutritional methods still need to be explored.

## Role of Micronutrients in Anxiety and Depression

The deficiency in micronutrients may impact worse in physical as well as mental health. To know the issue, the psychological and the environmental stress impact on the body and may lead to stress. In a study, the US during the pandemic reported more cases of mental illness and chronic diseases due to insufficient of vitamins, minerals, and phytonutrients. As all of these play important role in promoting mental wellness.[18]

In a review conducted in the year 2005 on folic acid and Vitamin B12 to see the effect on depression. It was reported that folic acid and Vitamin B12 are major factors in carbon metabolism as far as S-adenosylmethionine (SAM) is formed. SAM provides a methyl group that is important for nerve function. Increases in plasma homocysteine are two functional markers of folic acid and Vitamin B12 deficiency. In depressive patients, the level of homocysteine is found to be increased. It concluded that oral doses of both folic acid (800 μg daily) and Vitamin B12 (1 mg daily) should be tried to improve treatment outcome in depression.[19]

A research was conducted in the year 2010, which enrolled university female aged 20–25years as subjects. The main objective of the study was to observe the correlation between serum zinc concentration and dietary zinc intake in diets accompanying depression. The students who were depressed were supplemented with meats and chicken as main source of food. Beck's questionnaire and food recall questionnaire were used, which concluded that serum zinc levels were inversely proportional to the depression scale ($r = 0.58$; $P < 0.001$). The result revealed that there was inverse correlation between depression score and dietary zinc intake. In the hippocampus and cerebral cortex of the brain, zinc is present in high amount as it influences brain zinc homeostasis. It leads to alteration in behavior, learning, and mental function. Hence it can be concluded that consumption of dietary zinc such as red meats and chicken should be encouraged in young depressed girls.[20]

An article was written in 2011 on micronutrients and depression by the department of family and community health, school of nursing, university of Pennsylvania Philadelphia. According to study micronutrient deficiencies play a role in the development of depression, and the use of micronutrient supplementation has a pharmacotherapy for a psychiatric illness. Iron deficiency can lead to synthesis of neurotransmitters and has a correlation with postpartum depression. Zinc is an essential mineral that participates in variety of biochemical process related to brain growth and function. The study concluded that zinc and magnesium work as antidepressant.[21]

In the year 2011, a study was conducted with the objective micronutrients reducing stress and anxiety in elderly with attention hyperactivity disorder after the 7.1 earthquakes. Fourteen adults subjects were enrolled and method used was randomized controlled trail. According to research attention-deficit hyperactivity disorder (ADHD) is a characterized problem with inattention, hyperactivity, and impulsivity is mainly occurred in 4–5% of adults. The consumption of micronutrients such as vitamins, minerals, and amino acids has revisited the treatment of ADHD symptoms such as depression and anxiety. Micronutrient formula is known as EMPowerplus (EMP+). It consists of 36 ingredients, 14 Vitamins, 16 minerals, three amino acids, and three antioxidants. It has been shown beneficial for ADHD symptoms. The study concluded that micronutrients positively influence emotional response to a highly stress event. The micronutrients play a role in reducing stress responses to distressing events, extended to individuals with or without mental illness.[22]

The review was conducted in the year 2014 on poor Vitamin C status associated with increased depression symptoms in older people. 322 patients were selected as subjects in the study. The methods used were randomized, double blind, placebo-controlled trail. The nutritional status was calculated with the help of anthropometric, hematological, and biochemical data. The outcome of the research was 116 (36%) patients had Vitamin C concentration below 11 μmol/L and at 6 months and 6 weeks, the score was 28 (22%) and 44 (28%), respectively. The result stated that Vitamin C has significant benefits for physical and mental health and a plasma concentration that reflects recent intake. The purpose of this review was to study the prevalence and clinical significance of Vitamin C deficiency in admitted acutely ill geriatric patients. The report concluded that high proportion of older patients had sub-optimal Vitamin C status and this was associated with increased symptoms of depression.[23]

A study on anxiety and depression enrolled 11 participants of age 16 years, to the study of Vitamin D deficiency with respect to anxiety and depression in children with chromosome 22q11.2 deletion syndrome, the chromosome 22q11.2 deletion syndrome is a complex disorder which causes serious medical, cognitive and emotional syndrome throughout the life. It participates in brain development and neuroprotection, gene transcription, immune regulation, and affects nerve signals. Low levels of Vitamin D have been linked to schizophrenia, depression, and anxiety. The blood plasma level of Vitamin D in children aged 7–16 years with ($n$ = 11) and without ($n$ = 16) 11q11.2DS in relation with parents report of children's anxiety and atypically. The study concluded that deficiency is associated with higher levels of anxiety and depression, and leads to an increased risk of mental illness in the population.[24]

A randomized controlled trial was carried out in the year 2017 on human adults (≥18 years old) on the effect of magnesium supplementation on subjective anxiety and stress. The results revealed that magnesium is associated with anxiety. Eighteen studies were included in which 4/8 in anxious samples, 4/7 in PMS sample, and ½ in hypertensive samples reported positive effects of Mg on subjective anxiety outcomes. The study concluded that there is inconclusive evidence for beneficial effect of magnesium supplementation in anxiety.[25]

A cross-sectional study was done to observe the association between iron-deficiency anemia and depression which stated that; there is a correlation between poor nutrition and depression. 100 subjects were selected as sample. Women of childbearing age are low in nutritional factors such as iron. The hemorrhage in the post-partum period is due to iron deficiency and depression. The study concluded that self-reported history of iron deficiency anemia was associated with higher psychological distress.[26]

A case-control research was conducted on low serum Vitamin D levels associated with anxiety in children and adolescents on dialysis in the year 2018. The total subjects enrolled were 156 pediatric patient on hemodialysis or peritoneal dialysis and 100 healthy controls. Research estimated that Vitamin D is a neurosteroid hormone which is more essential for human health. Research demonstrated an important association between serum Vitamin D levels and anxiety in anxiety among children and adolescents with dialysis.[27]

A review was conducted in the year 2020 which included 8 experimental studies involving supplementation and 22 observational studies. The aim objective of review was to check the evidence of selected micronutrients i.e. vitamins A,B,C,D,E, calcium, chromium, copper, iron, magnesium, manganese, lead, potassium, selenium, and zinc on depression among children and adolescents (age 13.8 ± 2.4 years). There was a correlation between deficiencies of Vitamin B, E, and D, as these deficiencies badly affect the mitochondrial function, metabolism, genetic polymorphisms, or atypical nutrient which is increased in inflammation and oxidative stress with depression.[28]

A study was conducted in the year 2020 on the evaluation of serum amino acids and non-enzymatic antioxidants in drug-native first episode MDD. The study involved 247 MDD patients and 248 healthy patients as subjects. The Hamilton depression rating scale was used to measure. Amino acids supplement usually reduces or ease the symptoms of depression and other mental illness as it convert into neurotransmitters. The amino acids like tryptophan, tyrosine, and phenylalanine play a vital role in the pathogenesis of depression. Methionine also helps the body to produce S-adenosyl-1 methionine which lowers the depression. The study concluded that lower levels of serum methionine, phenylalanine, tryptophan, tyrosine, and non-enzymatic antioxidants are correlated with depression, whereas this parameter in MDD patients reduced the cause of major depression.[29]

## Role of Physical Activity in Depression and Anxiety

Regular exercises ease the symptoms of depression and anxiety as it releases endorphins. Endorphins are a feeling good hormone, natural brain chemicals such as cannabis, and endogenous cannabinoids. also enhance the sense of well-being. Through daily physical activity, we can take our mind off from worries i.e. from the negative thoughts which lead to depression and anxiety. It can also help to gain confidence, getting more social interaction, doing some positive things, etc.[30]

A study was conducted in the year 2010 to link physical activity as a treatment for depression stated that physical activity is an effective treatment for depression. The subject selected were 33 patients who were interviewed and result was calculated using randomized control trial. It was found that patient's physical activity had "self-regulatory" way to manage the depression symptoms without taking any antidepressant. The patients concluded that meditation was an effective way to cope with the depressive disorder.[31]

A research was conducted in the year 2010 to examine the relationship between depression and physical activity and depressive symptoms both cross-sectional and longitudinally. A total of 3322 subjects (pupils) were enrolled aged 9–12 years and overall response was 84%. Depressive symptoms were measured using the Short Moods and Feelings Questionnaire and the study was analyzed by logistic regression. There was cross-sectional association between physical activity and depressive symptoms for both boys and girls showing symptoms of about 8% for per additional hour of exercise, i.e., boys: odds ratio (OR) = 0.92, 95% confidence interval (CI) 0.85–0.99; girls: OR = 0.92, 95% CI 0.85–1.00 This study showed that there was on association between physical activity and depression in adolescents.[32]

A survey was conducted in the year 2010 to investigate the long-term benefits of a 6-week comprehensive Cardiac Rehabilitation (CR) program on physical activity, physical well-being, and quality of life in patients with coronary heart disease. The subjects involved were 147 patients and questionnaire was developed with Hospital Anxiety and Depression Scale. The research concluded that a 6 week CR program is beneficial in improving quality of life, physical activity status, anxiety, and depression. The result showcased that energy expenditure was significantly higher for men compared to women.[33]

A study was conducted to treat major depression with physical activity. The study was done in the year 2014 by a randomized controlled trail design. Physical activity is a treatment that has great interest. Physical activity increases fitness, cognitive functioning, and general well-being and has decreasing or preventive effect on mental and physical conditions and anxiety. It was found that 1 hour of physical activity in a week reduces depressive disorder. The result revealed that there was a strong proof that there was physical activity was inversely correlated with depressive disorder.[34]

A survey was conducted in the year 2016 to see the preferences for exercise as a treatment for depression. 102 subjects with major

depression participated in the study in an online survey. The main score of the Physical Activity Questionnaire-8 was 16.8 (SD=4.1; range = 10–24). 83.3% sample received treatment for depression during lifetime and 62.7% were receiving treatment. The result revealed that both sexes reported high interest in depression exercise programs. The research concluded that majority group have interest in exercise, but the symptoms were significant lack of motivation, mood and fatigue were reported by majority of participants of both gender. "lack encouragement and support from family/friends."[35]

In 2017 a study was undertaken to observe association between physical activity and symptoms of depression, by the Norwegian social research with regional centers for drug rehabilitation. The age group included 15–16 years old adolescents as subjects. Binomial logistic regression was used to analyze association between physical activity and depression.

Participation in sports reduces the level of depression and stress among adolescents was the main result of the study. The study concluded that physical activity had a different impact on adolescents and their mental health.[36]

A study was carried out in 2019 on the physical activity and depressive disorders in pregnant women which revealed that pregnancy is a unique period in the life of women. Regular physical activity was one way to maintain normal mental and physical well-being. Pregnant women who had moderate physical activity on regular basis had lower risk of developing obesity and overweight. On the basis of this study, it was concluded that physical activity helps in reduction symptoms of depression during pregnancy and is a safe form of treatment.[37]

According to a research conducted in 2016 regular exercise reduced the self-reported depression, anxiety, and psychosomatic stress and had a positive result on the quality of life. 153 university students from which 127 were women, mean age 23 years. Out of them 32 students registered for laboratory study and others for online. Six weeks of aerobic exercise resulted improvement in self -reported depression and anxiety symptoms. This confirmed that relation between physical activity and depression as well as anxiety.[38]

## Conclusion

As seen in the review above there is a increase in prevalence of anxiety and depression. A few of the micronutrients such as zinc, selenium, magnesium, iodine, Vitamin A, B complex, Vitamin C, and Vitamin D, have shown a beneficial effects on its etiology. But only a few studies are available on the beneficial role of these micronutrients in anxiety and depression. Hence, we need a few more studies to prove the importance of this micronutrient intake in the etiology of anxiety and depression.

## References


1. Available from: https://www.bbrfoundation.org/depression. [last accessed on 2022 Feb 16].
2. Available from: https://www.whiteswanfoundation.org/depression. [last accessed on 2022 Feb 16].
3. Available from: https://www.helpguide.org. [last accessed on 2022 Feb 18].
4. Available from: https://www.medicinenet.com. [last accessed on 2022 Feb 18].
5. Available from: https://www.medicalnewstoday.com. [last accessed on 2022 Feb 18].
6. Available from: https://www.my.clevelandclinic.org. [last accessed on 2022 Feb 20].
7. Available from: https://www.everydayhealth.com. [last accessed on 2022 Feb 20].
8. Available from: https://www.ourbetterworld.org. [last accessed on 2022 Feb 20].
9. Available from: https://www.nimh.nih.gov/health/topics/anxiety-disorders. [last accessed on 2022 Feb 21].
10. Available from: https://www.who.int. [last accessed on 2022 Feb 21].
11. Gandhi PA, Kishore J. Prevalence of depression and the associated factors among the software professionals in Delhi: A cross-sectional study. Indian J Public Health 2020;64:413-6.
12. Arvind BA, Gururaj G, Loganathan S, Amudhan S, Varghese M, Benegal V, *et al*. Prevalence and socioeconomic impact of depressive disorders in India: Multisite population-based cross-sectional study. BMJ Open 2019;9:e027250.
13. Pilania M, Yadav V, Bairwa M, Behera P, Gupta SD, Khurana H, *et al*. Prevalence of depression among the elderly (60 years and above) population in India, 1997-2016: A systematic review and meta-analysis. BMC Public Health 2019;19:832.
14. Baxter AJ, Scott KM, Vos T, Whiteford HA. Global prevalence of anxiety disorders: A systematic review and meta-regression. Psychol Med 2013;43:897-910.
15. Available from: https://www.ourworldindata.org. [last accessed on 2022 Feb 21].
16. Murthy RS. National mental health survey of India 2015-2016. Indian J Psychiatry 2017;59:21-6.
17. Tran TT, Nguyen NB, Luong MA, Bui TH, Phan TD, Tran VO, et al. Stress, anxiety and depression in clinical nurses in Vietnam: A cross-sectional survey and cluster analysis. Int J Ment Health Syst 2019;13:3.
18. Available from: https://www.frontiersin.org. [last accessed on 2022 Feb 22].
19. Coppen A, Bolander-Gouaille C. Treatment of depression: Time to consider folic acid and Vitamin B12. J Psychopharmacol 2005;19:59-65.
20. Amani R, Saeidi S, Nazari Z, Nematpour S. Correlation between dietary zinc intakes and its serum levels with depression scales in young female students. Biol Trace Elem Res 2010;137:150-8.
21. Dickerman B, Liu J. Do the micronutrients zinc and magnesium play a role in adult depression? Top Clin Nutr 2011;26:257-67.
22. Rucklidge J, Johnstone J, Harrison R, Boggis A. Micronutrients reduce stress and anxiety in adults with attention-deficit/hyperactivity disorder following a 7.1 earthquake. Psychiatry Res 2011;189:281-7.
23. Gariballa S. Poor Vitamin C status is associated with increased depression symptoms following acute illness in older people. Int J Vitam Nutr Res 2014;84:12-7.
24. Kelley L, Sanders AF, Beaton EA. Vitamin D deficiency, behavioral atypicality, anxiety and depression in children with chromosome 22q11.2 deletion syndrome. J Dev Orig Health Dis 2016;7:616-25.
25. Boyle NB, Lawton C, Dye L. The effects of magnesium supplementation on subjective anxiety and stress-a systematic review. Nutrients 2017;9:429.
26. Hidese S, Saito K, Asano S, Kunugi H. Association between iron-deficiency anemia and depression: A web-based Japanese investigation. Psychiatry Clin Neurosci 2018;72:513-21.
27. Han B, Zhu FX, Yu HF, Liu S, Zhou JL. Low serum levels of Vitamin D are associated with anxiety in children and adolescents with dialysis. Sci Rep 2018;8:5956.
28. Campisi SC, Zasowski C, Shah S, Shah A, Bradley-Ridout G, Korczak DJ, *et al*. Assessing the evidence of micronutrients on depression among children and adolescents: An evidence gap map. Adv Nutr 2020;11:908-27.
29. Islam R, Ali S, Karmoker JR, Kadir MF, Ahmed MU, Nahar Z, *et al*. Evaluation of serum amino acids and non-enzymatic antioxidants in drug-naïve first-episode major depressive disorder. BMC Psychiatry 2020;30:333.
30. Available from: https://www.mayoclinic.org. [last accessed on 2022

Feb 22].
31. Searle A, Calnan M, Lewis G, Campbell J, Taylor A, Turner K. Patients' views of physical activity as treatment for depression: A qualitative study. Br J Gen Pract 2011;61:149-56.
32. Rothon C, Edwards P, Bhui K, Viner RM, Taylor S, Stansfeld SA. Physical activity and depressive symptoms in adolescents: A prospective study. BMC Med 2010;8:32.
33. Yohannes AM, Doherty P, Bundy C, Yalfani A. The long-term benefits of cardiac rehabilitation on depression, anxiety, physical activity and quality of life. J Clin Nurs 2010;19:2806-13.
34. Nystrom MB, Neely G, Hassmen P, Carlbring P. Treating major depression with physical activity: A systematic overview with recommendations. Cogn Behav Ther 2015;44:341-52.
35. Busch AM, Ciccolo JT, Puspitasari AJ, Nosrat S, Whitworth JW, Stults-Kolehmainen M. Preferences for exercise as a treatment for depression. Ment Health Phys Act 2016;10:68-72.
36. Kleppang AL, Hartz I, Thurston M, Hagquist C. The association between physical activity and symptoms of depression in different contexts-a cross-sectional study of Norwegian adolescents. BMC Public Health 2018;18:1368.
37. Kołomańska D, Zarawski M, Mazur-Bialy A. Physical activity and depressive disorders in pregnant women-a systematic review. Medicina (Kaunas) 2019;55:212.
38. Herbert C, Meixner F, Wiebking C, Gilg V. Regular physical activity, short-term exercise, mental health, and well-being among university students: The results of an online and a laboratory study. Front Psychol 2020;11:509.