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# Essential nutritional, psychological and physical management for boosting the immunity against COVID-19 infection

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## Abstract

This updated review is related to current situation of COVID-19 in this world.Loss of immunity is the main cause of this severe infection.Through this review many essential nutrition , psychological and physical activities are explained which are usefull to boost the immunity as per reported litterature.All data has been collected from latest repoted research by Web of science, Scopus ,Google scholar and Pubmed. In addition, this article expressed that all repoted. Vitamins, micronutrients, herbal extracts, psychological interventions , recommended changes in lifestyle and physical activities can boost the immunity in human and make his body powerful against COVID-19 infection.

**Keywords**: Nutrition, Psychological interventions, Physical activities, Immunity, COVID-19

**Paper type:** Review Article**.**

## 1.Introduction

As a novel infectious disease, the COVID-19 has a lot of special influencing factors and conditions (Li et al., 2020). Coronaviruses are among the spectrum of viruses that can cause the common cold and severe acute respiratory syndrome (SARS). New infectious diseases, such as SARS show a serious threat to public health (Arshad et al., 2020). Coronavirus has an ability to spread fast in multiple countries. Millions of people have died due to this infection till now (Y. J. Suzuki et al., 2021; Zahid et al., 2021) .The coronaviruses belongs to Coronaviridae family and Coronavirinae subfamilies (Nyayanit et al., 2021), this subfamily consist of four genera: α-coronavirus, β-coronavirus, γ-coronavirus, and δ-coronavirus (Mirzaei et al., 2020). Coronaviruses are enveloped RNA viruses with a non-segmented genome (Paybast et al., 2020).

Currently there is not completely clear pathological mechanism of COVID-19 infection (Yuksel et al., 2020), The viral infection and host-related effects are assumed to be crucial in this disease (Alvarez-Munoz et al., 2021). It is also be considered that immunopathogenesis is related with a weak immune system, which may lead to pulmonary tissue damage. Therefore, there is an urgent need to boost up the immune response against COVID -19 infection (Mirzaei et al., 2020). Adaptive Immunity is the natural process that our body developed to fight any bacteria, viruses or unknown substances (Lee et al., 2020). The immune system requires to be strong enough in order to fight with any diseases caused by these foreign substances (Scudiero et al., 2021). So, this theory itself explains the people recovering from corona virus infection are with strong immunity. On the other hand, old age people due to weak immunity have more risk to get infected severely with COVID-19 (Sharma, 2020). There are four main functions of the immune system that enable defence of host, creating a barrier to prevent pathogens from entering the body. Identifying pathogens if they breech a barrier. Eliminating pathogens. Generating an immunological memory (Calder, 2020).

Weak immune system can also lead the death after severe infection caused by corona virus (Jain et al., 2020; Shankhdhar et al., 2020). The immune system becomes active all time but further cells become functional in the presence of pathogens (Gombart et al., 2020). This function results in a significant increase in the demand of the immune system for energy yielding substrates (amino acids ,glucose and fatty acids)(Calder, 2020; François et al., 2020). Immune response induces the generation of lipid-derived mediators such as leukotrienes, prostaglandins and many other of different protein including immunoglobulins, cytokines chemokines, adhesion molecules, cytokine receptors, and acute-phase proteins. This requires the substrate fatty acids and amino acids, respectively (Ayola-Serrano et al., 2021; Miles et al., 2021).

The COVID-19 pandemic has prompted an increase in claims that certain foods, beverages, and dietary supplements can "boost" immunity (dos Santos Ferreira et al., 2021). The immune system is very complex, made up of many different cell types and processes, and proper nutrition is undoubtedly required to maintain its function. Specific functions have been identified for several micronutrients, including vitamins A, B6, B12, C, and D, copper, folic acid, iron, selenium, and zinc, with documented effects on aspects of immune function as a result of clinical deficiencies.(Lockyer, 2020). Increased susceptibility to infection and worse outcomes with malnutrition have often been observed (Bencivenga et al., 2020). However, high body weight, diabetes, and aging are also associated with immunodeficiency. The gut microbiota is closely linked to the immune system and there is evidence that components of food that change their composition favourably, such as prebiotics and probiotics, may be beneficial in immune modulation (Zhou et al., 2021). Studies also point to some benefits of certain dietary supplements; For example, vitamin C and zinc supplements have been shown to reduce the duration of a cold, Probiotics have been suggested to reduce the duration and severity of acute infections (Lordan et al., 2021). Diet and immunity have been a hot topic in recent months in COVID-19 pandemic (Rodriguez-Leyva et al., 2021), various media reports showed various food components and supplements (vitamin C and garlic) as beneficial for boosting the immune system (Khoramipour et al., 2021; Namdeo, 2021). Some articles have also been suggesting that people should be avoiding some foods (like animal foods, too much alcohol, ice cream) in order to protect the lives from infection (Calina et al., 2021; Mishra et al., 2021).

Chronic Psychological stress in COVID-19 can cause some serious adverse effects on the immune system. The interventional techniques for stress management might be helpful in strong immune responses among stressed patients(Saini et al., 2021). COVID-19 pandemic is a worldwide public health disaster and a big cause of physiological stress and fear. Population in every country all over the world is affected directly or indirectly by this pandemic that has created huge stress, which affects the brain. Now it is well established that the physiological and psychological responses to stress are mediated by the hypothalamic-pituitary-adrenal (HPA) axis, sympatho-adrenergic and brain monoaminergic systems (Rasheed, 2021), and most importantly an altered function of HPA-axis was recently reported in patients with COVID-19 (Hashim et al., 2021; Isidori et al., 2020) Psychological disturbance lead further cardiac issues also (Bashir et al., 2019a), which needs combined treatment with anti-psychotic drugs and cardiac medications (Bashir et al., 2019b).

It is well established that the abnormalities in neurotransmitters such as noradrenaline, dopamine, and 5-hydroxytryptamine are involved in the development of stress-mediated neurodegenerative disorders. Numerous herbal plants and their active ingredients have been tested on different stress model that increase the immunity and lower the stress (Bashir et al., 2020; Khanal et al., 2020; Oladi, 2021). high level serotonin and noradrenaline boost immunity in COVID 19 (Sohel et al., 2021).Many herbal plants that have strong antioxidant activity can boost the immunity (Kaz Abdul Aziz et al., 2020).

Concept of Psychoneuroimmunity may be proved as beneficial in understanding the various factors under influence of the Corona virus infection (Wang et al., 2021). COVID-19 patients have a variety of psychological stresses, including uncertain future of the family ,occupational damage, and fear of death which cause anxiety disorder among them, Several factors, including social supports, health supports, psychological counselling, spiritual connections, food habit, positive thoughts ,control on emotions, and interesting reasons for living (interest in life) may increase the self-confidence against COVID-19 effects. Many evidence also suggests an association between immune response and psychological conditions (Hannan et al., 2020).

Psychological interventions can decrease the stress may control an acute immune response and increase the neurotransmitters level in the brain which further enhance the Self-confidence (Perlmutter, 2021; Rashid et al., 2020). There are also some clinical benefits of optimizing the lifestyle among COVID-19 patients, according to some evidences, it is suggested that healthy lifestyle practices in patients with infectious diseases may boost their immune system. Whereas some unhealthy lifestyle (like poor sleep , physical inactivity , poor diet, stress, loneliness smoking and alcohol) can significantly damage the immune system and predispose people to higher susceptibility to infectious diseases (Monye et al., 2020).

Physical activity is an important and core focus treatment of low immunity. Exercise can increase the immunity and decrease the stress (Peters et al., 2021) Exercise along medicine can give more benefits sometimes (Bashir MS, 2017). Moderate-intensity physical activity is highly recommended to enhance the immune function and to be useful for preventing acute upper respiratory infections and similar conditions. Many people practice low-intensity short-duration exercise with the expectation of a beneficial effect on immunocompetency.(K. Suzuki et al., 2021). Furthermore, it is proved that good

sleep can increase the immunity and improve normal psychological functions in COVID 19 (Richter et al., 2021).

In this current review all beneficial micronutrients, herbal extracts, psychological interventions and physical activities are comprehensively discussed that can increase the immunity against COVID-19.

## 2.Nutritional Management for Boosting the Immunity against Covid-19.

### 2.1 Vitamins and Micronutrients

A very well balanced diet including vitamin A, B, C, D, E, and K, and some micronutrients such as copper, zinc, selenium , folate ,sodium and calcium may be beneficial in various infectious diseases (Kumar et al., 2021). A deficiency of these vitamins and minerals in the plasma concentration may lead to a reduction of immunity (Gombart et al., 2020; Mikkelsen et al., 2019).

### 2.2 Vitamin A

Vitamin A refers to a group of fat-soluble vitamins. It includes retinol, retinal, retinoic acid (Chandrasekhar, 2021). This Vitamin boosts the production of immunoglobulin G. Vitamin A and its active metabolite have been shown to produce anti-inflammatory effects through different mechanisms. Vitamin A deficiency can negatively effects the normal function of cells of the innate and adaptive immune systems (Shojadoost et al., 2021).

### 2.3 Vitamin B6

Vitamin B6 is also a water-soluble vitamin present in various types of foods such as fish, whole grains, and banana etc. (Kumrungsee et al., 2020) .This vitamin is needed for lymphocyte and interleukin-2 production that play a vital role in immune system further (Qian et al., 2017).

### 2.4 Vitamin B12

Vitamin B12 also called as cobalamin, it is found in many foods from animal sources, such as red meat, fish, poultry, milk, yogurt, and eggs (MOGHADDAS et al., 2021). Vitamin B12 plays a key role in the immunity and brain's proper functioning .It increases the CD8 ( a mediator of adaptive immunity) and natural killer cells (DONMA et al., 2021).

### 2.5 Vitamins C

Vitamin C also known as Ascorbic acid is a water-soluble micronutrient with antioxidant properties that plays a vital role in the immune system (Junaid et al., 2020), by supporting the epithelial barrier against the entry of pathogens and the cellular functions of the innate and adaptive immune systems (Souza et al., 2020).

### 2.6 Vitamins D

Rather than the traditional name, in actual vitamin D is a hormone. Vitamin D3 ( a further type of Vitamin D) plays an important role in the body's immune function(King, 2021). In fact, Vitamin D acts as a powerful modulator of the immune system. Vitamin D has receptors in all immune cells. It is

associated with the production of T lymphocytes and the differentiation of B lymphocytes. Vitamin D also optimizes anti-inflammatory mechanism of body (Fabbri et al., 2020).

### 2.7 Copper

Copper (Cu), one of the trace elements that is playing vital role in growth, and immunity in body (Dharmalingam et al., 2021), It can increase the IgM production and also involved in the production of interleukin-2(Dawood et al., 2020).Mostly it can be found in Nuts and Seeds, Lobster ,Leafy Greens,Dark Chocolate (Sharma, 2020).

### 2.8 Folate

Folate which is also known as vitamin B9, is an essential water-soluble micronutrient that plays a key role in the synthesis of and normal cellular function (Kaur, 2015). It is Needed for thymus, spleen, and circulating T lymphocytes (Unnithan, 2021). Brussels sprouts , Broccoli, chickpeas, kidney beans and leafy green vegetables, such as cabbage, kale, spring greens , spinach, peas are the main sources of folate (Sharma, 2020).

### 2.9 Selenium

Selenium (Se) is an essential trace element in human body for strong immune system, it has also anti-inflammatory and antioxidant effects. Its deficiency increases RNA-virus replication and virulent mutations which lead to more severe tissue damage (Q. Liu et al., 2021) . It is effective against COVID as it Increases the activity of cytotoxic lymphocytes and natural killer cells (He et al., 2021). Beef, turkey, chicken, fish, shellfish, and eggs contain high amounts of selenium (Konikowska et al., 2018; Surai et al., 2017).

### 2.10 Zinc

Zinc is involved in the production process of many proteins and is involved in activating the enzymes necessary for normal cellular functions (Chasapis et al., 2020). Meat is an excellent source of zinc. It can be found in seeds ,whole grains and Nuts as well (Uwitonze et al., 2020).

## 3. Herbal plants for improving the immunity

### 3.1 *Panax Ginseng*

*Panax ginseng* belongs to Araliaceae family (L. Liu et al., 2020). It contains triterpene glycosides, or saponins, commonly referred to as ginsenosides. Many active compounds can be found in all parts of the plant, including, alkaloids, amino acids, , proteins, polypeptides, phenols and vitamins B1 and B2.Many previous research reviews postulate that extracts of *P. ginseng* affect the hypothalamus pituitary-adrenal axis and the immune system both (Namdeo, 2021).

### 3.2 *Aloe barbadensis*

*Aloe barbadensis* is the member of Asphodelaceae family (Vandebroek et al., 2020). It contains vitamins A (beta-carotene), C and E, which are strong antioxidants. It also contains folic acid, vitamin B12, amino acids, minerals and choline (Mehrabi et al., 2019).

### 3.3 *Echinacea perpurea*

This plant is related to Asteraceae family (Mei et al., 2020). *Echinacea perpurea* is one of the most famous herbs which has been extensively studied for the immune system. It has been used as an immune stimulant in common colds and flu. It is widely promoted for its ability to increase the innate immunity (Declerck et al., 2021).

### 3.4 *Withania somnifera*

It belongs to Solanaceae family (Mehmood et al., 2020). Previously it has been showed a significant enhancement in neutrophil adhesion and delayed-type hypersensitivity (DTH) response. It can potentiate the cellular immunity(Dongre, 2020).

### 3.5 *Azadirachta indica*

Azadirachta indica is the part of a family named as Meliaceae (Bezerra et al., 2021). "Neem" is its common name. It helps to boost your immune system and cooling down your body internally. It possesses both antibacterial and anti-fungal properties that help keep your skin radiant, clean, and healthy. Neem also has blood purifying properties as well (Duarte et al., 2020).

### 3.6 *Allium sativum*

*Allium sativum* is famous member of family Alliaceae (ERDOĞAN, 2020). Garlic is considered as a capable candidate for maintaining the homeostasis in immune system. It has been found that garlic protein fraction has a significant stimulatory effect on lymphocytes, Natural Killer (NK) cells, and macrophages cytotoxicity (Moutia et al., 2018).

### 3.7 *Ocimum tenuiflorum*

Ocimum tenuiflorum is the member of Lamiaceae and known as ''Tulsi" in many places (Zahran et al., 2020). This plant can help the people in protection against certain infections and viral infections. It has strong disinfectant and germicidal factors are not the only reason why Tulsi is a great herb for boosting your immunity(Patil et al., 2020)

### 3.8 *Emblica officinalis*

This plant belongs to Phyllantheacae family (Akbar, 2020). The fruit extract of *Emblica officinalis* (Amla) has been shown to have strong free radical scavenging activity and immunomodulatory properties (Nirala, 2020).

### 3.9 *Curcuma longa*

It is the part of Zingiberaceae family and well known as "Turmeric"(Phukhahad et al., 2021). Turmeric is among the richest food sources of Iron, as 67.8 mg is iron per 100 g of turmeric powder. Iron is an important herb for improving the immunity (Namdeo, 2021)**.**

## 4. Psychological and life style Interventions.

### 4.1 Social Supports

Social support can relieve psychological pressure of a person. It can eliminate the psychological obstacles and promote mental health. A study have proposed various forms of support, such as peer support and counselling service to alleviate psychological problems (Fang et al., 2021).Social support is an important psychological aid in current situation of restriction of movement loneliness and depression. social support is a mental health coping strategy. It can improve the mental health level of many people who are not affected with COVID yet but they are under influence of stress and fear of COVID disasters (McKinley, 2020).

### 4.2 Spiritual connections

Strong spiritual connections are important resources to support adaptation, providing assistance to honour and grieve all that was lost and going on with life (Walsh, 2020) . In this time of COVID-19, many worships help families to increase their confidence (Hannan et al., 2020).

### 4.3 Food habit

Food habit is related to life style. In this condition many populations are living at home. Previous research observed a limited mobility among citizens' routines at homes, it influenced their life habits, including food management (Vidal-Mones et al., 2021). Opposing behaviors tended to be perceived because, although part of the population improved its diet during the lockdown and put the lockdown to good use to prepare healthier meals, another part increased its intake of alcohol, fizzy drinks, snacks, and sweet food which can lower the immunity of a person (Kriaucioniene et al., 2020)

### 4.4 Control on emotions

In this situation control on emotions like anxiety and fear is necessary. An anxiety may lead to substandard care for patients that may negatively impact patient safety. Previously reported data shows that control on emotions (eg, anxiety and fear) leads toward the infection prevention practices (Apisarnthanarak et al., 2020).

### 4.5 Positive thoughts.

The positive thoughts are directly proportional to the positive effects on immunity by controlling or decreasing stress level. The decrease in the positive thoughts have direct impact on health, thus it paves a way for occurrence of disease(Shankar et al., 2020). Some study show the relationship of positive thinking to the recovery of positive patients with Covid 19(Alhempi et al., 2021).

### 4.6 Self-confidence

self-confidence that can mitigate psychological stresses posed by COVID-19 can play an important role in consolidating immune response against this disease(Hannan et al., 2020). Self-confidence interacts with the overwhelmed immune response may offer a prospective strategy for the prevention as well as effective management of COVID-19 in means of stress induced immunity loss recovery (Gros, 2021).

### 4.7 Sleep

Sleep is a physiological and behavioural state which is essential to life, considered to play a vital role in the immune system, homeostasis, maintaining performance, muscle restoration, energy metabolism, cognitive function, and neural plasticity by increasing the serotonin, noradrenaline and dopamine in brain. It has also been recommended that adult sleep duration must be between seven and nine hours per night (De Mello et al., 2020).Sleep deprivation (SD) leads to decreased cognitive and physical performance. Less sleep reduce the alertness, and has a negative impact on health including increased risk of stroke, diabetes, obesity, osteoporosis, cancer, and cardiovascular disease (Crowther et al., 2021).

## 5. Physical Activities for increasing the Immunity

### 5.1 Exercise Immunology.

Exercise immunology have shown that the immune system is highly responsive to acute and chronic exercise. Moderate exercise can enhance the immunosurveillance and when repeated over time generate multiple health benefits (Nieman et al., 2020). Physical activity represents one of the basic units of health living and is also the thus a primary component of living medicine. It is consistently shown to dramatically reduce the risk for developing systemic inflammation, excess body mass and non-communicable diseases known to compromise immune function (Laddu et al., 2021). Physical exercise can enhance body immunity and respiratory function. Moderate types of physical exercise such as aerobics can increasing the immunity by using the increasing the function of T-lymphocytes, immunoglobulins, mainly Ig G and Ig A, regulating C-reactive protein levels to prevent limit lung feature and extend the vital capacity of the lungs. Continuous physical workout of moderate intensity has been proven as effective booster of immune system against infection disease (Suciliyana et al., 2021).

### 5.2 Yoga

Yoga plays an important role in the life wellbeing. It is the one amongst the foremost effective and tried resistance boosters that can be adopted for a healthier life (Bankar et al., 2021). Yoga strengthens our body physically similarly as mentally (Pande et al., 2020).

### 5.3 Deep breathing

Deep breathing is a classic and practical method to reduce the stress and to reduce the nervousness. It has been widely recognized in psychology and physiology. Deep breathing method is beneficial to reduce the stress induced by wearing a mask for a long time (Tian et al., 2020).

### 5.4 Swimming

Swimming rises the heart rate which improves the cardiovascular strength and helps to maintain ideal body weight. Swimming is recommended to keep healthy heart and lung (Ashwini et al., 2020).

### 5.5 Brisk walking

Brisk walking is just a walk faster than the normal, for example hundred steps per minute. Which help to improve aerobic capacity and improve blood circulation (Dixit, 2020).

### 5.6 Low impact aerobic exercises

Aerobic exercise helps to improve the aerobic capacity of the individual and also improves strength, reduce mental stress which can enhance the immunity (Ashwini et al., 2020).

## 6.Conclusion

It is concluded that all reported Vitamins, micronutrients, herbal extracts along with psychological interventions and physical activities can be proved as beneficial foe boosting the immunity against the COVID-19 on the bases of recorded evidences regarding immunity boosting effects.

**Conflicts of Interest**:

The authors declare no conflict of interest.

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