

## Review Article,

**Possible nutritional approach to cope with COVID-19 in Indian perspective****Swapan Banerjee<sup>1\*</sup>, Saroj Srivastava<sup>2</sup>, Ashim Kumar Giri<sup>3</sup>**

1. Faculty of Nutrition, Vivekananda Mission Seva Pratisthan, Ariadaha, West Bengal, 700056, India.

2. Department of Dietetics, Orchid Medical Centre, New Barhi Toli, Ranchi, 834001, India.

3. Faculty of Nutrition, Vivekananda Mission Seva Pratisthan, Ariadaha, West Bengal, 700056, India.

Corresponding author: Swapan Banerjee, Email:- [sbanerjee90@gmail.com](mailto:sbanerjee90@gmail.com)

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**Abstract:**

The coronavirus, also known as Covid-19, has infected more than 5.8 million people with over 351,000 deaths around the world. India is one of the faster-infected countries where tentatively 89,000 active cases, 86,000 discharged or cured and 5150 deaths reported as per the Indian Ministry of Health and Family Welfare by the end of May 2020. People of India are already beyond their all extreme capacities, and patience due to phase-wise lockdown imposed more than two months, i.e. since 24<sup>th</sup> March 2020. They are now waiting to rejoin in their work and resume their suspended services from 8<sup>th</sup> June (unlock phase-1). COVID-19 infections and death affected not only people's physical and mental health but also the entire economy as well as per capita income due to closures of almost all industries. In this review article, we are concern about essential nutrition through the daily average staple meals based on a much lower budget than usual due to financial troubles in the middle-class families and other classes as well. The only option to be healthy is by adding immunity-boosting foods which are not only cheap and best but readily available in our daily diet. In this COVID-19 phases, Indian people can exclusively rely on traditional foods as immunity elevator such as spices, citrus fruits, some vegetables, herbal tea, honey etc. The article, therefore, provides an overview of the home-based simple practice of diet based on online searches of relevant literature available in NCBI, Embase, other useful databases including Google scholar. The study overall reviews the values of Ayurveda, nutrition, yoga and their health benefits by protecting and boosting immunity.

**Keywords:** Nutrition, diet, immunity-boosting foods, Covid-19 diet, traditional medicines, exercise**Introduction:**

**COVID-19 Outbreak:** The world is severely affected by the novel coronavirus, i.e., COVID-19 pandemic, and that has become a serious concern worldwide for the survival of human beings. In last year December, several patients were reported with pneumonia of an unknown aetiology and admitted to hospitals in Wuhan, Hubei, China. It was predicted after initial analysis that the

spread of the novel coronavirus caused the disease, i.e., severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The virus was detected under the family of coronaviridae, so the health issue was initially named as nCoV-2019 and later, got a new name as COVID-19 by World Health Organization (WHO) on 11<sup>th</sup> February 2020. World Health Organization (WHO)

declared the outbreak of the novel coronavirus as a Public Health Emergency of International Concern (PHEIC) also. Centres for Disease Control and Prevention (CDC) showed that Coronavirus 2 is possibly a novel recombinant virus due to its similar genome structure of severe acute respiratory syndrome (SARS). Some studies already discussed that the primary origin perhaps from horseshoe bats or pangolin available in China as well as other Asian countries (1, 2,3, 4).

**Infection Mechanism:** The COVID-19 virus spreads through the contacts human to the human just because of close contact with an infected person. The persons who are having issues like sneezing, coughing may spread the virus through respiratory droplets or aerosols, and these aerosols can enter mainly in the lungs by inhalation. Further, people who are having weak immunity or other comorbidities such as diabetes, chronic kidney disease, cancer also more prone to the infection (5,6). SARS-CoV-2 pathogen mainly targets the respiratory system of the human body by using angiotensin-converting enzyme<sub>2</sub> (ACE<sub>2</sub>) receptors and angiotensin receptor, which are having a high susceptibility to COVID-19. The data showed that usually, the cause of death was due to severe atypical pneumonia in China but later proved other internal infections or comorbidities might welcome this deadly virus (7, 8, 9).

**Psychological and Behavioural Health:** COVID-19 outbreak not only affecting physical health but also mental health, whether rich or poor and male or females. Some developing countries, including India, are suffering more due to population, poverty, and ignorance. Therefore, coping with situations is highly challenging for them during this crisis period. Phase-wise lockdown since 24th March 2020 has devastated the economy due to closures of all industries resulting almost nil per capita income. Daily wages labourers and other below poverty line (BPL) people in India are severely affected, which is perhaps never seen in Indian history. Further, middle-class people are also struggling to survive during the crisis phases because of loss of jobs,

closures of shops, and other freelance earnings (10, 11).

**Foods and Nutrition:** Foods, cloths, and shelter are the basic needs of any human being anywhere in the world to live or even survive under any situation. During this crisis, poor people are mainly facing challenges to get minimum foods to meet their hunger, whether staying at their cottage or returning home from the workplace (12, 13). However, foods give energy and help a person active and live all time. Unfortunately, there is also a food security issue despite several governmental plans and projects to save lives (14).

**Immunity by Foods:** Rich or poor, all need foods to survive at least through the primary level nutrition. In this crisis, nutrition plays a vital role by building up immunity against any foreign invasion in any human body (15). Several studies showed that the nutritional status of an individual always determines the right body functions and also directs their appropriate psychological wellbeing (16, 17, 18). Therefore, to maintain the physical and mental wellbeing of an individual and community amid the COVID-19 pandemic, this review article has drawn essential overviews of the importance of diet and nutrition. The objective of this article is to review and analyze the readily available foods by identifying their proper uses. As per traditional culture in India, so many fruits, vegetables, spices are helpful for immunity boost up that overall provide the best nutrition to fight against coronavirus as well as other infections. The article, therefore conducted through the information that was gathered from published research and review articles. Literature was searched in PubMed (NCBI), Google Scholar and other important databases including some government portals like the Ministry of Health and Family Welfare (Government of India), Indian Council of Medical Research (ICMR) and World Health Organisation (WHO) etc. COVID-19, coronavirus, immunity-boosting foods, balanced diet, traditional foods, yoga, and exercise etc. keywords have been used for online searching of the literature.

**Nutrition and Dietary Intake:** Dietary intake forms a significant link between an individual's immunity level and their capability to fight many diseases, including viral infections like COVID-19. The role of specific nutrients or a combination of nutrients in the overall health maintenance of the immune system is not something unprecedented. Nutrients modulate an individual's immunity by regulating the production of signalling molecules and gene expression. Hence immune cell activity becomes much better (19). Therefore, it is essential to have an adequate amount of dietary intake of vitamins and minerals for enhancing the immune system, so that it can combat any diseases, including COVID-19. In nutrition, carbohydrate, protein and fat, minerals and multivitamins have vital roles to boost up and also retain immunity. A study showed that one of the fat-soluble vitamin D, which reduces the viral replication rates that can lead to lung injury-causing pneumonia by reducing pro-inflammatory cytokines. This way vitamin D helps in not only the musculoskeletal system but also the respiratory system (20). Besides, Vitamin A, E, B6, and B12, iron, and zinc are also very crucial for building a healthy immune system (7, 17, 21).

On the other hand, Vitamin C is one of the best-known antioxidants that is required to balance the damage caused by reactive oxygen species (ROS) and ultimately protecting the body from oxidative stress. Vitamin C (also called Ascorbic acid) provides a significant contribution to maintain a healthy immune system on the frame against any viral infection by positively regulating the T-lymphocytes and NK (Natural Killer) cells (22). It has been well reported that any viral infection manifests its effect by decreasing vitamin C levels within the body, and the patient's requirement of vitamin C depends on the severity of the disease (21, 22).

**Hydration and Immunity:** In India, according to the Ministry of AYUSH, dehydration is another reason for low resistance. Hence, it is essential to keep oneself hydrated by having either an adequate amount of plain water or other dietary

liquids. The dietary liquids are readily available like lemon or saltwater, glucose solutions, clear low-calorie fruits juices extracted from mosambi or orange. As per AYUSH, sometimes warm water is necessary for respiratory health or other health issues (23). In a survey-based study in West Bengal showed that an average direct drinking water consumption for adult males is 3.95 L/day, females 3.03L/day and children (age <15 years) 2.14 L/day depending upon BMI, humidity, activities and other conditions (24). Water added with lemon, rock salt, iodized salt, apple cider vinegar, berries, aloe vera can also be consumed to keep the body hydrated and immunized in general or during the humid season. Older adults or patients who are suffering from any types of diabetes or CKD or other chronic diseases must avoid salt and sugar except for a few cases as per medical advice by a doctor (33, 34).

**Ayurveda in Nutrition:** India is the top producer cum exporter of various spices. Spices are not only used for taste, flavour, palatability but also as medicines as per traditional Ayurveda therapeutic systems. Since old age, Garlic, Clove, Cumin, Turmeric, Coriander and other spices available either dust or leaves which play a crucial role in building immunity in a human body. Haldi (Turmeric) popularly known as golden milk in India, can also be consumed with any types of milk daily. It is recommended to consume Chyavanprash for boosting immunity since a few generations (23). However, a diabetic person should only consume sugar-free Chyavanprash or avoid altogether unless very necessary or doctor's advice. In addition to that, herbal tea which is a decoction of dry Ginger, Black pepper, Cinnamon, Basil, and Raisin etc. altogether is recommended as per schedule dosages for refreshments and also in lethargy. In Ayurveda, if a person has a sore throat, then it is advisable to have honey with clove powder mixed up to 2-3 times a day (25, 26). The study reviewed that India is such a country where almost 40%-50% of people are vegetarian (in dietary term 'vegan'). The vegan people do not get animal protein but having other nutritional sources to meet their daily nutrition. In

practical, the vegan people are equally active and competent through their various defence jobs,

sports participation and other high-level activities as like non-vegetarian people. (28, 30, 31, 32).

**Table 1. Immunity-Boosting Foods (Edible parts)**

Sl	Ingredient	Scientific Name	Form*	Nutrient value*kcal/100g.	Health Benefits
1	Turmeric (curcumin)	<i>Curcuma domestica</i>	powder	282	Anti-inflammatory cum ant mutagenic, antimicrobial [35, 36] and anticancer properties [37, 38] reduced total cholesterol & LDL [39, 40, 41].
2	Cumin (Jeera)	<i>Cuminum cyminum</i>	seeds	306	Improve gut motility and help in digestion [42] ,anti-microbial, anti-oxidant, anti-diabetic [43,44] anti-cancer & anti-fertility, anti-osteoporotic [45].
3	Coriandar (Dhaniya)	<i>Coriandrum sativum</i>	seeds	270	Helps in Type 2 Diabetes [46]. Rich in immune-boosting antioxidants [18]. May fight infections [47], benefit heart health [48], and protect brain health [49].
4	Garlic (Lahasun)	<i>Allium sativum</i>	small clove	123	An antioxidant that supports the body's protective mechanisms against oxidative damage and the common cold. Reduce blood pressure; lower the risk of heart disease, increasing testicular testosterone. Natural antiseptic [50]. Antiviral and having anti-Diabetes properties [51].
5	Cinnamon (Dalchini)	<i>Cinnamomum verum</i>	ground	247	Antioxidant, antifungal, antibiotic, antimicrobial can kill bacteria, viruses and even some drug-resistant fungi. Fights diabetes& reduce heart disease [52, 53]. Anti-inflammatory, anti-cancerous, anti-diabetes [53].
6	Ginger (Adarak)	<i>Zingiber officinale</i>	fresh ginger	55	Antioxidative stress effects [53] raise the immune system [54]. In hyperuricemia and rheumatoid arthritis [55]. Anti-tumour effect on colorectal and other cancers like liver, G.I, ovarian, breast, skin, and prostate.[56,57]. Effective control in diabetes, weight management, LDL, TGL, VLDL [58]. Antiviral activity against human respiratory use ginger to help recover from a cold or the flue [59].
7	Black pepper (Kalimirsch)	<i>Piper nigrum</i>	seeds	218	Immunity promoting increases the concentration of good cholesterol, antioxidant and anti-inflammatory, sore throat due to flu, [60] in enhancing digestive tract function, nervous system benefit and antimicrobial properties [61].
8	Cloves (Laung)	<i>Syzygium aromaticum</i>	cloves	187	Antiviral, antimicrobial activity, hepatoprotective antidiabetic, anti-inflammatory action. Anti-stress activity,

					chemopreventive, and a total antioxidant by Clove. To remove bad breath, chew clove buds [58]. For oral health, antiseptic, obesity, osteoporosis, COPD, cough & cold, vomiting, good for eyes, pain abdomen [62].
9	Curry leaves	<i>Murraya koenigii</i>	leaves	64	Anti-inflammatory activity [35,37] oxidative stress inducer [38]. Immunomodulatory activity [50]. Anti-diarrheal activity [51]. Anti-microbial activity [47] & anti-diabetic [48].
10	Mint leaves (Pudina)	<i>Mentha spicata</i>	leaves	37	Dry cough / sore throat, Immunity boosting, [49]. Helps in digestion, treats asthma, treats common cold, cures headache, oral care, improves brain power, beats stress and depression [50].
11	Coriander leaves	<i>Coriandrum sativum</i>	leaves	31	Helps in diabetes therapy [51], antibacterial activity [52] digestive health and control of diarrhoea, mouth ulcers. Anaemia, Menstrual disorders, Eyecare, Skin disorders,[53,54]. COPD, cough & cold, fever, and boosts immunity [55,68,70].
12	Fenugreek seeds (Methi)	<i>Trigonella foenum graecum</i>	seeds	236	Helps in healthy bowel movement, libido, skin, increased breast milk production, boosting testosterone, lowering blood sugar levels, anti-acid, high antioxidant flavonoid [56, 57, 58]
13	Cardamom, green	<i>Elettaria cardamomum</i>	seeds	256	Increasing HDL cholesterol [62] inflammation [60], antioxidant activity [61], lowering Blood Pressure [62, 67, 69] antibacterial and antifungal [63, 64,68].
14	Black Cumin (Fennel flower)	<i>Nigella sativa</i>	seeds	346**	Useful antioxidant activity, antidiabetic activity, anti-hypertensive activity, neuroprotective effects, anti-inflammatory and analgesic effects. Antiviral Activity, anticancer activity [65, 66] and male infertility [72, 73,74].

\*Source : Indian Food Composition Tables, 2017 [108] ; \*\* Source: USDA Nutrient Database [74].

**Table 2. Immunity-Boosting Foods (Edible parts)**

Sl.	Ingredient	Scientific Name	Form [74,108]	Nutrient value kcal/100g. [74,108]	Health Benefit
1	Amla	<i>Phyllanthus emblica</i>	raw	24	Immunity booster, respiratory disorders, diabetes, heart disorder, eye disorder, eye disorder, hypertension. Natural cure for anemia [71, 75]. Antioxidant improves digestion brain and mental functioning [79,80]. Helps the urinary system, good for the skin, promote hair health, for the treatment

					of diarrhoea [76, 77, 81].
2	Ajwain (Caraway seeds)	<i>Trachyspermum ammi</i>	raw	333	Dry cough / sore throat, and combats infection promotes digestion, controlling high blood pressure [81, 82].
3	Green tea (regular)	<i>Camellia sinensis</i>	brewed	0.96	Antioxidant and hepato-protective Activity [78, 83].Anticancer, anti lethargic, and anti-mutagenic activity.Antimicrobial,antioxidant and antiviral activity and cardio-protective activity [84, 85]. Antidiabetic and anti-obesity and anti-inflammatory, analgesic, antipyretic, and anti-allergic activity [85, 86, 88].
4	Tulsi (Basil)	<i>Ocimum tenuiflorum</i>	leaves	22	Improvement in fasting blood glucose [87,88,89,90] Immunomodulation, inflammation [91,92] and antioxidant [93,94] treatment of epilepsy, asthma or dyspnea, hiccups, cough, skin and haematological diseases, parasitic infections, neuralgia, headache, wounds, gastric and hepatic disorders [95].
5	Honey	C <sub>6</sub> H <sub>12</sub> O <sub>6</sub> (by honey bee) <i>Apis mellifera</i> )	raw	304	Antibacterial, antiviral and fungicidal effects [96] anti-oxidative, anti-diabetes, immune-modulating, anti-cancer, anti-inflammatory anti-Hypertensive [97].
6	Yoghurt	<i>Dairy product, (culture of Lactobacillus bulgaricus)</i>	unsweetened, plain made by whole milk.	97	Protection against infections, reduce blood glucose and insulin, increase of good cholesterol [96.97], eczema, allergic rhinitis, or asthma, reduced risk of antibiotic-associated diarrhoea, intestinal flora balance [98].
7	Pipul	<i>Ficus religiosa</i> (Genus- <i>Ficus</i> )	raw	74	All types of Cancers, Cardiac disorders, chronic respiratory diseases and diabetes mellitus /Type-II [88, 89, 91].
8	Almond	<i>Prunus amygdalus</i>	raw	612	Type 2 diabetes, [90] , overweight and obese [92].
9.	Groundnut	<i>Arachis hypogaea</i>	raw	522	Cardio-protective effect [99] antioxidant, diabetes and inflammation. Helpful for cancer and allergies [100].
10	Tomato	<i>Lycopersicon esculentum</i>	raw	20	Cholesterol under control, vital antioxidant, [92] risk of prostate cancer, heart, kidney, diabetes, disease, good for your eyes [95]. Increase cellular immunity, [96] reduce the risk of pancreatic cancer [101].
11	Lemon	<i>Citrus limon</i>	juice	37	Lowering stroke risk [100] improves the blood pressure in humans [98, 99]

					common cold, lower respiratory symptoms, throat colds, pneumonia [101,102]. Boosting the immune system by reducing cough and the flu [100].
12	Neem leaves	<i>Azadirachta indica</i>	juice (organic)	28kcal/100ml	Antioxidant activity role in the control of damage caused by free radicals/reactive oxygen species. [102]. Anti-inflammatory, anti-diabetic activity, antiviral activity [103]. Immunomodulatory and growth promoting effect [100,104].

**Mind Setup:** The need for the crucial phases is to stay positive-minded, always alert, and ready to eat healthy foods. These are the tools that always keep human active and healthy. A lot of green vegetables, fruit and water along with some physical exercise and sound sleep are the essential requirements for daily practise during these crucial days, as advised by World Health Organization (WHO) and health authorities. Since there is no vaccine or specific drug to treat COVID-19; so a person's healthy immune system and a sharp mind set up synergistically may help to face these COVID phases (26,27). The excellent health signifies not only physical health but also psycho-behavioural wellbeing.

**Lifestyles Changes:** Measures taken to curb the spread of this pandemic viral infections, SARS-CoV-2 infection are social distancing, and that has been made possible by nationwide lockdown resulting in disease containment. However, such measures have a massive impact on the diet of an individual because of the sudden change of lifestyle and less physical activity in lockdown period (18,106). Less physical activity results in low-calorie expenditure affect the health of an individual. Further, fear, anxiety related to the uncertainty of the surroundings, also impact the psychological wellness, and that has a profound effect on individual physiology too (7,18,105). Therefore, regular physical exercise or yoga asana, pranayama and meditation not only help to keep organs and muscles active but also balance the level of hormones. Biologically, these hormones help in the keeping overall maintenance

of an individual's body systems, including psycho-behavioural health [105,107].

### Conclusion:

COVID-19 infections can only be managed or reduced by maintaining social distancing, personal hygiene and immunity-boosting functional foods. Any pathogen mainly virus can quickly enter by the contamination and gradually affect the organs, including the death of a person. Anyways that would be difficult if there is a secure immunity system. Immunity system of a human body works through a defence mechanism which may be susceptible and vulnerable because of the low level of protein, vitamins, minerals and other essential nutrients. Here, foods play a significant role by providing the proper nutrition which helps not only to maintain all functions of all the systems of a human body but also strengthen immunity system to fight against any foreign particles like COVID-19. As per India's indigenous cultures and traditional medicinal systems, foods are medicines having almost nil side effects and available in nature in the form of spices, fruits and vegetables. Hence, foods as medicines as practical cum natural approach by protecting the total human health.

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