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2. Immunity Booster on COVID-19

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2.1 Introduction:

Corona virus disease 2019 (COVID-19) is an infectious disease caused by Severe Acute Respiratory Syndrome Corona Virus 2 (SARS-CoV-2). It was first identified in December 2019 in Wuhan, China, and has since spread globally, resulting in an ongoing pandemic [2, 3]. As of 10 June 2020, more than 7.3 million cases have been reported across 188 countries and territories, resulting in more than 413,000 deaths with more than 10% mortality rate.

The corona virus (COVID-19) is having very high transmission rate among humans and it and it had transmitted throughout the globe, it is critical to practice the preventive measures to protect ourselves against these viruses. According to WHO's recent report viral diseases are world's highest public wellbeing challenges. (WHO, 2020).

The World Health Organization (WHO) estimates occasional flu brings about 3-5 million cases every year. Today understand hygiene and social distancing are the key practices in protecting yourself as well as other people from getting an infection while additionally easing back the spread of the Virus.

COVID-19 or 2019 novel Corona virus was declared as a pandemic by the World Health Organization in Feb 2020 and keeping in mind that the various countries are thinking about approaching threats that this virus poses to mankind, there are limited measures that people can take to battle this pandemic.

Covid-19 attacks people with low immune systems and people especially people of under and over ages. The immune system is built on beneficial live bacteria that live in the gut which protect the human body from various diseases. When the immune system response is low, weak, or damaged, it becomes an open invitation for infections such as corona virus or other diseases like diabetes, heart disease, or cancer.

Plant-based foods increase and help the intestinal beneficial bacteria, and the overall gut micro biome health which makes up to 85% of the body's immune system. On the other hand, excess of animal foods deplete the body from good bacteria, promote inflammation, and are the underlying cause of diabetes, chronic obstructive pulmonary disease cardiovascular diseases, hepatitis B, cancer, and chronic kidney diseases.

With the 2019 corona virus COVID-19 pandemic, it's especially important to understand that no supplement, diet, or other lifestyle modification other than physical distancing, also known as social distancing, and proper hygiene practices can protect any and proper hygiene practices can protect any person from COVID-19. Currently, no research supports the use of any food supplement to protect against COVID-19 specifically. Our immune system consists of a complex collection of cells, processes, and chemicals that constantly defends body against invading pathogens, including viruses, toxins, and bacteria. 'Keeping our immune system healthy year-round is key to preventing infection and disease'. Making healthy lifestyle choices by consuming nutritious foods and getting enough sleep and exercise are the most important ways to boost our immune system. In addition, research has shown that supplementing with certain vitamins, minerals, herbs, and other substances can improve immune response and potentially protect against illness.

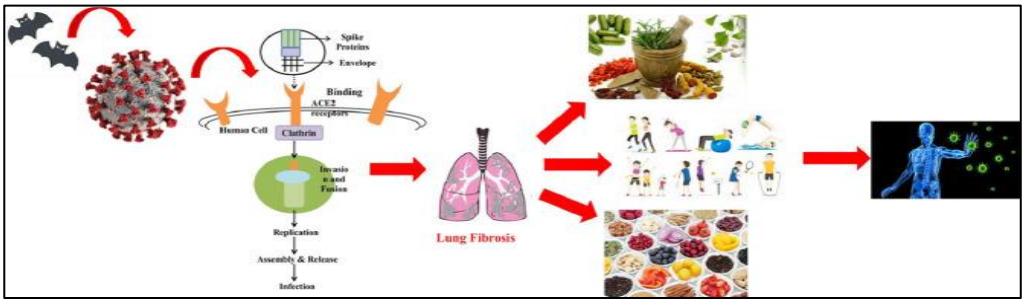

Figure 2.1: A General Overview on Corona virus:

SARS-CoV-2, provisionally known as 2019-novel corona virus, is an enveloped positive-sense single-stranded RNA virus that belongs to the subfamily Orthocoronavirinae, and the family Corona viridae. Subfamily, Orthocoronavirinae, includes four genera, namely alpha, beta-, delta- and gamma corona virus. Predominantly, alpha-and beta- CoV s infect mammals, whereas the main targets of delta- and gamma-CoV s are avian species. With the outbreak of recent SARS-CoV-2 total of seven human-susceptible CoV s strains have been currently identified that can infect human population.

Most of these viruses tend to cause mild infections; however, SARS-CoV identified in 2002, MERS-CoV identified in 2012 and ongoing pandemic caused by SARS-CoV-2 have emerged as fatal CoV s capable of causing severe respiratory tract infections. Genomic sequencing analyses have revealed the close evolutionary relationship of SARS-CoV-2 with other beta-CoV s.

It resembles more with Sarbecovirus subgenus that comprises of SARS-CoV than that of MERS-CoV s of Merbecovirus subgenus origin. At the nucleotide level, SARS-CoV-2 shares 79% homology with SARS-CoV, whereas only 50% with MERS-CoV s. Moreover, SARS-CoV-2 just like SARS-CoV utilizes the same ACE2 receptors to infect its hosts.

Thus, the sites where ACE2 protein is mainly expressed are the potential target sites for SARS-CoV-2 respectively. These regions are belonging to type II alveolar cells of the lungs and enterocytes of the small intestine.

Nevertheless, there are some remarkable biological differences between the SARS-CoV-2 and the other beta-CoV s, which probably make it more infectious. Consequently, the epidemiological dynamics of SARS-CoV-2 is different from previous human-CoV outbreaks having striking local and global spread. Although, SARS-CoV-2 shows greater human-to-human transmission efficiency, its crude fatality rate (0.25% to 5%) is comparatively far less than that of SARS-CoV which is approx. 10%. Furthermore, SARS-CoV-2 has R0 (basic reproduction number) of 4.7 to 6.6.

This highly contagious nature of SARS-CoV-2 is supported by the fact that its spike (S) protein possesses 10 to 20 time's greater affinity for ACE2 receptors than SARS-CoV. S-protein is the surface glycoprotein that assists the virus in the attachment to the host cells through its receptor-binding domain (RBD). S-protein has several domains, one of the sections termed as ectodomain has two subunits, S1 and S2, which form a crown-like structure around the virus. Besides, S-protein of SARS-CoV-2 contains a furin-like cleavage site at the S1–S2 junction, missing in other members of its sister clade. This additional cleavage site might also be responsible for greater pathogen city of SARS-CoV-2 as it also occurs in highly infectious form of influenza virus but lacking in less pathogenic ones.

2.1.1 Supplementing Immunity:

A good strategy is to selectively increase nutrients that may be lacking in our climate and in diet. Vitamin D, for instance, is likely to be low in individuals who live in northern climates with less sunlight. For normal levels, a daily supplement of about 600 to 800 IU of vitamin D is suggested, but with lower levels, a medical consultation is advisable. Since this is a fat-soluble vitamin, it should be taken with fatty foods to maximize the absorption. A healthy sprinkle of herbs like garlic, ginger, rosemary, oregano, and turmeric will also introduce natural anti-inflammatory compounds, which also help to fend off respiratory viruses.

2.1.2 Improve Diet:

The food eaten plays a key aspect in determining overall health and immunity. Eat low carbohydrate diets, as this will help control high blood sugar and blood pressure. A low carbohydrate diet will help slow down diabetes and focus on a protein-rich diet to keep in good shape to any human. And regularly consume vegetables and fruits rich in Beta carotene, Ascorbic acid and other essential vitamins. Certain foods like mushrooms, tomato, bell pepper and green vegetables like broccoli, spinach are also good options to build resilience in the body against pathogenic infections. In diet daily includes supplements rich in omega 3 and 6 fatty acids, if stepping out to buy groceries is not an option during social distancing. Some natural immunity supplements include ginger, gooseberries (amla) and turmeric. Some of these super foods are common ingredients in Indian dishes and snacks. There are several herbs that help in boosting immunity like garlic, Basil leaves and Black cumin. Certain seeds and nuts like sunflower seeds, Flax seed, pumpkin seeds and melon seeds are excellent sources of protein and vitamin E.Probiotics like Yoghurt, Yakult and fermented food are also excellent sources to rejuvenate the composition of gut bacteria, which is important for nutrient absorption by the body.

These are good options for the older generation too in these pandemic days here are some key nutrients that play a role in immunity boosting.

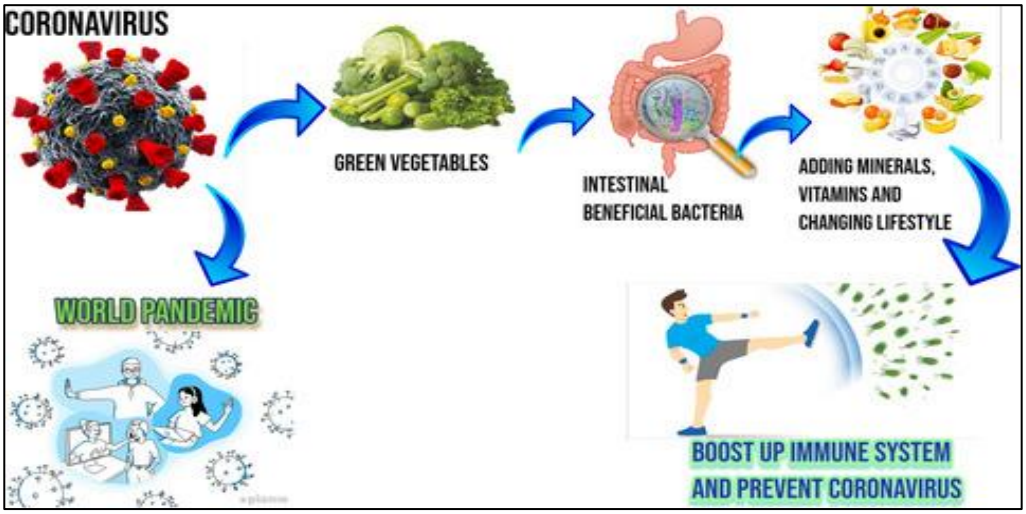

Figure 2.2: Relation between Good Food and Healthy Gut:

A better place to begin is diet, as per health specialists, 80% of the body's immune system is in the gut. A strong gut will give a more significant level of resistance. The Mediterranean diet is a healthy alternative with its focus on fresh fruits and vegetable, whole grains, fatty fish, nuts, and olive oil. The diet gives a lot of nutrients, including vitamin A, B2, B6 and B12, C, D, and E.

Additionally gives zinc, iron, selenium, and other plant-derived minerals and cancer prevention agents i.e. food rich in antioxidants. As per the instruction of WHO consume diet rich in fruits and vegetable locally available in market which boost the immune system i.e. Citrus fruits like orange, grape as well as banana and apples, root vegetables such as carrot, turnips and beetroot.

At long last, it gives healthy fats from fish oil. Recent research propose older adults on a Mediterranean-style diet who additionally took a vitamin D supplement of 400 IU/day had demonstrated increased level of healthy

T cells in one year, demonstrating a positive impact on immunity. Whole foods is always more advisable, and a healthy dosage of matured food sources i.e. fermented foods, including sauerkraut, yogurt, and kefir (fermented milk product), depending upon the nearby culture, is likewise encouraged. Fiber and lentils are likewise food to eat for healthy gut micro-biomes.

In addition, there are evidence that nutrition and other way of life estimates impact immune capacity and susceptibility to infectious illnesses [5].Whether these measures do or don't impact susceptibility to COVID-19 or its clinical course isn't yet known.

2.2 Immunity-Boosting Vitamins and Minerals:

Figure 2.3: Covid-19 Immune System Boosters

For supporting immune system, one can eat immunity supporting foods rich in vitamins like citrus fruits, broccoli, and spinach. It can be helpful to supplement with key vitamins and minerals that may have become depleted like Vitamin C, Vitamin E, Vitamin B, Vitamin D, and Zinc, Magnesium etc.

2.2.1 Vitamin D:

Vitamin D is a fat-soluble nutrient essential to the health and functioning of immune system. Vitamin D regulates the production of a protein that selectively kills infectious agents, including bacteria and viruses. Vitamin D enhances the pathogen-fighting effects of monocytes and macrophages — white blood cells (WBC) that are important parts of immune defense — and decreases inflammation, which helps promote immune response. Specifically, Vitamin D alters the activity and number of WBC, known as T 2 killer lymphocytes, which can reduce the spread of bacteria and viruses. Many people are deficient in this important vitamin, which may negatively affect immune function. In fact, low vitamin D levels are associated with an increased risk of upper respiratory tract infections, including influenza and allergic asthma. Some studies show that supplementing with vitamin D may improve immune response. In fact, recent research suggests that taking this vitamin may protect against respiratory tract infections. In a 2019 review of randomized control studies in 11,321 people, supplementing with vitamin D significantly decreased the risk of respiratory infections in people deficient in this vitamin and lowered infection risk in those with adequate vitamin D levels.

This suggests an overall protective effect. Other studies note that vitamin D supplements may improve response to antiviral treatments in people with certain infections, including hepatitis C and HIV Depending on blood levels, anywhere between 1,000 and 4,000 IU of supplemental vitamin D per day is sufficient for most people, though those with more serious deficiencies often require much higher dose. Sources: our exposure to sunlight, given the right season (not or limited during water depending on latitude) and enough time in the sun, has an important role in determining our vitamin D status. With the help of sunlight, Vitamin D is synthesized in the skin from a precursor derived from cholesterol. Vitamin D exists as either Vitamin D2 (ergocalciferol) or vitamin D3 (cholecalciferol). Oily fish-such as salmon, herring, mackerel, red meat, Liver, egg yolk, fortified foods such as-most fat spread and some breakfast cereals.

2.2.2 Vitamin C:

Vitamin C is an important aspect of improving immunity, for the kids, adults, or even elderly people. Fruits like oranges, papaya, kiwi, and guava are rich in vitamin C and should be included in diet. Moreover, some vegetables like eggplant, bell peppers, beetroots, spinach, and cauliflower are known to be quite rich in vitamin C and are good for immunity. Green vegetables like broccoli, mushrooms, and even kale are a few immunity boosters that one can include in the diet. They improve the immune system of older people quite rapidly. Berries can also be included in the diet along with foods rich in omega-3 fatty acids—beans, flax seeds, and even some nuts. Elderly people should consume Spirulina and Curcumin, as they are extremely rich in vitamin C and minerals. These super foods help in building and strengthening immunity at great level. Vitamin C increases blood levels of antibodies and helps to differentiate lymphocyte (white blood cells), which helps the body, determine what kind of protection is needed. Some research has suggested that higher levels of vitamin C (at least 200 mg) may slightly reduce the duration of cold symptoms.

One can easily consume 200 mg of vitamin C from a combination of foods such as oranges, grapefruit, kiwi, strawberries, Brussels sprouts, red and green peppers, broccoli, cooked cabbage and cauliflower. Vitamin C is perhaps the most popular supplement taken to protect against infection due to its important role in immune health.

Water: soluble vitamins have significant benefits in treatment of sepsis and septic shock, a life-threatening condition, which is caused by inflammation produced by pathogenic organisms. Other ways vitamin C aids the body are as a pro-oxidant for immune cells, antioxidant for lung epithelial cells, and immunosuppressive effects (Erol, 2020). Foods that contain vitamin C are oranges, kiwi, kale, and broccoli.

Bioavailability: Levels of vitamin C in foods depend on the growing condition, season, stage maturity, cooking practices and storage time prior to consumption.

Vitamin C is easily destroyed by heat and oxygen. Absorption levels depend on the amounts consumed. About 70-90% of vitamin c is absorbed. If intakes exceed 1000 mg/day, absorption levels drop to 50%. Sources: Fruits (especially citrus fruits like lemon, orange, amla etc.), cabbage-type vegetables, green leafy vegetables, lettuce, tomatoes, potatoes and liver.

2.2.3 Vitamin E:

Vitamin E is vital for maintaining the overall health of elderly people, including their immunity. Vitamin E is a powerful antioxidant that can protect you from various infections, bacteria, and viruses. Soaked almonds, peanut butter, sunflower seeds, and even hazelnuts should be consumed to get the daily dose of vitamin E.

Vitamin E functions primarily as an un-specific, chain-breaking antioxidant that bans the spread of lipid peroxidation. This vitamin is often a radical peroxyl scavenger that protects the polyunsaturated fats in plasma membranes and lipoproteins (Liang et al., 2003).

F2-isoprostan quantification is the most effective indices of free-radical production and oxidative lipid destruction in vivo (Lin et al., 2002).

The F2-isoprostans are enhanced, and their emission may be reduced by taking supplements with vitamin E. Vitamin E performs a significant part in preserving immune responses, with such a small deficiency effecting immunity, or supplements with rates higher than prescribed, improving elderly people's humeral and cell-mediated immunity (Mastaloudis, Leonard, & Traber, 2001).

The impact of vitamin E supplements is still not studied in sufficient aspect and equivocal on the immune and inflammatory response to sustained exercise.

Bioavailability:

Vitamin E is a fat soluble nutrient. As such, absorption of this vitamin is enhanced in the presence of fat in a meal. Individual on diets consisting mostly of starchy staples-with inconsistent intake of edible oils or other vegetables sources of Vitamin E-are at a higher risk of inadequate vitamin E intake.

Sources: Edible vegetable oils (i.e. wheat germ, sunflower and rapeseed), leafy green vegetables (spinach, chards etc.), nuts, avocados, sunflower seed, mango and kiwi fruit.

2.2.4 Vitamin B Complex:

B vitamins, including B12 and B6, are important for healthy immune response. Yet, many adults are deficient in them, which may negatively affect immune health.

2.2.5 Vitamin A:

Beta carotene gets converted to vitamin A, which is essential for a strong immune system. It works by helping antibodies respond to toxins and foreign substances.

Good sources of beta carotene include sweet potatoes, carrots, mangoes, apricots, spinach, kale, broccoli, squash and cantaloupe.

2.2.6 Zinc:

Zinc helps cells in your immune system grow and differentiate. One meta-analysis revealed that zinc supplements may shorten the duration of symptoms of the common cold (Hemila, H.et al., 2016). However, it concluded that "large high-quality trials are needed" before definitive recommendations can be made.

Sources of zinc include beans, chickpeas, lentils, tofu, fortified cereals, nuts, seeds, wheat germ, oysters (including canned), crab, lobster, beef, pork chop, dark meat poultry and yogurt. Zinc is a mineral that's commonly added to supplements and other healthcare products like lozenges that are meant to boost your immune system. This is because zinc is essential for immune system function. Zinc is needed for immune cell development and communication and plays an important role in inflammatory response. A deficiency in this nutrient significantly affects your immune system's ability to function properly, resulting in an increased risk of infection and disease, including pneumonia. Zinc deficiency affects around 2 billion people worldwide and is very common in older adults. In fact, up to 30% of older adults are considered deficient in this nutrient. Numerous studies reveal that zinc supplements may protect against respiratory tract infections like the common cold.

Bio availability: like Iron, Zinc absorption will depend on the zinc body pool, with those having poor zinc status able to absorb zinc more efficiently in the gut. Foods rich in phytate lead to previously absorbed zinc being lost in the faces. Protein may enhance absorption of Zinc.

Sources: meats, some shellfish, legumes, whole grains and some fortified cereals.

2.2.7 Magnesium:

A very vital mineral for our immune system, magnesium, is also an important electrolyte that helps our body strengthen our immune system's natural killer cells and lymphocytes. It is also a key source of energy for our cells called adenosine triphosphate (ATP), which is so crucial that without this energy, our cells cannot function properly. Magnesium helps the hemoglobin in our blood which is responsible for delivering oxygen from our lungs to the entire human body, which assists in a COVID-19 infection since the virus attacks the respiratory system (Sanderson, 2020). Foods rich in magnesium are dark chocolate, black beans, avocados, and whole grains.

2.2.8 Selenium:

Selenium is a mineral that's essential for immune health. Animal research demonstrates that selenium supplements may enhance antiviral defense against influenza strains, Including, H1N1.

Bioavailability: selenium from food sources is highly bioavailable.

Sources: Seafood, meat, whole grains, dairy, fruits and vegetables etc.

Table 2.1: Some Sources of Vitamins and Minerals

Vitamins or Minerals	Sources
Vitamin D	Eggs, Cheese, Tofu and Mushrooms
Vitamin C	Oranges, Grapefruit, Kiwi, Lemon, Strawberries, Brussels Sprouts,
B complex vitamins	Meat (Especially Liver), Seafood, Poultry, Eggs, Dairy Products, Legumes, Leafy Greens Vegetables, Seeds and Fortified Foods, Such As Breakfast Cereal and Nutritional Yeast.
Vitamin A	Sweet Potatoes, Carrots, Mangoes, Apricots, Spinach, Kale, Broccoli, Squash and Cantaloupe
Zinc	Beans, Nuts, Cereal and Seafood
Selenium	Whole grains and dairy products, including milk and yogurt, Pork, beef, turkey, chicken, fish, shellfish, and eggs.

2.2.9 Vitamin B6:

B6 is required for maintenance of homo-cysteine levels in Blood. (Raised homo-cysteine is a hazardous for cardiovascular disease). Vitamin B6, involves 3 structures pyridoxine, pyridoxal and pyridoxamine. All three types of B6 can be changed over to the co-enzyme PLP.

Vitamin B6 in its coenzyme structure is included responses and it is fair to state that vitamin B6 is required for most of biological responses in our body.

While more research is important to understood B6's role in immunity examines that Vitamin B6 inadequacy impact both hum-oral and cell mediated immune reactions and in this way disables immune reaction.

Bioavailability: if consuming a mixed diet, the bioavailability of vitamin B6 is about 75%. Vitamin B6 is destroyed by heat but it remains stable during storage.

Sources: Chicken, liver, Fish, Nuts, Chickpeas, maize and whole grain and cereals, and vegetables (especially green leafy vegetables), bananas, potatoes and other starchy vegetables.

2.2.10 Vitamin B12:

Vitamin B12 is required for appropriate red blood cell construction, nerve system capacity, and DNA combination. It cooperates with Foliate and Vitamin B6, to help support blood homo-cysteine levels, at a research point of view vitamin B12 has an important role in immune modulator for cellular immunity.

Bioavailability: while there is insufficient data on the absorption of vitamin B12, experts assume that about 50% vitamins B12 are absorbed by adults with a healthy digestive tract. Inadequate absorption occurs when there is not enough acid in the stomach or when a protein called intrinsic factors is not produced in the stomach.

Conventional cooking methods involving high heat and long cooking times may result in some vitamin B12 losses.

Sources: it Include mainly animal sources like shellfish, liver, some fish (herring, sardines, salmon, trout) milk and milk products.

2.2.11 Iron:

Iron is fundamental for the development of hemoglobin in red platelets; which transports oxygen around the body. Iron additionally serve as a cofactor to enzyme in oxidation/decrease responses (i.e., acknowledges or gives electrons). These responses are vital to cells' energy metabolism .Research recommends a low iron level affects our capacity to have a sufficient immune reaction.

It is required for immune cell production and development especially lymphocytes, which are connected to the specific reactions to infection. Iron sequestration is a significant intrinsic host defense system because numerous pathogens rely upon this fundamental component. As a result, availability of body iron is carefully controlled and bound to proteins, for example, transferring and ferreting

Bioavailability: Iron is carefully regulated by the body and absorption rates vary by the size of a person’s iron stores. Many factors affect the absorption of iron. Factors that enhance absorption of in organic iron are Vitamin C and animal protein. Factors that inhibit inorganic iron absorption include phytate, polyphenol, vegetable protein and calcium.

Source: red meat, fish, poultry, shellfish, eggs, legumes, grains, and dried fruits.

2.2.12 Medicinal Mushrooms:

Medicinal mushrooms have been used since ancient times to prevent and treat infection and disease. Many types of medicinal mushrooms have been studied for their immune-boosting potential. Over 270 recognized species of medicinal mushrooms are known to have immune-enhancing properties.

Cordyceps, lion’s mane, maitake, shitake, reishi, and turkey tail are all types that have been shown to benefit immune health. Some research demonstrates that supplementing with specific types of medicinal mushrooms may enhance immune health in several ways, as well as reduce symptoms of certain conditions, including asthma and lung infections.

Aside from the items listed above, many supplements basically from medicinal plants may help improve immune response:

a. **Astragalus:** Astragalus (Astragaluspropinquus) is an herb commonly used in Traditional Chinese medicine (TCM). Animal research suggests that its extract may significantly improve immune-related responses.
b. **Garlic:** Garlic (Allium sativum) has powerful anti-inflammatory and antiviral properties. It has been shown to enhance immune health by stimulating protective white blood cells like NK cells and macrophages. However, human research is limited.
c. **Turmeric:** The bright yellow spice, Turmeric, contains a compound called cur-cumin, which boosts the immune function.
d. **Andrographis:** Andrographis (Andrographis paniculata) this herb contains andrographolide, a terpenoid compound found to have antiviral effects against respiratory-disease-causing viruses, including enter virus D68 and influenza A.
e. **Licorice:** Licorice (Glycerrhizaglabra) contains many substances, including glycyrrhizin that may help protect against viral infections. According to test-tube research, glycyrrhizin exhibits antiviral activity against severe acute respiratory-syndrome-related corona virus (SARS-CoV).
f. **Pelargonium Sidoides:** Some human research supports the use of this plant's extract for alleviating symptoms of acute viral respiratory infections, including the common cold and bronchitis. Still, results are mixed, and more research is needed.
g. **Curcumin:** Curcumin is the main active compound in turmeric. It has powerful anti-inflammatory properties, and animal studies indicate that it may help improve immune function.
h. **Echinacea:** Echinacea is a genus of plants in the daisy family. Certain species have been shown to improve immune health and may have antiviral effects against several respiratory viruses, including syncytial virus and rhinoviruses.
i. **Propolis:** Propolis is a resin-like material produced by honeybees for use as a sealant in hives. Though it has imprerespiratory immune-enhancing effects and may have antiviral properties as well, more human research is needed.

Elderberry:

Elderberries are full of nutrients including minerals like phosphorus, potassium, iron, copper and vitamins, such as vitamin A, B, and C, proteins and dietary fiber. Elderberries have antibacterial and antiviral qualities which help fight cold and influenza.

2.2.13 Antioxidants:

Glutathione is a powerful antioxidant in the body, it scavenges damaging free radicals and is involved in tissue repair and builds chemicals and proteins that are used for the immune system. N-Acetylcysteine, or NAC, promotes the production of glutathione and is also used as a supplement.

Studies in animal models of other viral infections have shown that NAC reduced the severity and duration of symptoms by increasing cellular defense and repair.

NAC is taken in doses of 500-600 mg. Glutathione can be taken orally 500 mg or by IV 400–2400 mg with a doctor's order.

Quercetin is a bioflavonoid found in a variety of fruits and vegetables. Animal and laboratory studies have demonstrated that Quercetin can inhibit a wide range of virus infections including a COVID-19-related corona virus SARS CoV. Quercetin supports antioxidant capacity and protects lung tissue.

As a supplement is combined with vitamin C, brome lain is sold as a single supplement. Recommendation is between 500 and 1000 mg daily (Center and fees, 2020).

Major sources are leafy green vegetables, dill, peppers, apples, grapes, fennel leaf, red onion, oregano, chili pepper, green tea, and black tea.

2.3 Remedies for Immunity Boosting:

a. Amla or Indian Gooseberry: It is a powerhouse of nutrition and is matchless in its power to boost the body's immunity. Have half a teaspoon of crushed fresh amla with one crushed garlic clove on an empty stomach.
b. Immunity Balls: Take one teaspoon powdered turmeric, one tablespoon jaggery, one tablespoon cow ghee, and one tablespoon dry ginger powder. Mix well and make into small round balls. Have 2-3 daily.
c. Turmeric Milk: Half tea spoon Haldi (turmeric) powder in 150 ml hot milk-once or twice a day.
d. Ghee: Ghee (clarified butter), Sesame oil, or Coconut oil in both the nostrils to keep the nostrils clean.
e. Herbal Tea: herbal tea or decoction of Holy basil, Cinnamon, Black pepper, Dry Ginger and Raisin.
f. Tulsi-Peppercorn: Begin your day with home grown tulsi leaves along with organic honey and freshly crushed peppercorn. Take 5-7 leaves, add two crushed peppercorns with one teaspoon honey and consume immediately on an empty stomach and do not drink water after this.
g. Orange Juice with Pepper: Drink a glass of fresh orange juice daily to which a pinch of pepper has been added. It is loaded with antioxidants and is a rich source of Vitamin C. It will naturally help in boosting your immunity.
h. Ginger-Tulsi: All you need to do is, take juice of fresh ginger, and crush some tulsi leaves in it. Add a teaspoon of honey to it. Consume it daily to get relief from cough and increase the body immunity.
i. Kadha: Make a warm tea with few tulsi leaves, a piece of ginger and a dash of black pepper. All these ingredients play an important role in fighting illness-causing bacteria and increase the body's immunity.
j. Tender Neem Leaves: Traditionally in India, tender neem leaves were consumed by people on an empty stomach and it was believed to be a potent blood purifier. It has antiviral and anti-bacterial properties and is believed to increase the body's immunity.

Some other remedies are Kalonji oil, Elderberry, Astragalus, Andrographis, Curcumin, Echinacea, Propolis, and Quercetin.

Also, there are many products formulations are available in market for Immunity Boosting like Gilroy Ghanvati, Vitamin C capsules, Amla juice etc.

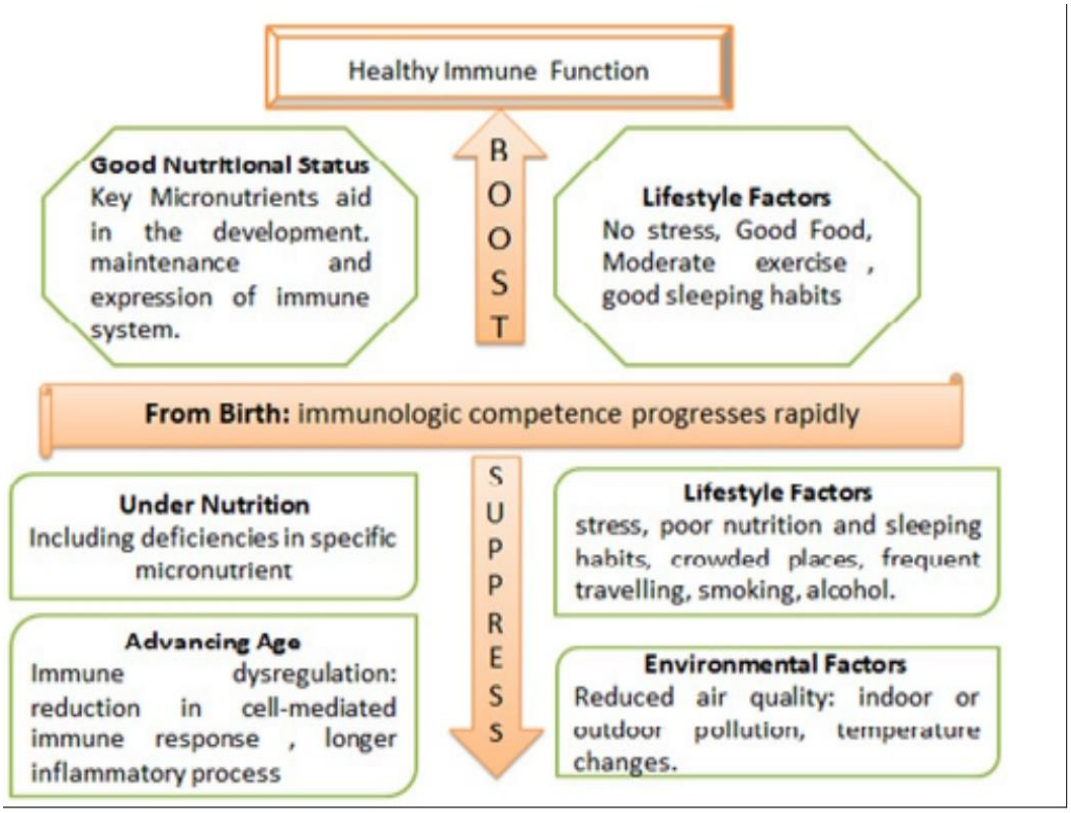

Figure 2.4: Factors Affecting Immune System

Apart from above supplements, Protein is a key building block for immune cells and antibodies and plays a crucial role in helping our immune system do its job. Protein comes from both animal and plant-based sources and includes fish, poultry, beef, milk, yogurt, eggs and cottage cheese, as well as nuts, seeds, beans and lentils.

Probiotics and prebiotics also boost the health of the micro biome, which in turn supports our immune system. Sources of probiotics include fermented dairy foods such as yogurt and kefir, and aged cheeses, as well as fermented foods such as kimchi, sauerkraut, miso, and tempeh and sourdough bread. Sources of prebiotics include whole grains, bananas, onions, garlic, leeks, asparagus, artichokes and beans. Apart from maintaining a healthy lifestyle, includes immunity booster in diet i.e. taking supplements, the Indian health ministry is also suggesting few organic and natural ways to practice as preventive measures to fight COVID-19.

The Ministry of AYUSH has recommended the following self-care guidelines as preventive measures and to boost immunity with special reference to respiratory health.

a. Drink warm water throughout the day.
b. Practice Meditation, Yogasana, and Pranayama.
c. Increase the intake of Turmeric, Cumin, Coriander and garlic.

d. Drink herbal tea or decoction of Holy basil, Cinnamon, Black pepper, Dry Ginger and Raisin.
e. Avoid sugar and replace it with jaggery if needed.
f. Apply Ghee (clarified butter), Sesame oil, or Coconut oil in both the nostrils to keep the nostrils clean.
g. Inhale steam with Mint leaves and Caraway seeds.

2.4 Some Other Activities to Do For Immunity-Boosting Other Than Healthy Diet:

Don't Compromise on Sleep: Good snooze time for 7-8 hours is the best way to help your body build immunity; lesser sleep will leave you tired and impair your brain activity. The lack of sleep will prevent the body from resting and this will impair other bodily functions that will have a direct impact on your immunity. Lack of sleep adversely affects the action of the flu vaccine. Stay Hydrated: Drink up to 8-10 glasses of water every day, to stay hydrated. Hydration will help flush out the toxins from the body and lower the chances of flu. Other alternatives include juices made of citrus fruits and coconut water, to beat the heat.

Don't Skip on Exercise: A good diet should be followed by an exercise routine. Remember to exercise regularly; even light exercise will go a long way in releasing the toxins from your body. It is recommended to exercise for 30 to 45 minutes, depending on your stamina.

If you have not started exercising yet, then it is a good time to start. There are several YouTube channels and apps to help you exercise at home. Regular exercise improves metabolism, which has a direct correlation with body immunity.

Distress Yourself: These are testing times, and a prolonged period of staying indoors has its implications on your mental wellbeing. The growing anxiety around the pandemic is another concern that is affecting millions across the globe. While the uncertainty might be overwhelming, there are few steps we can follow regularly to help relieve our stress, stress is known to have an adverse effect on immunity.

Practice meditation: Too much stress releases the hormone known as cortisol, which impairs your response to immediate surroundings and makes your body susceptible to infections; you are left feeling constantly anxious. The best way to relieve stress is through meditation, it is a tried and tested activity to calm the nerves. If you need help meditating, then there are several channels on YouTube that have instructional resources to help you meditate.

2.4.1 Avoid Smoking, Alcohol and Other Addictive Substances:

Certain habits like smoking, vaping, alcohol consumption and substance abuse have a direct correlation between weakened body defenses and respiratory illnesses. Engaging in smoking and vaping is proven to weaken your lung capacity and destroy the cells lining your respiratory tracts, these cells are crucial to fight viruses that enter through your nasal orifices.

There is new research claiming that individuals who engage in heavy alcohol consumption tend to suffer from ARDS (Acute Respiratory distress syndrome) which is one of the conditions caused by Covid 19 infection. Practice moderation, if you are dependent on any of these, as sudden withdrawal can also prove to be risky.

Travelling: Avoid all kinds of non-essential travels. Most Covid 19 positive cases are imported cases, which later spread to the communities. Avoid being exposed to the public transport system and public places to avoid any likelihood of exposure. In case you have to travel, make sure to cover your nose and mouth with a mask and carry an alcohol-based hand sanitizer, at all times.

Remember to sanitize each time you touch a surface, as Covid 19 strain can stay on surfaces for a few hours to days. Use your non-dominant hand while accessing the doorknobs and handles, as these are frequently touched by many people.

Lifestyle: Stress negatively alters the immune system responses within the body (Salleh, 2008). Stepping away from the media and TV is also very important in letting one's mind distress from the world a bit. Try limiting yourself to about an hour in the morning and at night to just catch up and see if there are any important changes.

Sleep, a huge influence on the immune system, gives the body an opportunity to heal and rest, especially in critical illnesses (Kamdar, Needham, & Collop, 2012). Furthermore, sleep was considered extremely important by doctors in the recovery of their patients during the Spanish Flu Pandemic.

Exercising helps raise the levels of white blood cells and antibodies that fight off infections (Join & Calendar, 2020). Exercise is especially important after a critical illness to improve muscle mass, strength, and resiliency (Heyland et al., 2016). Exercise can also help with the prevention of blood clots, which have been a symptom for some people who contracted COVID-19.

Eating a well-balanced, healthy diet and staying away from processed junk food is very important to maintain overall health, as well as to support immune functions. Eat as much fresh produce as possible, but if it is not in season or hard to find then the next best thing is fermented or frozen. These items are normally picked at the peak of the season and then frozen or fermented straight away (Join & Calendar, 2020), also, make sure to eat sufficient protein (Hyman, 2020).

While the battle against the Covid-19 pandemic is fought by our health care workers, we can do our bit by limiting our exposure to the virus by staying indoors, social distancing, eating healthy, hydrating and following basic hygiene protocol.

2.5 Conclusion:

Great nutrition is central to improving immunity. The immune system is the body's protection against disease and virus and it has long been studied that few variables impact the capacity of the immune system including stress and nutrition.

Vitamins and minerals, known as micronutrients, are supplements required by our body for ideal function and frequently required in just limited quantities. These micronutrients are not delivered in the body and in this way should be acquired from our food. Many researches show the key role nutrition plays in powerful working of our immune system. Giving a diet high in nutritious food rich in vitamins and minerals supports ideal capacity of the immune system by giving cancer prevention agents to slow harm of cells brought about by free radicals or aiding T-cell creation.

Although, there is no information concerning nutritional components according to the hazard and seriousness of viral disease, such as, COVID-19 the role of nutrition in immunity has been established. The European Journal of Clinical Nutrition concluded that without satisfactory nutrition, the immune system is clearly deprived of the components expected to create a successful immune reaction. Great nutrition is in this way significant in supporting an ideal immune system which can lessen the danger of viral diseases.

Vitamin C, vitamin D and zinc have immune improving and immune regulating properties and assume synergistic role in supporting parts of both innate and adaptive immunity which contain epithelial obstructions, cell resistance and antibodies comprising the three primary lines of resistant protection.

Then again, lacks of vitamin C, vitamin D and of zinc seriously discourage immune reactions and lead to an expanded hazard for infection for model in the respiratory tract. Micronutrients are accepted to work all things considered to help an ideal immune system. Based on a variety of systematic and clinical information, vitamin A, B, C, D, E, foliate, zinc, iron, copper, and selenium are especially imperative to boosting immune response.

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