



Importance of Fruits and Vegetables in Boosting our Immune System amid the COVID19

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ABSTRACT

The whole world is suffering from an ongoing global pandemic i.e. Covid-19. Though there is no development of any vaccine yet so good immune system becomes the only option to tackle the disease. The perfect immune system can be obtained by following a healthy diet and regular exercise or yoga. Fruits and vegetables are loaded with vitamins, minerals, and other compounds which helps in improving our immune system. This article has focused on the role of fruits and vegetables in maintaining perfect immunity.

Coronavirus (Covid19) is grasping the whole world rapidly. To date, there is no vaccine available or any curative measure against the virus. Most of the countries are investing a lot in their research and development for finding the vaccines as soon as possible. All the countries are in a race to find the vaccine so that they could save the lives of their countryman. Covid19 is declared a global pandemic by the World Health Organization and Dr. Michael Osterholm, director of the Center for Infectious Disease Research and Policy at the University of Minnesota, said that it won't slow down until it hits 60 to 70 percent of the population (Alltucker, 2020). It is observed that Coronaviruses mostly affect the respiratory system, which is a group of organs and tissues which is responsible for breathing (Kandola, 2020). According to Patel (2020), people who are older than 65 and those with diabetes, chronic lung disease, cancer, chronic kidney disease, and obesity are more prone to severe COVID-19 and its respiratory complications. Old age and these diseases hinder the immune system and responsible for the severe deterioration of health and may often lead to death. Therefore, people with a proper immune system could tackle the virus and could recover after a fairly short period.

For boosting the immune system, we need to maintain a proper diet which is could be possible by following a strict diet plan and eat food that will boost our immune. Fruits and vegetables contain various vitamins and minerals that help our body to boost or immune system. Adding proper fruits and vegetables to our diet is the need of the hour to tackle the coronavirus. This article will focus on the role of fruits and vegetables to improve the immune system.

Role of Fruits in Improving Immune System

Citrus fruit contains active phytochemicals that can protect health. It provides an ample supply of vitamin C, folic acid, potassium, and pectin which helps in improving the immune system (Guimarães *et al.*, 2009). Lemon, orange, mandarins, lime, etc. are loaded with Vitamins which helps in increasing immunity.

Aonla is one of the most popular fruit to increase human immunity. According to Peramachi (2020), this fruit is packed with natural vitamin C which is an immunity booster. Antioxidants such as polyphenols & tannins are derived from these fruits. It also contains phyllemblic acid, gallic acid, ellagic acid and flavonoids which is beneficial to prevent many ailments as it improves the longevity of human beings by improving digestion. It helps to treat diabetes, asthma, heart disorders, cold & cough.

Jamun is stated to have many medicinal properties such as anti-diabetic, anti-oxidant, anti-allergic, anti-arthritis, anti-microbial, anti-inflammatory, etc. Among these, the anti-diabetic property of Jamun fruits has the most promising nutraceutical value. The fruit predominantly contains flavonoids and phenolics which boost immunity (Srivastava and Chandra, 2013).

Watermelon has the highest levels of lycopene when ripened, which is capable of reducing respiratory inflammation and protecting from infections. The fruit is also considered a good source of vitamin C, A, and B6, which are needed to increase immunity (Anurag, 2020).

Papaya is a rich source of iron and calcium. Vitamins such as vitamins A, B, and C (ascorbic acid) are abundantly found in papaya which are important ingredients to boost the immune system. Carpine present



in papaya slows the heart rate in humans and helps in reducing blood pressure. Folic acid found in papaya is required for the conversion of homocysteine into amino acids and if it is not converted, homocysteine can directly damage blood vessel walls which could be a significant risk factor for a heart attack or stroke (Aravind *et al.*, 2013).

Table 1 – Different nutrients of fruits which helps in boosting immunity.

Sl. No.	Fruits	Nutrients	
1.	Citrus fruits (Sissons, 2019)	Lemons	Vitamin C, Folic Acid, Potassium, Pectin
		Oranges	Fiber, Calcium, Magnesium, Potassium, Vitamin C
		Limes	Calcium, Magnesium, Potassium, Vitamin C
		Grapefruit	Fiber, Calcium, Magnesium, Potassium, Vitamin C
2.	Aonla	Vitamin C, Polyphenol, Tannins, Phyllemblic Acid, Gallic Acid, Ellagic Acid (Peramachi, 2020)	
3.	Jamun	Calcium, Iron, Potassium, Vitamin C (Jha, 2015)	
4.	Watermelon	Vitamin C, A, B6 (Anurag, 2020)	
5.	Papaya	Vitamins A, B, And C, Carpaine, Folic Acid (Aravind <i>et al.</i> , 2013)	
6.	Banana	Iron, Potassium (Jyothirmayi and Mallikarjuna, 2015), Calcium, Magnesium (Kaimal <i>et al.</i> , 2010)	
7.	Pomegranate	Vitamin C, E (Kumari, 2020)	
8.	Berries	Vitamin C, Vitamin A, Potassium, Manganese, Fibers (Anurag, 2020).	
9.	Pineapple	Vitamin C, Malic Acid (Hendrickson, 2011). Bromelain (Hossain <i>et al.</i> , 2015)	

Banana is an excellent source of nourishment and a well-balanced diet for people of all ages. Bananas are a rich source of iron which helps in stimulating the production of hemoglobin in the blood. It contains high potassium

and low salt content which responsible for reducing the risk of blood pressure and heart stroke (Jyothirmayi and Mallikarjuna, 2015). Kaimal *et al.*, (2010) stated that ethanol extract of mature green fruits of banana has antioxidant and hypolipidaemic properties which may be used for treating diabetes mellitus.

Pomegranate juice was observed to reduce heart disease risk factors (Esmailzadeh *et al.*, 2006). Pomegranate contains vitamin C and E which helps in boosting the defense mechanism of our body to protect from severe infections. It also boosts the production of antibodies (Kumari, 2020).

Berries such as strawberries, raspberries, cranberries, blueberries, etc. are very nutritious. Studies suggest that berries contain the highest number of antioxidants. Antioxidants like polyphenol in strawberry and flavonoids in blueberries help in reducing the damage of cells inside our body and ultimately improve immunity. These sweet-sour fruits have a good amount of vitamin C, vitamin A, potassium, manganese, and fibers (Anurag, 2020).

Pineapple is packed with vitamin C which helps in boosting the immune system. Malic acid is also one of the major constituents of pineapple which is beneficial for health. It helps to boost immunity and reduces the risk of toxic metal poisoning (Hendrickson, 2011). Bromelain found in pineapple fruit has demonstrated significant anti-inflammatory effects, reducing swelling in inflammatory conditions such as acute sinusitis, sore throat, arthritis, etc. (Hossain *et al.*, 2015).

Role of Vegetables in Improving the immune System

Broccoli contains a high amount of potassium and minerals like magnesium, calcium, which helps maintain a healthy nervous system and regulates blood pressure. It also contains trace mineral i.e. zinc and selenium which helps to strengthen immune defense actions (Rasquinha, 2013, Shubha *et al.*, 2020).

Brussel sprouts contain antioxidant alpha-lipoic acid (ALA) (Salehi *et al.*, 2019). This ALA can lower glucose levels, increase insulin sensitivity, and prevent oxidative stress-induced changes in people with diabetes (Ware, 2019). Brussels sprouts contain a large amount of vitamin C which is a protective antioxidant in the body. Vitamin C helps in boosting immunity against viruses (Nandi, 2018).



Cauliflower as plays a vital role to improve the immune system. It contains compounds such as choline and an antioxidant called glutathione which helps the body to fight against different viruses. Choline also helps in maintaining the structure of the cellular membrane, assisting in fat absorption, and reduces chronic inflammation. The presence of antioxidants such as vitamin K, vitamin C, and manganese helps in lowering the risk of oxidative stress and helps to keep the body healthy (Lall, 2019). According to Morris *et al.*, (2012), glutathione modulates the behavior of many cells related to the immune system, affecting adaptive immunity and protecting against viral, microbial, and other infections.

Lall (2019) who wrote the book “Journey to a Healthy Life” mentioned that **carrot** contains β -carotene which is a powerful phytonutrient. This phytonutrient helps in improving the immune of humans. It enhances the production of infection-fighting cells and T-cells. He also added that carrot contains a high amount of vitamin C which increases the activity of White blood cells in the body ultimately helps to boost the human immune system. Carrots are a rich source of soluble fiber that helps keep blood sugar and insulin levels under control. Also, it is observed from studies that certain nutrients like vitamin A in carrots help in blood sugar control. The regular intake of fiber can reduce the risk of developing type 2 diabetes and fiber can help lower their blood sugar levels. Vitamin A and C found in the carrot will boost our immune system and improve our body's ability to heal itself (Ghosh, 2020).

Spinach is one of the most important nutritious vegetables. Spinach contains Vitamin K i.e. Vitamin K1 which is obtained from spinach vegetables (Miano, 2016). Spinach loaded with antioxidants such as flavonoids, carotenoids, vitamins (C, E), and phenolic compounds control the effect of free radicals to reduce their harmful effect when consumed in our diet (Bergquist, 2006). Spinach is packed with digestion-regulating fiber as well as contains vitamin C which can assist in preventing the common cold and help reduce symptoms of sickness (Hussein, 2020).

Onions are one of most nutritious food which contains organic compounds, such as flavonoids, organosulfur compounds, and fructans, that may prevent our body against certain microbial pathogens. Goldman (2020) stated that onion possesses the property of anti-viral, which could act as protective aid to combat the influenza virus. Blood sugar can be lowered by the consumption of

onions in our diet (Aggarwal and Yost, 2011). Onions are packed with immune-boosting nutrients like selenium, sulfur compounds, zinc, and vitamin C (Agustin-Bunch, 2020).

Tomatoes are loaded with all kinds of health benefits. Lycopene is one of the vital antioxidants found in tomatoes that helps in fighting against cancerous cell formation as well as other diseases. Tomatoes contain vitamins such as Vitamin A and Vitamin C which is again an important immunity booster compound. Vitamin B and potassium in tomatoes are effective in lowering blood pressure and reducing cholesterol levels in the human body. It also contains valuable mineral i.e. chromium which works effectively to help diabetics to keep their blood sugar levels under better control (Bhowmik *et al.*, 2012).

Arreola *et al.*, (2015), reported that **garlic** contains a sulfur compound called allicin. This immune-stimulating compound increases natural killer cells in the body and helps in maintaining the immune system by preventing immune dysfunction. It also helps in treating microbial infections, reducing inflammation, and keeping your heart healthy.

Ginger has been traditionally used as medicine for over 25 centuries. It is primarily used to treat nausea and also used as a cholesterol-lowering herb (Bayati Zadeh and Moradi-Kor, 2013). Ginger is used to improve the blood circulation throughout the body by a powerful stimulatory effect on the heart muscle and by diluting blood (Mowrey and Clayson, 1982). Several pieces of evidence have suggested that ginger helps in regulating blood pressure and heart rate (James *et al.*, 1999). In terms of immunity, ginger is most commonly used to reduce inflammation which may be caused due to rheumatoid arthritis, asthma, and irritable bowel syndrome (Gleb, 2017).

Beetroot is rich in iron which plays an important role in increasing the production of white blood cells. It acts as an excellent detoxifying agent that is good for the organs. It also helps in preventing diseases like heart disease, cancer, etc. The fiber content of this vegetable is pretty high which is good for digestion (Nangia, 2018).

Turmeric is an important constituent of the Indian diet. It is known for its numerous medicinal properties. According to Arora (2020), curcumin helps in making our immunity strong. He quoted, Curcumin helps to fight



Table 2 – Different nutrients of vegetables which helps in boosting immunity.

Sl. No.	Vegetables	Nutrients
1.	Broccoli	Potassium, Magnesium, Calcium, Zinc, Selenium (Rasquinha, 2013)
2.	Brussel sprouts	Alpha-Lipoic Acid (Ware, 2019), vitamin C (Nandi, 2018)
3.	Cauliflower	Glutathione, Choline, Vitamin K and C, Manganese (Lall, 2019)
4.	Carrot	B-Carotene, Vitamin C, Fiber (Lall, 2019), Vitamin A (Ghosh, 2020)
5.	Spinach	Vitamin K (Miano, 2016), Flavonoids, Carotenoids, Vitamins (C, E) (Bergquist, 2006)
6.	Onions	Organosulfur, Fructans Goldman (2020), Selenium, Sulfur Compounds, Zinc, Vitamin C (Agustin-Bunch, 2020)
7.	Tomatoes	Lycopene, Vitamin A, Vitamin C, Vitamin B, Potassium, Chromium (Bhowmik <i>et al.</i> , 2012)
8.	Garlic	Allicin (Arreola <i>et al.</i> , 2015)
9.	Ginger	Vitamin B3, B6, Iron, Potassium, Vitamin C, Magnesium, Phosphorus, Riboflavin (Goldman, 2019)
10.	Turmeric	Curcumin (Arora, 2020), Calcium, Potassium, Iron, Thiamine, Riboflavin, Niacin, Ascorbic Acid, (Balakrishnan, 2007)

against cough, flu, etc. and people suffering from bronchial problems like Sinsuits which lower our immunity. Balakrishnan (2007) stated that turmeric also

contains nutrients like calcium, potassium, iron, thiamine, riboflavin, niacin, ascorbic acid, etc. which is required for boosting immunity.

Conclusion

Perfect food is the most important criterion to obtain good health. We have to consume food rich in different compounds which is responsible for building our immunity. Fruits and vegetables are rich sources of antioxidants, vitamins, and minerals. Adequate amounts of fruits and vegetables are recommended for a perfect diet. A person consuming the required amount of fruits and vegetables can tackle the current situation, where perfect immunity is the only option left until any vaccine is discovered. There are other foods such as mushrooms, dairy products, meat, eggs, etc. which could also help us enhancing the immune system. Consumption of fruits and vegetables will not only help us to tackle coronavirus but also other diseases that could be equally dangerous. Therefore, consume foods that are beneficial to our body and maintain perfect health with a special focus on hygiene and never forget to wash your hand frequently at least 20 seconds and of course maintain social distance.

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