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A Critical Review on Immune-Boosting Therapeutic Diet Against Coronavirus (Covid-19)

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Abstract: *Now a days the news of coronavirus is on all news paper's headline. Coronavirus is spreading from animal market of Wuhan in central China. There are several types of coronavirus but all are not dangerous but this new coronavirus is very dangerous. It is a group of RNA viruses that cause a variety of disease in animal and animal to human. The efficiency of this new coronavirus found in the live animal market of Wuhan in central China, circulate in a range of animals and spread from animal to animal and animal to human also which is called Spillover. Mild symptoms of coronavirus are cough, shortness of breath and severe problems are pneumonia, kidney failure and death also. Basically corona virus effects on immune systems and decrease the immune power. There are no specific treatments or vaccines for this disease still now. So in this condition, people have to maintain immunity and should increase immune power to fight against coronavirus. Only washing hand and wearing a mask are not enough to fight against this virus, people have to modify their daily diet. This article summarizes the immune-boosting therapeutic diet against coronavirus (COVID-19).*

Keywords*:Coronavirus, immune system, therapeutic diet, pharma-therapeutic foods, garlic, turmeric, neem leaves, tulsi leaves, and diet chart for coronavirus*

I. Introduction

Coronaviruses are a wide family of viruses that can cause disease in animals or humans **(WHO Q & amp, 2020)** **[1]**. Seven coronaviruses can cause infection in people around the world, but only four human coronaviruses are usually transmitted by men: 229E, NL63, OC43, and HKU1. These typically cause respiratory infection ranging from the common cold to more severe illnesses such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS), and the most recent coronavirus (COVID-19) causes infectious disease. This zoonotic illness caused by massive coronavirus 2 (SARS-CoV-2) acute respiratory syndromes. The WHO originally named these communicable diseases Novel Coronavirus-Infected Pneumonia (NCIP), and the 2019 novel coronavirus (2019-nCoV) had been named.

The outbreak of coronavirus disease 2019 (COVID-19) has become a pandemic **(According to World Health Organization)** **[2]**, which at the time of writing had affected more than 17,449,943 people and caused more than 675,514 deaths worldwide.

The virus outbreak has been declared by the World Health Organization (WHO) as a public health emergency of international concern since December 2019, when Covid-19 emerged on the Hunan seafood market in Wuhan, South China and spread rapidly around the world.

1.1 Symptoms of COVID-19

Maximum number of virus-infected patients will suffer common cold and flu while few will remain asymptomatic. 80 percent of patients will experience mild disease symptoms. Adult has the strongest immune power to combat the infection but the demerit is that they are more likely to transmit the infection **[3]**.

A recent research of nearly patients (140 case studies) at Wuhan University's Zhongnan Hospital reported different types of symptoms, contributing to a disease known as COVID-19. Ninety-nine percent of patients reported severe high-temperature fever, while over half felt dry cough and fatigue. One-third of the patient experienced dry cough and breathing difficulties **(Bendix, 2020)** [4].
Research from the Chinese CDC indicates that about 80 per cent of cases of corona virus are moderate, about 15 per cent of patients have serious cases, and 5 per cent have been seriously ill. A day-to-day analysis of symptoms of coronavirus indicates how symptoms progress among typical patients, and how symptoms grow among rare patients. High fever, dry cough, chest pain or discomfort like breathing difficulties, confusion and bluish lips or face these are the common symptoms of coronavirus.

1.2 Coronavirus and human immunity

The coronavirus effects on immune systems in human body. This virus is mainly breakdown the balance of immunity, so in this condition, people have to maintain immunity and should increase immune power to fight against coronavirus. Immunity is a state of resistance to protect organisms by invading pathogens (biotic & abiotic) and their harmful effects. Immunity prevents the development of infection and maintains the organism's integrity by counteracting, neutralizing, and clearing pathogens. Good immune system helps to protect the human body against many communicable and non-communicable diseases. Covid-19 is considered to be highly mutated **(Gua *et al.*, 2020)** [5]. Researchers are trying to discover proper medicine or vaccine to cure this virus infection. Still, now there are no vaccines in the world. So people have to maintain their immunity and increase immune power by maintaining their daily diet.

1.3 Pharma-therapeutic diet against corona virus

Therapeutic diet is a diet which is given to the patient who is suffering from any type of disease condition **(Tewari, 2019)** [6].
There are different types of immune-boosting foods are present, which helps to increase immunity and helps to fight against different virus infection. The most important pharma-therapeutic foods are garlic, turmeric, neem leaves and tulsi leaves, green tea, high anti-oxidant fruits and vegetables.

1.3.1 Garlic and its immunomodulatory properties

Garlic (*Allium sativum*) is one of the good pharma-therapeutic immune-boosting spices. Garlic has pharmacological properties against microbial infection and also helps to prevent inflammation.
Recently garlic has been considered as an immunomodulatory spices. Immunomodulators are medicines which are used to regulate or normalize the immune system. Several researches have been studied out in animal models to examine the effects of garlic compound as an immunomodulator **(Arreola, *et al.*, 2015)** [7].
Different studies have been carried out to find out the effects of garlic compounds on cells of the immune system and these studies found that garlic compound can maintain immunity by its immunomodulatory activities **(Bauer, *et al.*, 2014; Park, *et al.*, 2014)** [8, 9].

1.3.2 Turmeric

Turmeric is a natural polyphenolic compound, which helps to protect from infection of coronavirus **(Zahedipour *et al.*, 2020)** [10].
Zorofchian Moghadamtousi (2014) reported that turmeric has inhibitory potential activities against various viral infections. Virus- like stomatitis virus, parainfluenza virus type-3, respiratory syncytial virus and simplex virus [11].
Turmeric has also pleiotropic effects (producing or having multiple effects from a single gene) against viruses **(Ahn; Sethi, Jain, Jaiswal, Aggarwal; 2006; D. Mathew and Hsu; 2018; Parditya *et al.*, 2019)** [12, 13 & 14].
Turmeric may have beneficial effects against infection with COVID-19 as it has the ability to modulate the various molecular targets that lead to the attachment and internalization of SARS-COV-2 in many organs such as the liver, kidney, and heart.

1.3.3 Neem leaves

Neem is a traditional ancient medicinal plant that has beneficial effects on various viral diseases **(Biswas *et al.*, 2002)** [15].
Many researchers have been studied that neem has a biologically active compound, that acts as an antiviral, anti-inflammatory, antiseptic, and antifungal.
Isopropenoids and non-isoprenoids are two important compounds which are found in neem extract.
Isoprenoids are composed of diterpenoids and triterpenoids consisting of protomeliacins, limonoids, azadirone with its gedunin, nimbin, vilasinin, salanine and azadinactin derivatives. Proteins, carbohydrates, sulphorous compounds, etc. are non-isoprenoids **(Ong, *et al.*, 2014)** [16].

1.3.4 Tulsi leaves

In India, Tulsi is the oldest traditional medicinal plant, which has broad beneficial effects on human health for preventing viral fever and cough etc.

According to **Charaka Samhita (Claus, 2003)** Tulsi helps to maintain balance various mechanism and increases the life span [17].

Mohan *et al.*, (2011); Pattanayak *et al.*, (2010) noted that Tulsi is being used for the management of pain, diarrhoea, cough and fever. Tulsi leaves have beneficial effects on various normal fever to malaria fever [18, 19].

Singh *et al.*, (2010) reported that for controlling pneumonia, Tulsi leaves with the addition of cow ghee are the best medicine [20].

Tulsi leaves have inhibitory effects on various deadly viruses like vaccinia virus, infections, Bursal Disease virus and Newcastle Disease virus **(Prakash and Gupta, 2005)** [21].

Sharma, (1983) reported that Tulsi also helpful to relief from symptoms of asthma [22].

1.3.5 *Green tea and its potential health benefits*

The green tea has physiological and pharmacological health benefits. **Steinmann *et al.*, (2013)** reported that the main component of green tea is epigallocatechin-3-gallate (EGCG) that is very helpful for the controlling infection and others viral fever, because it has anti-infective and anti-viral properties. Also, the EGCG catechine has antifungal activity against human-pathogenic yeasts such as Candida albicans. Although EGCG's mechanistic effects are not completely known findings are suggesting that EGCG binds to lipid membranes and affects the bacteria and fungi's folic acid metabolism by inhibiting the cytoplasmic enzyme dihydrofolate reductase [23].

Lee *et al.*, (2012) reported that green tea has Epigallocatechin-3-gallate (EGCG) compound that has beneficial effects on Chikungunya virus (CHIKV). It is a transmitted alphavirus that causes chikungunya fever. Researchers also noted that green tea has antiviral properties that are helpful for the prevention of viral infection and fever [24].

Song *et al.*, (2005) noted that green tea contains compound catechins, epigallocatechin gallate (EGCG), epicatechin gallate (ECG) and epigallocatechin (EGC) which can inhibit influenza virus replication in cell culture and for potentially direct virucidal effect [25].

1.3.6 Protein rich foods

Milk, Egg, tofu, tempeh and fish these are a complete protein, helps maintain immunity. Under vegetables broccoli, spinach and carrot are good source of anti-oxidant, which is beneficial for this pandemic situation.

1.3.7 High Omega-3 fatty acid rich foods

Omega-3 fatty acid-rich foods help to increase immunity. Omega-3 rich fishes are Coldwater fish like salmon, mackerel, sardines and tuna.

1.3.8 Highly anti-oxidant rich fruits and vegetables

Vegetables and fruits are important human sources of abundant vitamins, minerals, and fibres. They vary in several ways, however, including the content of vitamins, minerals, and fibres, and their antioxidant ability. Fruits are well known to be abundant in various antioxidants including ascorbic acid, carotenoids and phenolics **(Arshiya, 2013)** [26].

Some studies indicate the bioavailability of the antioxidants found in some fruits and vegetables **(Parashar *et al.*, 2008)** [27]. Many fruits and vegetables can also be used as an excellent source of natural antioxidants. It is possible to speculate that increased consumption of these fruits would intentionally increase the intake of natural antioxidants which can provide an alternative in the involvement of the ageing process by protecting against oxidative harm.

Table 1: Common Indian fruits and their nutritional value (in each 100 g edible portion)

Name of fruits	Vitamin-C (mg)
Amla	600
Apple	15
Bael	60
Banana	10
Cherry	10
Dates	0
Grape fruits (red)	40

Grapes	3.0
Guava	218
Jackfruits	13.7
Kiwi fruits	70
Lemon	40
Lime	40
Mango	53
Papaya	49
Pear	4
Pineapple	25
Plum	5
Pomegranate	7
Strawberry	60
Star fruits	34.4

(**Source:** *Nevo table 1996, Nevo Foundation, Netherlands Nutrition Centre*)

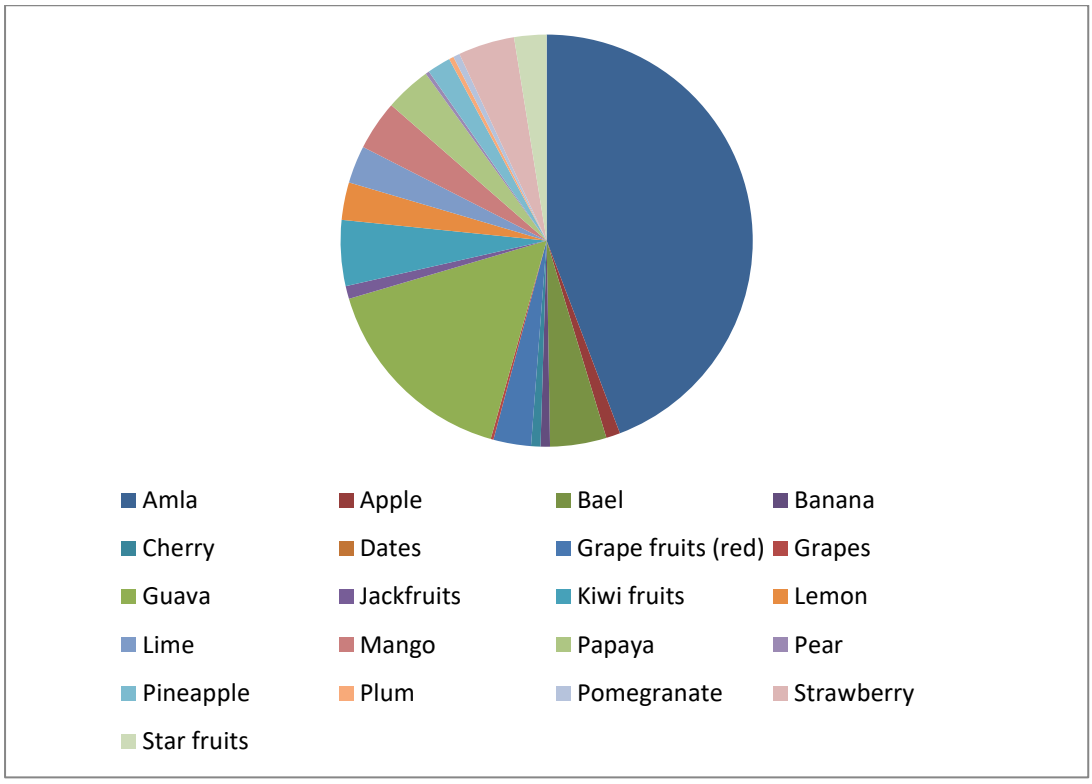

Figure 1: Comparison of vitamin C (gm) level in different types of fruits

The above graph showing that amla has highest vitamin C after guava and kiwi fruits. To increase immunity people can add these three fruits in daily diet.

Table 2: Daily routine therapeutic diet to maintain immunity

Time	Therapeutic diet
Early morning (6 am to 6.30 am)	2 Take one small piece raw turmeric after brushing. 3 Take sprouted grain (25 gm). 4 Almond (1 to 3 pieces). 5 2 pieces biscuits with Tulsi tea (Tulsi leaves are cooked for 10 minutes and then added to lemon juice).
Breakfast (8.30 am to 9.00 am)	• Roti and sabji (capsicum, tomato, broccoli, carrot, potato) • Boiled egg (55gm) • Channa (40gm)
Mid morning (11 am to 11.30 am)	• Soup with garlic slices/ lemon coriander soup. • Chicken soup medium spices
Lunch (12.30 pm to 1.30 pm)	• Rice /roti and sabji (broccoli, tomato, carrot, drumstick, potato, papaya etc) • Dal (1 bowl) • Small fish/ chicken (75gm)\ • Dahi (1/2 bowl) • Lemon
Afternoon (3.30 pm to 4.30 pm)	• Guava/ kiwifruits/amla, Apple, Indian blackberry, Orange (70gm). • Pomegranate Juice (1 cup) • Neem leaves (2 to 4 leaves)
Snacks (6 pm to 7 pm)	• Tea with ginger and black pepper (1 cup) • Rice flakes (1 bowl)/ Puffed rice (1 bowl)
Dinner	• Rice /roti and sabji (broccoli, carrot and

(9 pm to 10pm)	spinach) • Dal (1 bowl) • Small fish (30gm)
Bedtime (10.30 pm)	• Milk (1 glass)

II. Conclusion

In this pandemic condition, researchers are trying to discover appropriate vaccine or medicine to control coronavirus spreading, but still now there is no appropriate vaccine or medicine. So people have to maintain their daily diet to maintain immunity because initially corona virus effects on our immunity and decrease the immune power. Within this study, we have attempted an overview of therapeutic diet against COVID-19, which may be helpful to increase immunity.

Garlic, turmeric, neem, tulsi, green tea, high antioxidant-rich fruits are most abundant immune-boosting foods, plant and spices to boost immunity, people can add these items as a therapeutic diet in daily diet. Different studies have been conducted to determine the effects of garlic compounds on immune system cells and these studies have shown that garlic compounds can maintain immunity through their immunomodulatory activities. Turmaric can have beneficial implications against infection with COVID-19 Through its capacity to modulate the different molecular targets which contribute Assembling and internalizing SARS-CoV-2 in several organs; Liver, digestive system and kidney included. Various medicinal plants like neem, tulsi are very helpful to prevent viral disease. Tulsi leaves have inhibitory effects on various deadly viruses like vaccinia virus, infections, Bursal Disease virus and Newcastle Disease virus. Neem is an ancient herbal medicinal plant with beneficial effects on various viral diseases. It has been observed by several researchers that neem has a biologically active compound that functions as an antiseptic, antiviral, anti-inflammatory and antifungal. Isopropenoids and non-isoprenoids are two important compounds which are found in neem extract.

To sum up, this review shows that Immune-boosting therapeutic diet can be helpful for both prevention and treatment of new emerging coronavirus. However, well-designed clinical trials are needed to demonstrate the potential efficacy of Immune-boosting therapeutic diet against SARS-CoV-2 infection and its ensuing complications.

III. Acknowledgment

Since the beginning of the global COVID-19 pandemic, scientists and clinician-researchers have been trying to recognize and minimize the threat, sharing their views with others. We have taken the approach in this series to collect the recent information and have submitted a manuscript for publication.

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