

Knowledge, Perception and Practices of Immunity Boosters During Covid-19 Outbreak Among Adults Residing in Urban Areas of Delhi

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ABSTRACT

Context: Amidst coronavirus infection, many people have changed their lifestyle and dietary practices specially to improve their immunity against the viral infection. However, practices related to consumption of immune boosting substances during COVID-19 pandemic, have not been extensively studied. **Aims:** The present study was undertaken to explore the knowledge, perception, and practices about the immune boosting substances among adults residing in urban areas of Delhi. **Method and Material:** This is an exploratory cross-sectional study conducted among 391 adult subjects using self-structured online google form. Information was sought on the socio-demographic profile, knowledge, perception, and practices of consuming immunity boosting foods and supplements before and during COVID-19 pandemic. **Results:** The present study revealed that while most of the subjects had the knowledge about immunity and immune boosters, only 4.6% of them were consuming the foods or supplements to boost their immunity before pandemic. About 50% of respondents had self-awareness about immunity boosters and for the others source of information was friends, families or social media (36.7%) followed by medical professionals (12.6%). A statistically significant increase (71.5%) was noted in consumption of various immune boosting foods/supplements during pandemic. The consumption was higher in females compared to males (76.5% vs. 63.2%) and among respondents above 21 years of age as compared to their younger counterparts (80.4% vs. 69%). Before pandemic plant extracts and Indian herbs/spices were the commonly consumed immune boosters, whereas nutrient and ayurveda supplements were preferred during pandemic. Despite increased consumption, most of the respondents were not sure about the impact of immunity foods/supplements. **Conclusion:** The consumption of immune boosters is a feasible strategy for protection against infection. To avoid overconsumption or adverse effects of immunity boosting substances, guidance from a medical practitioner/dietician should be considered.

Keywords: Indian traditional foods, Immunity-boosting foods, Immunity boosters, Nutritional supplements, COVID-19, Pandemic

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INTRODUCTION

The COVID-19 disease caused by a novel Coronavirus, started in December 2019 in China, and soon escalated into a pandemic. The pandemic caught the world unprepared and not only caused vast morbidity and mortality but was also responsible for wide disruption in social life and economy.^[1] Although COVID-19 infection affected all ages, it causes more severe symptoms and exhibited a higher mortality rate in individuals with comorbidities, such as diabetes, asthma, hypertension, cerebro-cardiovascular abnormalities, cancer, as

well as in elderly people.^[2,3] While the pharmaceutical measures against the infections like use of antiviral medications and vaccines took time to develop, several non-pharmaceutical measures were adopted to control the outbreak, especially during early stages of the upsurge. These non-pharmacological preventive measures included social distancing, contact tracing

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and isolation of cases, use of face masks and frequent washing of hands with soap and water among others.^[4] Within these preventive measures, development of the natural ability of the body to defend against infections or immunity gained paramount importance. Myriad research studies emphasized that if the immune system of the body is functioning normally, infections such as COVID-19, may go unnoticed.^[5]

A healthy immune system is an interplay of various factors, optimal nutrition being one of the most critical determinants. Malnutrition can result in significant impairment of several pathways necessary for the body's immune system to function properly like decreased concentration, reduced cell mediated immunity, phagocyte function, and cytokine production. Furthermore, deficiency of a single nutrient can result in altered immune response. The immune system is always at work, but its activity gets intensified when an individual gets infected. Thus, to boost immune activity within the body during an episode of infection, the demand for energy, substrates for biosynthesis and regulatory molecules increases which are all eventually provided from the diet of an individual.^[6] The literature has highlighted the role of various nutrients like vitamins A, vitamin B₆, vitamin B₁₂, folate, vitamin C, vitamin D and vitamin E and trace elements like zinc, copper, selenium, iron in supporting the human immune system and reducing risk of infections. Few amino acids and fatty acids also have demonstrated beneficial effects in boosting immunity. In addition to these nutrients, the gut microbiota has a prudent role in strengthening the immune system.^[7] Agarwal *et al.*, emphasized that the general principle of consuming a balanced diet containing optimal amounts of micro and macro nutrients can help fight against infections even in older people in pandemic situations.^[8] Therefore, the capacity of dietary practices to improve immunity is evident and holds a potential to overcome COVID-19 spread.

The Indian traditional foods consist of various herbs and spices including turmeric, clove, cinnamon, giloy, tulsi, garlic, which besides adding taste and aesthetic in food, may help in improving the body immunity.^[9,10, 11, 12] Tulsi is reported to modulate both innate and adaptive immunity by increasing the number of immune cells including lymphocytes, neutrophils, natural killer cells and increasing phagocytic activity.^[13,14,15] Cinnamon is another Indian herb which is used as a potent immune system booster and has been effective against various ailments like flu, indigestion, edema, cough, etc.^[16] Black pepper has been also found to increase bioavailability, thus enhancing the therapeutic efficacy of many drugs, vaccines and nutrients and have immune-modulatory effects.^[17] The *in vitro* and *in vivo* pharmacological studies on *Embllica officinalis* (*Amla*) revealed its antimicrobial, antioxidant, anti-inflammatory, immunomodulatory effect.^[18] Other studies also documented the immunomodulatory effect of

spices such as clove, cinnamon, ginger, black pepper, and turmeric and their effectiveness against viral infections.^[19, 20] Diets based on plants improves gut commensals and in turn boost on immunity.^[21] However, in literature few dietary practices have been reported to decline the immunity of an individual. In a study done by Isfahani *et al.* (2021), fat and sugar rich diets or high consumption of refined carbohydrates and ultra-processed food have been found to suppress the immunity and make individuals more prone to infection.^[22]

An impact of COVID-19 pandemic on dietary practices has been documented in many research studies. A review of 11 studies conducted in India, which included 1 hospital and 10 community-based studies reported mixed results about dietary practices followed during Covid-19 pandemic among adults aged 18-70 years comprising both genders. Overall, the review concluded overeating was being practiced by most of the subjects, especially there was an increase in snacking and meal frequency among the subjects.^[23] On the other hand, a study conducted by Narayanan *et al.* (2020), on 1011 respondents residing in India concluded that there was a significant drop in intake of fast foods during pandemic.^[24] In another cross-sectional study conducted by Chopra *et al.* (2020), on lifestyle-related behaviours among 995 respondents across India reported that there was an enhancement in healthy meal consumption pattern and avoidance of unhealthy food items, especially in the younger population (age <30 years).^[25] Few studies also reported that there was an increase in consumption of fruits and vegetables as well as immunity boosting foods like ginger, garlic along with multivitamins.^[26, 27] Review studies from several other countries like Poland, France, Spain, Italy and China also reported an increase in the consumption of fruits and vegetables among adults and children during pandemic.^[28]

To protect themselves and their families from coronavirus infection, people tried different combinations of immune boosting foods and supplements during COVID-19 pandemic, however not many studies have extensively investigated this aspect of dietary modification. Therefore, the present study was undertaken to explore the perceptions and knowledge of adults about the immune boosters. Further, the consumption pattern and type of immune boosting foods/supplements consumed before and during the pandemic were investigated in the study.

MATERIALS AND METHODS

This is an exploratory cross-sectional study conducted among the adult population residing in Delhi. Data collection was done between August 2020 to October 2020 using self-structured online google form. For the study, the objectives were explained to the participants and those who agreed to

participate in the research were included in the study after taking their informed consent. The sample size for the study was calculated using the formula

$$(Z_{1-\alpha/2})^2 (p)(q) / d^2$$

Where p was considered 50% with absolute error of 5%, confidence interval 95%. The estimated sample size was calculated to be 385 participants. Therefore, a sample of 390 eligible participants, who met the inclusion and exclusion criteria were selected for the study using convenience sampling method.

A self-structured questionnaire was used for data collection from the respondents which had information on the socio-demographic profile, knowledge on immunity and immunity boosting foods and supplements, the perception regarding the role of diet and physical activity in enhancing their immunity. Data had also been collected on the types of the immunity boosters consumed before and during COVID-19 and possible effects of their consumption. The data was collected in online mode using google forms. The form was duly pretested and had clear instructions so there was no missing data found. The received data were exported to excel and suitably cleaned. Subsequent analysis was done using SPSS Version 23 as per the objectives of the study. Categorical variables were depicted in frequencies and percentage and continuous variables were depicted as means and standard deviations. Chi-square analysis has been applied to test the difference in consumption pattern of immunity boosting foods. Level of significance was considered as 0.05.

RESULTS

The data for the study has been collected from 391 respondents residing in urban areas of Delhi. Their age ranged from 16-40 years, with half of them aged between 19-21 years. Among them, 62.3% were females and 37.7 were males (Table 1).

From data given in Table 2, it can be inferred that most of the respondents had knowledge about immunity and immunity boosting foods. Multiple responses were obtained from the subjects like immunity enhances the body's ability to fight against diseases (88.2%), acts as a defense mechanism (84.6%), and capability to resist harmful microorganisms (82.3%). Similarly, immunity boosting foods were opined to enhance immunity (85.3%), help fight diseases (70%) and modify defense mechanisms of the body (68.9%). One in two respondents reported having self-awareness about the immunity boosting foods. The other sources reported to seek information about immunity boosting foods were friends/family members (19.5%) and social media (17.2%). Very few of them (12.6%) had referred to medical professionals for getting this information. The respondents were also asked

Table 1: Sociodemographic Profile of the Respondents

Parameters	Frequency	Percentage
Age of the Respondents		
<=18 years	103	26.4
19-21 years	195	50
> 21 years	92	23.6
Gender of the Respondents		
Female	243	62.3
Male	147	37.7

about their perceptions regarding the role of diet and exercise in boosting immunity. About 82% respondents opined that diet has a role in boosting immunity whereas 76.6% perceived immunity was affected by exercise. Data on frequency of falling ill before consuming immunity boosting supplements reflects that 49.7% rarely fell ill whereas 42.9% and 7.7% respondents reportedly fell occasionally and frequently before incorporating immunity boosting supplements.

The consumption of immunity boosters was statistically higher during pandemic as compared to before pandemic (71.5% vs. 4.5%; $\chi^2 = 393.27$; $p = 0.00$). The age-wise consumption patterns of immunity boosters during pandemic given in Figure 1 revealed that the intake was higher in respondents older than 21 years as compared to their younger counterparts, however this difference was not statistically significant ($\chi^2 = 4.776$; $p = 0.092$). Furthermore, a significantly higher percentage of female than males had consumed immunity boosting substances during the pandemic as shown in Figure 2 (76.5 vs. 63.2; $\chi^2 = 8.804$; $p = 0.012$). The respondents were also enquired about the type of immunity boosting substances consumed before and during pandemic (Table 3). Among the few respondents who reported consuming immunity boosters before the pandemic, plant extract/Indian spices and herbs which are commonly available in Indian households like tulsi, black pepper, giloy, cloves, dry ginger, asafetida, cinamon, turmeric etc. were most commonly consumed. However, during the pandemic consumption of various other types of immunity boosting substances have been reported. Nutrient supplements followed by ayurvedic supplements were more preferred than other foods to boost immunity. Most consumed nutrient supplements were in the form of multivitamin tablets and syrups. In the case of ayurvedic supplements chyawanprash, amla and aloe vera juice, ashwagandha, giloy, kalonji, mulethi, tulsi drops were most commonly consumed. AYUSH kadha was also reportedly consumed by many respondents. Few respondents also reported taking Indian spices.

Table 2: Knowledge and Perceptions Regarding Immunity and Immunity Boosting Foods of the Respondents		
Parameters	Frequency	Percentage
Knowledge about Immunity*		
Ability to fight against diseases	344	88.2
Defense mechanism of the body	330	84.6
Capability to resist harmful microorganisms	321	82.3
No idea	5	1.3
Knowledge about immunity boosting foods*		
Food that enhances immunity	333	85.3
Food that helps to fight against diseases	273	70
Foods that modify defense mechanism	269	68.9
No idea	3	0.8
Source of information about immunity boosting foods		
Medical professionals	49	12.6
Social media	67	17.2
Friend or family	76	19.5
Self-awareness	198	50.8
Perception regarding role of exercise in enhancing immunity		
Yes		
Maybe	283	76.6
No	94	24.1
	13	3.3
Perceptions regarding role of diet in enhancing immunity		
Yes	319	81.8
Maybe	56	14.4
No	15	3.8
Frequency of falling ill before consuming immunity boosting supplements		
Frequently	30	7.7
Occasionally	166	42.6
Rarely	194	49.7
Note: * Multiple Responses.		

Table 3: Consumption of Immunity Boosting Foods Before and During Covid-19 Pandemic		
Parameter	Frequency	Percentage
Type of immunity boosting foods consumed before Covid -19 Pandemic*		
Ayurvedic supplements	3	0.7
Plant extracts/Indian spices and herbs	16	4
Not consumed	372	95.4
Types of immunity boosting foods consumed during Covid -19 Pandemic*		
Nutrient supplements	157	40.2
Ayurvedic supplements	134	34.3
Plant extracts/Indian spices and herbs	99	25.3
Not consumed	111	28.5
Dietary changes during Covid -19 Pandemic*		
Avoiding junk food and alcohol	241	61.7
Increased consumption of fruits and vegetables	209	53.5
Daily consumption of lemon water	137	35.1
Consumption of a balanced diet	131	33.5
Consumption of protein and carbohydrates	115	29.4
Rich diet	132	33.7
No Change	5	1.2
Note: * Multiple Responses.		

The respondents were also asked about their dietary changes during the pandemic. Majority of respondents have reportedly made dietary changes. About two-third respondents have started avoiding junk food and alcohol on the other hand 53.5% respondents reported that they have increased the consumption of fruits and vegetables. The other notable changes were increase in the consumption of lemon water daily. About one-third respondents increased consuming a balanced diet especially rich in carbohydrates and proteins. Data on self-perception of immunity revealed that most respondents opined their immunity to be good/very good. Only a few respondents reported that their immunity is below average (Table 4). Many respondents had started consuming immunity boosting substances during the pandemic, but

Table 4: Perception of Effects of Immunity Boosting Foods on Health

Parameters	Frequency	Percentage
Rate your immunity		
Very poor	0	0
Poor	15	3.8
Average	98	25.1
Good	196	50.3
Very good	81	20.8
Perceived effect of immunity boosting substances on protection against infections		
No	0	0
Yes	7	1.8
May be	383	97.9
Perception of side effects on consumption of immunity boosting substances		
Yes	0	0
No	9	2.3
May be	381	97.6

the majority were not really sure if they have a potential protective effect against infections. Similarly, with respect to the perceived side-effects of immunity boosters, most of the respondents were unsure.

DISCUSSION

Immune system provides protection to an organism against various illnesses and pathogenic invaders including viruses, bacteria, fungi, protozoans, cancer etc. The Covid-19 pandemic made everyone realize the significance of strong immunity. Besides following covid appropriate behavior, the emphasis was given to boost immunity. Evidence from research studies conducted in India during COVID-19 pandemic, indicated a change in the lifestyle and dietary patterns especially towards consuming healthy products. The present study indicated among other dietary changes, the consumption of immunity boosting foods of various types which are a part of traditional Indian cuisine has increased during among adults residing in India. These findings are consistent with earlier studies where it was reported that up to 80% of the population in Asian and African countries depend primarily on traditional methods and natural sources for taking care of their health.^[29] A study conducted by Shashidhar (2021) also revealed a hike in the sale of natural products like turmeric, honey, and chyawanprash during the pandemic especially through e-commerce platforms in India.^[30] The Ministry of AYUSH in

Figure 1: Age-Wise Consumption of Immunity Boosters Before and During Pandemic

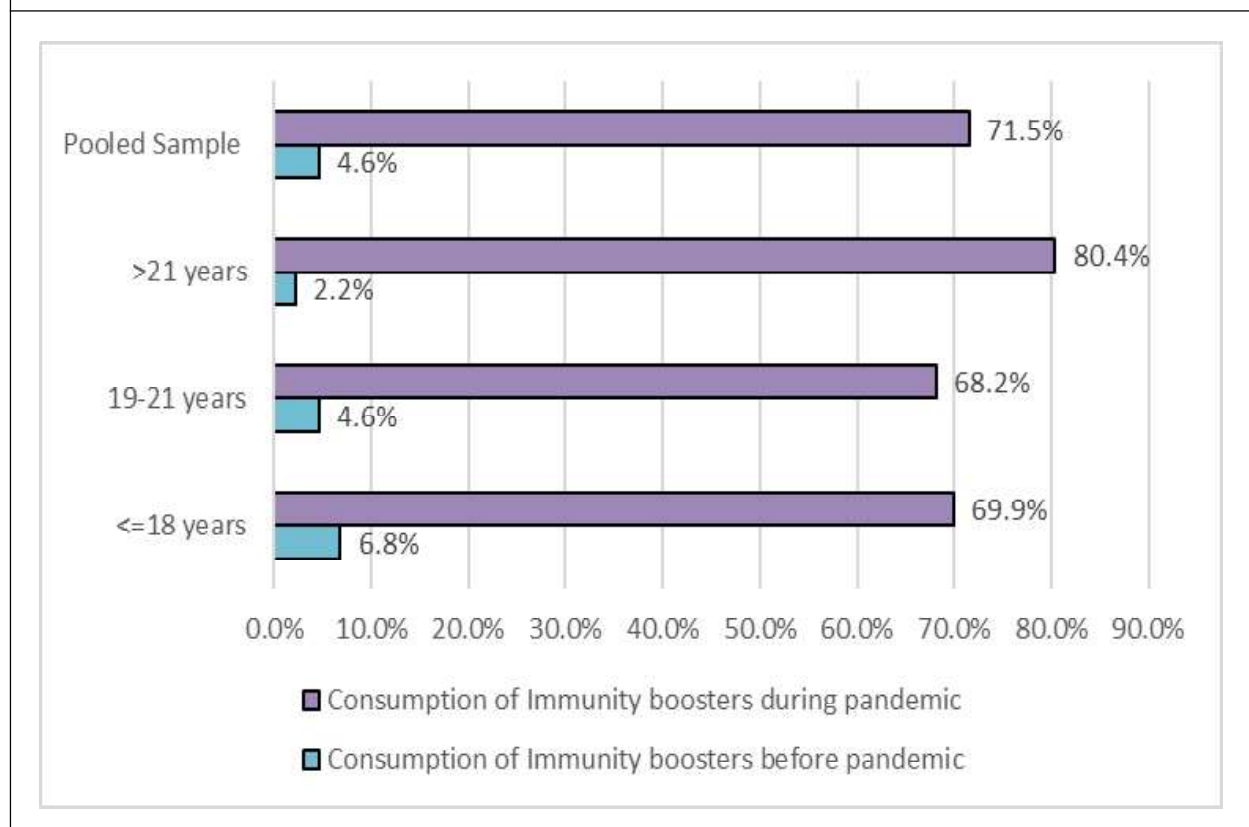
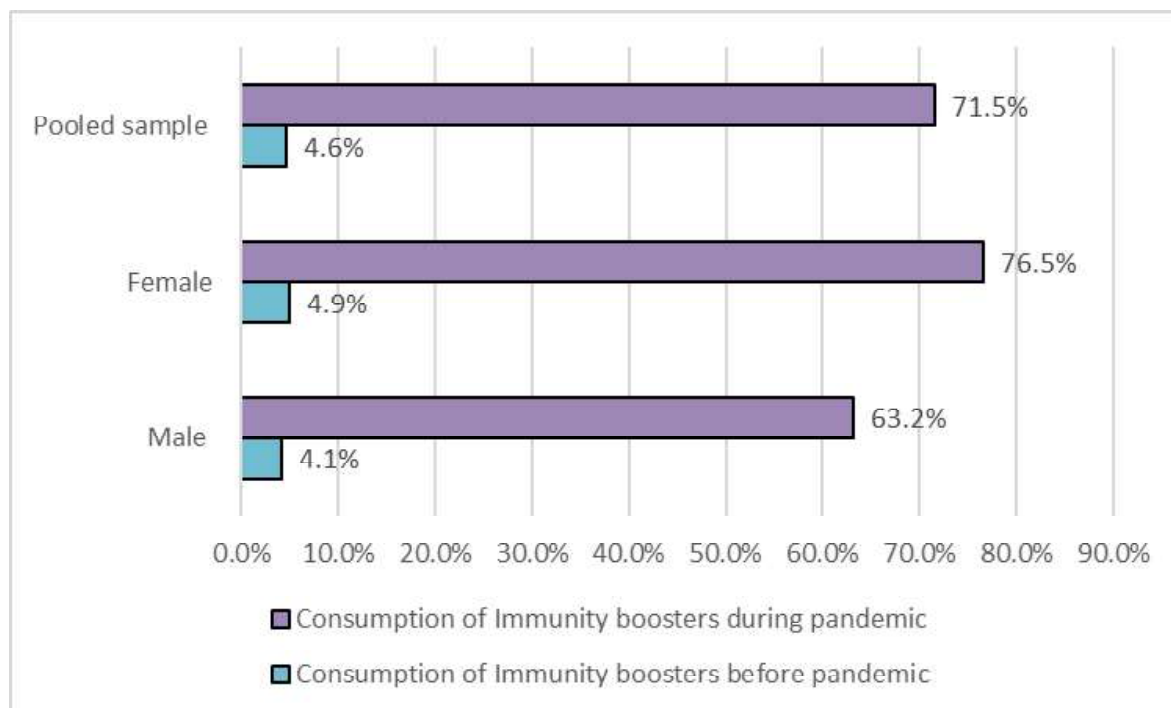


Figure 2: Gender-Wise Consumption of Immunity Boosters Before and During Pandemic



India released an advisory on ayurvedic methods for enhancing immunity and for self-care during the COVID-19 pandemic. It recommended including spices such as turmeric, cumin, coriander, and garlic that are used during cooking food. They have also advised drinking herbal tea/decoction (kadha).^[31]

In the present study, the intake of immunity boosters was higher among females and subjects older than 21 years. In a cross-sectional study conducted in India by Shamim, Ahmad and Alam in 2001 among 212 respondents aged above 18 years, it was suggested that females were more likely to adopt healthier food habits as compared to males during the pandemic.^[32] However, in the same study it was reported that consumers who are younger than 40 years are more likely to inculcate healthier eating habits as compared to those who are above 40 years. Similar results were found in a study conducted in India by Chopra *et al.* (2020), where an improvement in healthy meal consumption and the restriction of unhealthy food items was observed, more among the younger populations (<30 years of age).^[25] Apart from India, few studies conducted in other countries have also highlighted dietary changes during pandemic. A study conducted in Spain reported an increased consumption of fruits and vegetables among subjects, potentially due to increased meal preparation at home.^[33] Yet another Australian study reported healthy changes in physical activity, sleep, smoking, and alcohol consumption were by 3-21% of respondents while unhealthy changes were reported by 7-49% of respondents during the covid-19 pandemic.^[34]

Another noticeable finding for the study is that very few subjects had referred to medical professionals for getting the information related to immunity-boosting food indicating that most individuals are getting influenced by pseudo-scientific advertisements on social media or approaching unauthentic sources for information. However, unregulated intake of these immune boosters and home remedies, provoked by COVID-19 outbreak, may pose health dangers particularly in the ones having comorbidities.^[35] It is highly recommended to seek professional help before incorporating any modifications in dietary practices. In most cases, the claims of companies selling ‘immunity boosting’ foods which supposedly enhance immunity have no scientific evidence.^[36] The misleading information that may turn dangerous to human health needs intervention by scientists, health professionals and media to identify and tackle spread of fake news.^[37] As much as concerns about immunity are growing, healthcare professionals opined that there is no magic drug and immunity reflects one’s own health.^[38]

The Covid-19 pandemic had an enormous impact on the lifestyle and eating habits of people. The consumption of immune boosting substances was adopted as a feasible strategy by people for protecting themselves against infection. The Indian traditional cuisine has rich options of foods that can build immunity and these foods should be consumed on a regular basis as the threat of infections is not yet over, especially by elderly population. Positive practices adopted during pandemic like avoiding processed and junk foods

should be promoted. However, to avoid overconsumption or adverse effects of immunity boosters, guidance from a medical practitioner or dietician should be considered. The limitation of the study is that no direct interaction was possible with the respondents and no follow up was made to know any change in the consumption of the immune boosters after covid pandemic.

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