



Immunoboosting Potential of Spices with Special Reference to North East India against the Novel Coronavirus Pandemic- A Review

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Authors' contributions

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ABSTRACT

Spices, which is key ingredient in every household products not only used for adding aroma to food but however, has health promoting and protective activity against foreign pathogens. Different spices used in day to day life boosts the immune system that leads to healthy and prosperous life. The commonly used spices not only have antimicrobial or antiviral activity, but also serve as a rich source of various vitamins, minerals, antioxidants etc. The medicinal importance of spices dates from ancient *Ayurveda* and many studies indicating the potential of spices as immunoboosting agent had been carried out in the recent years. Therefore, this review highlights the medicinal importance of commonly used spices in North-East India as immunobooster against the current coronavirus pandemic.

Keywords: Immunity; spices; antimicrobial; medicinal importance; health; antioxidants; antiviral.

1. INTRODUCTION

Spices are commonly used in the form of dried seeds, fruits, leaves and flower as flavouring agent. However, their significant medicinal importance in combating different kinds of infection and diseases has come to light in the current novel coronavirus pandemic. Spices are generally used in India in combination for everyday cooking purposes which provides an excellent mixture of compounds in boosting immunity [1]. They are rich source of natural antioxidants containing many bioactive components like phenolics, flavonoids, carotenoids, foliates etc. which either scavenge or decompose the formation of free radical [2]. India being the spice hub of the world, is a source to many medicinally important spices. North eastern part of India, which is also a biodiversity hotspot also harbours many traditionally utilised medicinal spices which is endemic to this region. Immuno boosting capability of spices, reports from ancient Ayurveda and thereafter taking lead from such reports, numerous research on the antimicrobial and antiviral potential of spices extract had been reported [3]. These spices had direct and indirect effect against the disease by boosting immunity to eliminate or defend against the invaded pathogen. There are several reports that showed that many bacterial, fungal disease are controlled by spices directly or using their extract in combinations [4]. Now a days, due to increase drug resistance among the pathogenic microorganisms and side effects of allopathic medicine, use of medicinal plants and their products is the alternative. For example, researches have been carried out to examine the virucidal activity of curcumin (active component of *Curcuma longa*) and whether this biologically active compound can be served as antiviral therapy against different viral diseases [5, 6]. Various research on the broad-spectrum activity ginger rhizome is being carried out for the treatment of asthma, rheumatism, joint swelling liver problems, indigestion, loss of appetite, constipation, bloated stomach, vomiting, flatulence, piles, cold, cough, fever, physical weakness, arthritis. Headache, heart disorders, diabetes, diarrhoea and elephantiasis [7, 8]. This review mentions some of the commonly used spices of North East India, which can be commercially cultivated on industrial scale for medicinal as well as economic purpose.

2. COMMONLY USED NORTH-EAST INDIAN SPICES

2.1 Turmeric (*Curcuma longa* L.)

Turmeric (*Curcuma longa* L.) is a perennial rhizomatous plant belonging to the family Zingiberaceae with a characteristic yellow-colored rhizome [9]. The plant was likely to be originated from India where it has been used for almost 4000 years [10]. Apart from being tremendously used as an inevitable component of culinary spices, the rhizome of *C. longa* has its other important uses as a food preservative, natural dyeing agent and as a home remedy for different health issues. The commercially used form of the plant is the dried rhizome powder. Besides, the raw rhizome paste and decoction are also used for various purposes. The plant is best grown in the tropical and subtropical regions of the world. India ranked as the highest producer, consumer and exporter of turmeric all over the world [10].

The major polyphenolic groups of turmeric are Curcumin, demethoxycurcumin and di demethoxycurcumin which are collectively known as curcuminoids [11, 12]. Among these curcumin is the most potent compound which exhibits a plethora of biological activities including antibacterial, antiviral, antifungal, antioxidant, immunomodulatory, anti-inflammatory, anti-diabetic, anti hepatotoxic, and anti-cancerous (Table 1) activity [9, 10, 13]. These multidimensional functional aspects of curcumin make their uses for the treatment of different diseases like cold, cough, skin infections, cuts, wounds, swelling, liver problem, diabetes, rheumatism and many others [9, 10]. The inhibitory effect of curcumin was reported against different viruses like Human immunodeficiency virus (HIV), Parainfluenza virus type 3 (PIV-3), Hepatitis C virus (HCV), Feline infectious peritonitis virus (FIPV), Human cytomegalovirus (HCMV), Influenza A virus (IAV), vesicular stomatitis virus (VSV), herpes simplex virus (HSV), Epstein-Barr virus (EBV), Bovine herpesvirus 1 (BHV 1), flock house virus (FHV), Chikungunya virus, respiratory syncytial virus (RSV), Ebola virus, Rift Valley fever virus (RVFV), Enterovirus 71 (EV71), Human Norovirus (HuNoV) and viral haemorrhagic septicemia virus (VHSV) [5, 14]. In silico studies showed the potential inhibitory effect of curcumin against COVID 19 Main protease (Mpro) which is the key enzyme for viral replication and suggest its usefulness against this virus [6].

2.2 Lakadong Turmeric

The Lakadong variety of *C. longa* is one of the world's finest varieties of turmeric with a high curcumin content of 6.8-7.5% [10]. Being originated from the Lakadong area of Jayantia hills, this variety of turmeric is indigenous to the state of Meghalaya, India. The colour of its rhizome is darker than the other variety grown in India. The higher curcumin content of lakadong turmeric indicates its high significance towards its medicinal importance. Thus, the more frequent consumption of lakadong turmeric by the local inhabitant might also function as a natural armour against different diseases (Table 1).

2.3 Ginger (*Zingiber officinale* Rosc.)

Zingiber officinale, commonly known as ginger is also a member of the family Zingiberaceae. The North East region of India harbours a rich ginger diversity due to its different agro climatic conditions. Although ginger is cultivated throughout this region but the major states which produce this cash crop are Meghalaya, Mizoram, Arunachal Pradesh and Sikkim [15]. Besides the commercial variety like Nadia China, Varada, a large number of indigenous cultivars of ginger available here which are named by the individual localities they belonged. Though these local varieties are less prevalent, yet very popular among the local folks for their potent medicinal values. Some of the local cultivars are Moran ada, Bola ada, Thinglaidum, Keki, Shing bhukir, Naga shing, and Bhaise [16]. They all differ from each other in yield, oil characteristic and fiber content. Shing bhukir of Meghalaya has the smallest rhizome which is best known for its medicinal value [16] (Table 1). Another special variety of ginger called the black ginger with a deep bluish colored rhizome is used as folk medicine by some of the tribal communities like Bodo, Mizo, Meitei and Nagas [16]. The N. E region contributes 49% of the ginger cultivation area with 72% of India's total ginger yield [16]. Apart from the large-scale production, ginger is cultivated almost in every kitchen garden of the indigenous people inhabiting the rural areas of the N. E region. It is an integral component of North-eastern spices and has immense use as ethnomedicine for various health issues. Chemically the essential oil of the rhizome extract contains a mixture of different volatile and non-volatile compounds which impart unique odour and flavour to ginger. The non-volatile compounds glycerol, paradols, shogaols and zingerone present in ginger oil are responsible

for the characteristic pungency [17, 18]. The essential oil and oleoresin content were reported to be higher in the ginger cultivars from the North-eastern region as compared to the other ginger from the other parts of India [16]. The essential oil characteristic and yield vary from variety to variety and depends on the environmental conditions. The essential oil of ginger has been reported to exhibit different pharmacological activities like anti-inflammatory, antioxidant, antitumoral, anti-diabetic, hepatoprotective, gastroprotective and antimicrobial activity [7, 8]. The antiviral activity of *Zingiber officinale* was reported against Human Respiratory Syncytial Virus (HRSV), Hepatitis C virus, Calicivirus, Influenza A (H1N1) and Herpes Simplex Virus type 2 (HSV-2). The bioactive compounds of ginger were also virtually showed to exhibit inhibitory effects against Spike protein and MPro of SARS-CoV2 protein [19].

2.4 Bay Leaf (*Laurus nobilis* L.)

Laurus nobilis L. (Lauraceae) is an evergreen tree, growing up to ten meters high widespread in the Mediterranean area, and widely cultivated in many countries with moderate and subtropical climate (Turkey, Algeria, Morocco, Portugal, Spain, Italy, France, or Mexico), mainly for the commercial value of its aromatic leaves. It is well known as Bay, Bay Laurel, Sweet Bay, True Bay, Roman Laurel, Grecian Laurel, or Mediterranean Bay. The leaves are 5–10 cm in length and 2–5 cm in broad and leaf surface is leathery, elliptic-lanceolate and wavy at the margins. Dried bay leaves are used as a spice to improve flavor of soups, meats, fish, vinegars, and beverages and has been used mainly in Mediterranean cuisines [20]. Sweet bay is propagated by seeds or preferably by cuttings. From a well matured wood, branches or woods of about 7.5 to 10 cm length are put in sharp sand either under bell-glasses or in glass cases [21]. The rooted cuttings are placed in small pots containing fairly rich sandy loam with good drainage, and then can be put in a hot bed, with gentle bottom heat where they will make a good strong growth [22, 23]. Commercial essential oils generally obtained by hydro distillation or steam distillation are commonly employed by the pharmaceutical and food industries. The presence of large amount of the biologically active compounds in bay leaves like methyl eugenol for food use and 1,8-cineole for medicinal use can contribute to their pharmacological properties, muscle relaxant effect, and anti-inflammatory activity (Table 1), respectively [20].

The aqueous extracts of *Laurus nobilis* were evaluated for its wound healing activity in rats and effects of n-hexane fraction from *Laurus nobilis* leaves on dopamine induced intracellular reactive oxygen species (ROS) production and apoptosis in human neuroblastoma SH-SY5Y cells was also investigated [21]. Lyophilized aqueous and ethanol extract of *Laurus nobilis* were studied for their antioxidant properties. The antioxidant activity, reducing power, free radical scavenging, superoxide anion radical scavenging, hydrogen peroxide scavenging and metal chelating activities were evaluated to determine the total antioxidant capacity of both extracts [21]. The leaf essential oil of *Laurus nobilis* was tested for anticonvulsant activity against experimental seizures and essential oil protected mice against tonic convulsions induced by maximal electroshock and especially by pentylenetetrazole [24]. The essential oil of *Laurus nobilis* leaves evaluated for analgesic and anti-inflammatory activities in mice and rats [25]. The essential oil exhibited a significant analgesic effect in tail-flick and formalin tests, a dose-dependent anti-inflammatory effect in the formalin-induced edema and a moderate sedative effect at the anti-inflammatory doses [25]. The antimutagen was purified chromatographically from ethyl acetate extract of bay leaf and identified instrumentally to be 3-kaempferyl pcoumarate. Essential oils of *Laurus nobilis* were evaluated for their inhibitory activity against SARS-CoV and HSV-1 replication in vitro by visually scoring of the virus induced cytopathogenic effect post infection [26]. *Laurus nobilis* oil shown activity against SARS-CoV with an IC₅₀ value of 120 µg/ml and a selectivity index (SI) of 4.16. Essential oil, ethanolic extract and decoction of *Laurus nobilis* were analyzed for their activity towards acetyl cholinesterase (AChE) enzyme [21]. It showed AChE inhibitory capacity higher than 50% in the essential oil fraction. In vitro antibacterial activities of the essential oil, seed oil, and methanolic extract of seeds oil obtained from *Laurus nobilis* was observed along with the antifungal activity.

2.5 Chili (*Capsicum* spp.)

The genus *Capsicum* (hot pepper, chili pepper, chili, sweet pepper, and bell pepper) is indigenous to Central and South America from pre-Colombian times and belongs to the family Solanaceae [27]. Presently, this genus is believed to consist of 27 species, five of these being widely cultivated. These are *C. annuum* L., *C. chinense* Jacq., *C. frutescens* L., *C.*

pubescens R., and *C. baccatum* L. [28]. Regarding its origin and distribution, though *Capsicum* spp. are Mexican in origin but grown worldwide, the North Eastern India represents one of the hot spot for chilli cultivation due to its diverse topography and distinctive geography. In NE India, several *Capsicum* landraces are traditionally grown, which differ greatly based on their morphological appearance, flavour and pungency levels. These are locally assigned by a number of vernacular names, e.g. In Assam, Naga King chilli (Bhut Jolokia/Bih Jolokia/Naga Jolokia, Lota Bhut, Dhan Jolokia, Krishna Jolokia, Mem Jolokia, Raja mircha, U-morok), In Sikkim, they are known as Dalle Khursani (round chillies), Thadey Khursani (erect fruit), Thalo Khursani (vegetable type), Jeerey Khursani (thin fruit), Lamchey Khursani (medium size-less pungent), In Mizoram, Bird-eye chilli (Mizo chilli) and so on [29].

Chili pepper (*Capsicum* spp.) is being widely used as a spice, flavour enhancer, vegetable and a natural colorant for its pungency, color and flavour [30]. Besides, chilli is potentially used in pharmaceuticals and cosmetics for their efficient health functionality against various degenerative diseases caused by free radicals and microbes (Table 1). They also contain minerals like iron, magnesium and potassium, vitamins like A, C, B, E and P and dietary fibres [31] along with one of the most significant alkaloid "Capsaicinoid" which confers pungency, taste and aroma to the chilli pepper [32]. Due to presence of such a huge array of bioactive compounds, *Capsicum* provides enormous nutritional benefits towards human health. From the pharmacological viewpoint, *Capsicum* is documented with antioxidant, anti-inflammatory, anti-ulcer, anti-hemorrhoid, antiallergenic anti-carcinogenic, antipyretic and analgesic properties [31]. Presence of high amounts of beta – carotene, vitamin A and vitamin C along with its active ingredient capsaicinoid enables *Capsicum* to boost the immune system of the body and to lower the cholesterol level, effective in heart disorders. Chilli peppers are also effectively known for their antimicrobial activities. Capsaicin, the main Capsaicinoid of chilli has diverse uses in pharmaceuticals that are attributed to relief of pain, antiarthritic, anti-bacterial, anti-inflammatory, anti-rhinitis, and analgesic properties [33]. It was reported that capsaicin showed an in vitro growth inhibition against MtzR and MtzS strains and certain well-known foodborne pathogens like *Bacillus cereus*, *Bacillus subtilis*, *Enterobacter aerogenes*,

Pseudomonas aeruginosa etc. [34]. Though chilli pepper have not been assessed well yet for its antiviral activity, but it has been reported that Capsicum is found to be effective against Norovirus, a potent causative agent of diarrhoea, nausea, vomiting, stomach cramps, headache, and fever [35]. Corona virus Disease 2019 (COVID-19), an infectious, fatal disease caused by Severe Acute Respiratory Syndrome Corona virus 2 (SARS-CoV-2), which was originally identified in Wuhan, China (December 2019) has expanded into a pandemic in 2020. While investigating possible inhibitors of COVID-19 main protease (Mpro), required for viral multiplication, Capsaicin (extracted from *C. annuum*) is found to have immense potential in inhibiting COVID-19 Mpro with molecular docking score -8.0 Kcal/mol [36]. From this finding, we can conclude that as *Capsicum* is rich in immunity boosting ingredients, its regular consumption would definitely lead to the development of long-lasting immune protection against microbial and viral infection as well as would provide a prophylactic therapy to prevent and minimize the chances of infection.

2.6 Large Cardamom (*Amomum subulatum* Roxb.)

Large cardamom (*Amomum subulatum* Roxb.); described for the first time by William Roxburgh in the "Flora Indica" (1820b) belong to *Zingiberaceae* family, and is typically the largest genus which includes more than 150 species [37]. The spice is cultivated throughout the sub-Himalayan region which includes Sikkim, Darjeeling and Arunachal Pradesh. Large cardamom has an explicit aroma and pleasing odour; and regarded as Queen of spices present on earth. India in particular, is the largest producer of large cardamom, and contribute to 54% of total production [38]. Sikkim in general contributes to 88% among the total production quantity [38]. Essential oil content of large cardamom varied from 1.95% to 3.32% having medicinal properties like stimulant, stomachic, alexipharmic and astringent [39]. The spice is used in the treatment of indigestion, vomiting, biliousness, abdominal pains and rectal diseases apart from being used as flavouring agent [40]. The spice also contained various phenolic flavonoid compounds (Thymol, carvacrol, p-cymene and γ -terpene) having antimicrobial and antioxidant properties [39] (Table 1).

2.7 Black Pepper (*Piper nigrum*)

Black pepper; commonly known as Jaluk in North Eastern states often regarded as black gold in ancient times is a perennial woody climbing vine belonging to family *Piperaceae* is the King of all spices. The spice is a native of Western Ghats and is mostly used for culinary and medicinal purposes [38]. The spice is widely cultivated in the eastern parts of Assam and their adjoining areas. The active component piperine act as antioxidant and pain killer which helps in preventing cold and flu, bronchitis and improves blood circulation, clearing nasal passages, reducing fever and relieving coughs. Higher production of stomach hydrochloric acid is triggered that aid in digestion of food proteins. Consumption of pepper also eases out aching muscles and relieves inflammatory arthritis (Table 1).

2.8 Black Sesame (*Sesamum indicum* L)

Sesame, *Sesamum indicum* L., is commonly known as Sesamum or benniseed. It belongs from the Pedaliaceae family. Sesame is cultivated mainly in countries like India, Sudan, China, Burma etc. Since prehistoric times, sesame seeds have been grown in tropical areas throughout the globe [41]. It has been cultivated for centuries in Asia and Africa due to its high content of edible oil and protein. Sesame is commonly known as til (Hindi), huma (Chinese), sesame (French), goma (Japanese), gergelim (Portuguese), ajonjoli (Spanish) etc. in different languages [42]. India is one of the major producers of many oilseeds and the Indians consume substantial quantity of edible oil primarily for cooking. *Sesamum indicum* L. is one of the world's important oil crops. Major countries like India, China, and Sudan etc. produce approximately 60% of total world production [43]. Sesame seeds are the affluent source of nutritious fat, protein, carbohydrate, dietary fibre, zinc, magnesium and many other minerals. Sesame also contains good amounts of oleic (43%), linoleic (35%), palmitic (11%) and stearic acid (7%) which together comprise 96% of the total fatty acids of it [44] (Table 1).

Needless to say that sesame is rich in nutrients and many other nutraceutical components which help to make up the numerous health benefits of sesame seeds that have been experienced for thousands of years. Magnesium and other nutrients present in sesame seeds,

Table 1. Medicinal value of the Spices and their distribution in India

Spices	Distribution in India	Medicinal Importance	Ref.
Turmeric (<i>Curcuma longa</i> L.)	Andhra Pradesh, Maharashtra, Tamil Nadu, Odisha, Karnataka, Kerala, Madhya Pradesh, West Bengal, Uttar Pradesh, Himachal Pradesh, Assam, Bihar.	Anti-inflammatory, hypocholestraemic, choleraic, antimicrobial, antirheumatic, antifibrotic, antivenomous, antiviral, antidiabetic, antihepatotoxic, anticancerous.	[59] [60]
Lakadong Turmeric	Meghalaya	High Curcumin content.	[61]
Ginger (<i>Zingiber officinale</i> Rosc.)	Andaman and Nicobar Island, Assam, Meghalaya, Arunachal Pradesh, Sikkim, West Bengal, Tripura, Jammu and Kashmir, Karnataka, Kerala, Odisha, Tamil Nadu, Uttar Pradesh, Madhya Pradesh, Uttarakhand.	Antispasmodic, anti-inflammatory, lower cholesterol, lower blood pressure, effective against nausea, motion sickness and morning sickness, diaphoretic, diuretic, anti-inflammatory, anti-emetic and sialagogic properties.	[62] [63]
Bay leaf	North East Indian Mountains, Uttar Pradesh, Bihar, Kerala and Karnataka.	Wound healing activity, antioxidant activity, antibacterial activity, antiviral activity, immunostimulant activity, anticholinergic activity, antifungal activity, insect repellent activity, anticonvulsant activity, antimutagenic activity, and analgesic and antiinflammatory activity.	[64] [65]
Capsicum	All the states of India	Antioxidant, anti-inflammatory, anti-ulcer, anti-hemorrhoid, anti-allergenic, anti-carcinogenic, anti-pyretic and analgesic properties.	[66]
Large cardamom (<i>A. subulatum</i> Roxb.)	Sikkim, West Bengal, Assam, Nagaland, Arunachal Pradesh, Mizoram, Meghalaya, Manipur, Uttarakhand.	Analgesic, antimicrobial, cardiac stimulant, carminative, diuretic, stomachic.	[67] [68] [69] [70]
Black pepper (<i>P. nigrum</i>)	Andaman Island, Assam, Kerala, Meghalaya, Tamil Nadu, Karnataka.	Antihypertensive, antioxidant, antitumor, anti-asthmatics, analgesic, anti-inflammatory, anti-diarrheal, antispasmodic, antidepressants, immunomodulatory, anticonvulsant, anti-thyroids, antibacterial, antifungal, hepato-protective.	[71] [72]
Black sesame	All the states of India	Regulating cholesterol, Neurological role, blood pressure regulation, Antioxidant properties, Dermatological use.	[73] [74]
Coriander	All the states of India	Antioxidant, Antimicrobial, Antidiabetic, Anxiolytic, Cardioprotective, Anthelmintic, Antiulcer, Antiaging, Anticancer and diuretic effects	[75] [76] [77] [78]

and especially sesame oil, have been shown to combat diabetes. According to reports, sesame oil improves the effectiveness of the oral anti-diabetic drug glibenclamide in type 2 diabetic patients [45]. Another study concluded that substitution of sesame oil as the sole edible oil has an additive effect in further lowering blood pressure and plasma glucose in hypertensive diabetics [46]. Again, some report concludes that, sesame oil has been shown to lower blood pressure in hypertensive diabetics. Substitution of sesame oil in dietary oils brought down systolic and diastolic blood pressure to normal, in addition decreasing lipid peroxidation and antioxidant status [46]. Moreover magnesium has been shown to help in lowering blood pressure and sesame seeds are loaded with magnesium. Sesame seed oil which prevent atherosclerotic lesions can boost hearth health. Sesamol, which also shows anti-atherogenic properties, is thought to be one reason for the beneficial effects of sesame oil [41]. One of the most prominent benefits of sesame seeds and sesame oil revolves around removing dental plaque and boosting oral health [47]. Sesamol, which is found in sesame seeds and sesame oil, has been shown in some studies to protect against DNA damaged caused by radiation [48, 49]. Sesame seeds not only contain an anti-cancer compound called phytate, but also the magnesium in sesame seeds also possess anti-cancer properties [50]. Sesame seeds are also rich in fiber, for which it is known to beneficial for a healthy digestive system and a healthy colon. Copper is another mineral that is important for anti-inflammatory and antioxidant enzyme systems and also known for reducing pain and swelling associated with arthritis. High magnesium content in sesame seeds are helpful preventing asthma and other respiratory disorders as it prevents airway spasms [41]. As sesame oil has been used in wound healing and it major component sesamol antioxidative properties can be also used for rapid wound healing [51]. Sesamol has both antioxidant activity and anti-clastogenic activity [52]. Sesame seeds are rich in zinc, which is an essential mineral for producing collagen and giving skin more elasticity. Zinc also helps in repairing of damaged tissues in the body. Sesame oil is also popularly used to sooth burns and prevents skin related disorders [53]. Sesame oil or sesamol is rich in calcium (approx. 1%) and phosphorous (approx. 0.7%) and may help in the reduction of the inflammatory response in inflammation associated diseases [54, 55].

2.9 Coriander (*Coriandrum sativum* L.)

Coriander (*Coriandrum sativum* L.) is an annual herb, commonly used in culinary as seasoning and aromatic ingredients [56]. The plant belongs to Apiaceae family and widely cultivated in India and Indian subcontinents. The plant is widely cultivated throughout the country and has origin in the Near East which has been naturalized in many tropical and subtropical regions of the world. The plant as considered as highly medicinal plant in *Ayurveda* and commonly known as “Dhanya” in India [57]. Edible portion include roots, stems and leaves which is utilised freshly or processed depending on needs. The plant is native to southern Europe and North Africa to south-western Asia and commonly recognised by different names such as Chinese parsley or cilantro [58]. Seed oil obtained from the plant is used in flatulence, colic, rheumatism and neuralgia and digestive problems. In Asian countries, the herb is used in the treatment of piles, swellings and conjunctivitis [56]. The plant has been called as anti-diabetic in European countries (Table 1). Treatment of mouth ulcers and poultice is also employed by using seeds as mouth paste. The herb is rich in antioxidants that prevent breakdown of animal fats and neutralise meat spoiling bacteria and fungi [56].

3. CONCLUSION

This review discussed the spices commonly produced and used by the people of North eastern states of India for culinary purpose. Besides adding aroma to food, this review discussed the potential of different spices as alternative to many diseases where allopathic drugs are whether available or not. Role of spices in antibacterial, antifungal and antiviral activities cannot be substituted with any other alternatives. Diseases caused by different types of chronic viruses are considered to be a global health concern, and there is an urgent need for potential and effective antiviral drugs. Use of commonly available antiviral drugs have shown to possess a variety of side effects. In this pandemic, due to unavailability of any allopathic drugs; use of spices for immunity development has gained immense attention. Use of spices in each and every food product had become a common practise which simply imply the importance to mankind. Different by-products of spices had also gained considerable market attention in last few months alone. Therefore, based on the review; It can be concluded that

different spices which are used in day to day life can not only act as natural immunobooster but also had provided insights for its cultivation on commercial scale which can help in uplifting the economy of the country and also can reduce dependence on chemical drugs. Hence adding these spices to our diet in adequate amount will make our immune system function well thereby protecting us during this pandemic.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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