An appraisal on antiviral assets of some spices

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Abstract
Background: The spices are inseparable part of Indian Kitchen. According to the region their amount of usage varies. In spite of taste, flavor, fragrance they bears therapeutic potential too. The Antiviral herbals and their remedies are getting attention due to Covid-19 all over the globe. In search of the available herbals we focus on the antiviral potential of certain Indian spices which are easily available and can be used on daily basis.

Aim: To review the antiviral set of properties of Spices.

Material and Method: Intensive search of available literature on spices through the various search engines like Google, Google scholar, Pub med etc. is done for their antiviral properties.

Conclusion: These properties of spices could be utilize to check the viral attacks by converting them into suitable formulation for the interest of common public.

Keywords: Antiviral, benefit, Indian spices, Bioactives compounds

Introduction
The spices are inseparable part of Indian Kitchen. According to the region their amount of usage varies. In spite of taste, flavor, fragrance they bears therapeutic potential too. The Antiviral herbals and their remedies are getting attention due to Covid-19 all over the globe. There is lack of effective therapeutics for the most of viral diseases, emergence of antiviral drug resistance, and high cost of some antiviral therapies necessitate finding new effective antiviral compounds. Additionally, the existing antiviral therapies are not always well-tolerated or quite effective and satisfactory. Hence, the increasing requirement for antiviral substances will be more highlighted. Plants as a rich source of phytochemicals with different biological activities including antiviral activities are in interest of scientists.

Material and Method
Intensive search of available literature on spices through the various search engines like Google, Google scholar, Pub med etc. is done. In search of the available herbals we focus on the antiviral potential of certain spices which are easily available and can be used on daily basis in Indian cooking like ginger, garlic, cumin seeds, muster, turmeric, clove, cardamomum, fenugreek, saffron, black pepper, bishop’s weed.

Result and Discussion
The antiviral spices established through the various researches are as follows

1. Garlic: Mehrbod P et al. conducted study on antiviral effect of garlic extract on Enfluenza Virus. They measured the amount of the viral genome synthesized at different times after treatment, RNA extraction, Reverse Transcription-Polymerase Chain Reaction (RT-PCR) and free band densitometry software. Although the precise mechanism has not been defined but it was found that garlic extract with a good selectivity index (SI) has inhibitory effect on the virus penetration and proliferation in cell culture [1].

2. Ginger: Sulochana Kaushik et al. conducted study on cell culture for Chikungunya virus. when Vero cells were pre-treated with MNTD and half of MNTD of Z. officinale extract respectively. Similarly, in co-treatment, when MNTD, half of MNTD of Z. officinale and Median tissue culture infective dose CHIKV were inoculated simultaneously, then the viability of Vero cell-line was increases by 52.90% and 49.02% respectively. The rhizome extracts of Z. officinale have high potential to treat CHIKV [2].
3. Cumin Seeds: Sajid Umar et al. performed experimental study on 130 non vaccinated turkey pouls. they were challenged with H9N2 Virus and check the immune response and pathogenesis. significantly higher antibody titer against H9N2 was found in tuckeys fed with 6% cumin seeds. thus they concluded that supplement of cumin would enhance responsiveness and suppress pathogenicity of influenza virus [3].

4. Mustard seeds: N.K. Lee et al. studies the subcritical water extract of mustard seeds for A/H1N1 in non fat milk for the use as antiviral food. The antiviral activity of SWE of Brassica evaluated as n-hexane, ethanol and hot water extract. SWE has highest activity as antiviral and it was maintained in non fat milk. Author have suggested that SWE of Brassica may be used as food supplement in diary products against the viral infections [8].

5. Turmeric: Moghadamtousi S.Z. et al. studies the compound, Inosine monophosphate dehydrogenase (IMPDH) enzyme from turmeric due to rate-limiting activity in the de novo synthesis of guanine nucleotides is suggested as a therapeutic target for antiviral and anticancer compounds. Among the 15 different polyphenols, curcumin through inhibitory activity against IMPDH effect in either noncompetitive or competitive manner is suggested as a potent antiviral compound via this process. The study of different bioconjugates of curcumin, namely, di-O-tryptophan phenylalanine curcumin, di-O-decanoyl curcumin, di-O-pamitoyl curcumin, di-O-bis-(γ,γ)-foly curcumin, C5-ethyl-O-γ-foly curcumin, and 4-O-ethyl-O-γ-foly curcumin, against a variety of viruses including parainfluenza virus type 3 (PIV-3), feline infectious peritonitis virus (FIPV), vesicular stomatitis virus (VSV), herpes simplex virus (HSV), flock house virus (HHV), and respiratory syncytial virus (RSV) assessed by MTT test showed the potent antiviral activity of curcumin and its bioconjugates against different viral pathogens for further studies. Also, di-O-tryptophanphenylalanine curcumin and di-O-decanoyl curcumin revealed remarkable antiviral activity against VSV and FIPV/HHV with EC50 values of 0.011 μM and 0.029 μM, respectively [9].

6. Clove: Diego Francisco Cortés-Rojas et al. reviewed antiviral activity of eugenin, a compound isolated from S. aromatica and from Geum japonicum, was tested against herpes virus strains being effective at 5 μg/mL, and it was deduced that one of the major targets of eugenin is the viral DNA synthesis by the inhibition of the viral DNA polymerases. aqueous extracts of S. aromatica (L.) Merr. et Perry and other plants as Geum japonicum Thunb., Rhus javanica L., and Terminalia chebula Retzus among others showed strong antiherb simplex virus type 1 (HSV-1) activity when combined with acyclovir. This synergic activity was stronger in the brain that in the skin and it was also proved that those combinations were not toxic to mice. [6]

7. Cinnamon: Tamam SM et al. conducted study on one hundred and fifty one day-old chickens were fed by five diet supplements with 0%, 0.1%, 0.3% of essential oil, and 1%, 3% of cinnamon powder for 30 days serum and whole blood were collected for evaluation of T. protein, S. albumin, S. globulin, total antioxidant, lysozyme activity, phagocytic percent and phagocytic index. cinnamon zeylanicum essential oil and powder exhibit significant T. protein, Globulin and albumin and total ant-oxidant activity in chickens. Findings of the study establish cinnamon zeylanicum essential oil and powder had antiviral activity by appreciable immunostimulatory activity by increasing survival percent (challenge test) lysoyme, PI and phagocytic activity [7].

8. Fenugreek: Khansa A et al. The bioactive components of the seeds of fenugreek (Trigonella Foenum-graecum L.) in methanolic fenugreek seed extract scrutinized by Gas Chromatography-Mass Spectrometry, Azelaic acid, di(2-ethylhexyl) este in vitro exhibited the antiviral property [5].

9. Cinnamomum: Hayashi K, et al. suggested that, Trans-cinnamaldehyde (CA), is main essential oil constituent isolated from Cinnamomi cortex. It inhibits growth of influenza A/PR8 virus in vitro and in vivo and is used to treat acute respiratory infectious diseases. Similarly, Premanathan M, et al. studied Cardiospermum helicacabum (shoot + fruit) extracts against HIV-1 and HIV-2. The silver nanoparticles derived from Cinnamom extract enhanced the antiviral activity. In another study Yeh CF, et al. suggested that silver nanoparticles synthesized from Cinnamomum cassia extract were found effective against H7N3 Influenza A Virus. These effectively decrease HRSV induced plaque formation and syncytium formation in respiratory mucosal cell lines. It removes off obstructions occurred in airway epithelia due to HRSV infection through inhibiting viral attachment, internalization and syncytium formation [8].

10. Saffron: Sepehr Soleymani et al. have tested the anti-HSV-1 and anti-HIV-1 activities of Iranian saffron extract and its major ingredients including crocin and picrocrocin as well as cytotoxicity in vitro. The data showed that the aqueous saffron extract was not active against HIV-1 and HSV-1 virions at certain doses (i.e., a mild activity), but crocin and picrocrocin indicated significant anti-HSV-1 and also anti-HIV-1 activities. Crocin inhibited the HSV replication at before and after entry of virions into Vero cells. Indeed, crocin carotenoid suppressed HSV penetration in the target cells as well as disturbed virus replication after entry into the cells. Picrocrocin was also effective for inhibiting virus entry and also its replication. monoterpen aldehyde showed higher anti-HSV effects after virus penetrating in the cells. Generally, these sugar-containing compounds extracted from saffron showed to be effective antitherpetic drug candidates [12].

11. Black pepper: Priya N. C et al. conducted research on seeds of Piper nigrum. it’s chloroform and methanolic extracts were collected by reflux method and extracts were evaluated against Vesicular stomatitis virus and human para influenza virus on HeLa cell lines. Cytotoxicity assay carried out by MTT assay and LDH measurement. Anti-viral activity of Piper nigrum in chloroform extract showed higher activity than Piper nigrum methanolic extract against vesicular stomatitis Indiana virus and Human para influenza virus on HeLa cell line. extract of Piper nigrum treatment showed inhibition of growth of HeLa cells at IC50 values of 551.58, 24.18 and 17.47 μg/ml at 24, 48 and 72 hours of incubation respectively. LDH measurement showed 100% of inhibition at 260 mg/ml for both extracts of Piper nigrum. These results suggest that Piper nigrum have significant anti-viral and anti-cancer activity in HeLa cells. HPTLC analysis of both the pepper in chloroform extract at 254nm and 366 nm was done which produces different bands. At 254 nm resolutions of
bands were poor and at 366 nm well resolved bands with different intensity of color of bands confirmed the presence of piperidine [13].

12. Bishop’s weed: Hussein G et al. conducted the study on one hundred fifty-two methanol and water extracts of different parts of 71 plants commonly used in Sudanese traditional medicine for their inhibitory effects on hepatitis C virus (HCV) protease (PR) using in vitro assay methods. Of these, eight extracts, methanol extracts Trachyspermum ammi were found the most active (≥90% inhibition at 100 µg/mL) against hepatitis C virus (HCV) protease [14].

Table No. 1: Overview of the spices along with the antiviral properties

| S.N. | Name of the spices | Latin name | Family | Part used | Effective against virus |
|------|-------------------|------------|--------|-----------|------------------------|
| 1.   | Garlic            | Allium sativum | Amaryllidaceae | Rhizome | Influenza Virus. |
| 2.   | Ginger            | Zingiber officinale | Zingiberaceae | Rhizome | Chikungunya virus |
| 3.   | Cumin seeds       | Cuminum cyminum L | Apiaceae | Seeds | Avian influenza(H9N2) |
| 4.   | Mustard seeds     | Brassica juncea | Brassicaceae | Seeds | Influenza virus (A/ H1N1) |
| 5.   | Turmeric          | Curcuma longa | Zingiberaceae | Rhizome | feline infectious peritonitis virus (FIPV), vesicular stomatitis virus (VSV), herpes simplex virus (HSV), flock house virus (FHV), and respiratory syncytial virus (RSV) |
| 6.   | Clove             | Syzygium aromaticum (L.) Merr. | Myrtaceae | Flower buds | Antipher simplex virus type 1 (HSV-1) |
| 7.   | Cinnamon          | Cinnamomum zeylanicum | Lauraceae | Bark | Newcastle Disease Virus (NDV) |
| 8.   | Fenugreek         | Trigonella foenum | Fabaceae | Seeds | Influenza |
| 9.   | Cinnamomum        | Cinnamomum tamala | Lauraceae | Leaves | Influenza/PR/8 virus, human immunodeficiency virus (HIV) |
| 10.  | Saffron           | Crocus sativus | Iridaceae | Stigmas | HSV-1 and human immunodeficiency virus (HIV-1) |
| 11.  | Black pepper      | Piper nigrum | Piperaceae | Seeds | vesicular stomatitis virus (VSV) and Human para influenza virus(HPIVS) |
| 12.  | Bishop’s weed     | Trachyspermum ammi | Apiaceae | Fruit | hepatitis C virus (HCV) |

References

1. Mehrbod P, Amini E, Tavassoti-Kheiri. Antiviral Activity of Garlic Extract on Influenza Virus, Iranian Journal of Virology. 2009; 3(1):19-23.
2. Kaushik S, Jangra G, Kundu V, Yadav JP, Kaushik S. Anti-viral activity of Zingiber officinale (Ginger) ingredients against the Chikungunya virus, Indian Virological society, Springer, 2020
3. Umar S, Munir MT, Subhan S, Azam T, Nisa Q et al. Proactive and antiviral activity of Nigella sativa against avian influenza (H9N2) in tuckeys. J. Saudi Society of Agricultural Sciences, 2016, 1-24.
4. Lee NK, Lee NK, Lee JH, Lee SM, Lim KA, Lee YB et al. Antiviral activity of subcritical water extract of Brassica juncea against influenza virus A/H1N1 in non-fat milk. J. Dairy Sci. 2014; 97:5383-86.
5. Moghadamtousi SZ, Kadir HA, Hassandarvish P, Tajik H, Abubakar S, Zandi K. A Review on Antibacterial, Antiviral, and Antifungal Activity of Curcumin, Biomed Res Int. 2014; 2014:186864.
6. Diego Francisco Cortés-Rojas, Claudia Regina Fernandes de Souza, Wanderley Pereira Oliveira Clove. (Syzygium aromaticum): a precious spice. Asian Pac J Trop Biomed. 2014; 4(2):90-96.
7. Tamam SM, Abd el Hamid MS, Samah M, Helmyc, Marwa A, Nahkhiry. The Anti-viral and Immunomodulatory Activity of Cinnamon zeylanicum Against “NDV” Newcastle Disease Virus in Chickens. International Journal of Sciences: Basic and Applied Research. 2017; 32(2):251-62.
8. Khanssa A, Shaheed, Manal A, Alsirraj, Shatha A, Allaith et al. The biological activities of seeds extracts for fenugreek and black cumin and its inhibitory influences toward some pathogens. Iraq Med J. 2018; 2(2):46-50
9. Hayashi K et al. Inhibitory effect of cinnamaldehyde, derived from Cinnamomi cortex, on the growth of Influenza/PR/8 virus in vitro and in vivo. Antiviral Res. 2007; 74(1):1-8.
10. Premanathan M et al. A survey of some Indian medicinal plants for anti-human immunodeficiency virus (HIV) activity. Indian J Med Res. 2000; 112:73-77.
11. Yeh CF et al. Water extract of Cinnamomum cassia Blume inhibited human respiratory syncytial virus by preventing viral attachment, internalization, and syncytium formation. J Ethnopharmacol. 2013; 147(2):321-326.
12. Sepehr Soleymani, Rezvan Zabiollahi, Sepideh Shahbazi, Azam Bolhassani. Antiviral Effects of Saffron and its Major Ingredients, Curr Drug Deliv. 2018; 15(5):698-704.
13. Priya NC, Saravama Kumari P. Antiviral Activities and Cytotoxicity Assay of Seed Extracts of Piper longum and Piper nigrum on Human Cell Lines,International Journal of Pharmaceutical Sciences Review and Research. 2017; 44(1):197-202.
14. Hussein G, Miyashiro H, Nakamura N, Hattori M, Kakiuchi N. Inhibitory effects of Sudanese medicinal plant extracts on hepatitis C virus (HCV) protease, Phytother Res. 2000; 14(7):510-16.