

Review Paper

Medicinal Plants Effective in the Prevention and Control of Coronaviruses



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ABSTRACT

Objective Coronaviruses often cause acute complications in the respiratory system with cold-like symptoms. A number of them, such as Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS) and Coronavirus Disease 2019 (COVID-19) have killed thousands of people and have caused epidemics and pandemics. This review study aims to investigate the most common medicinal plants in Iran and introduce their natural products with antiviral effects on coronaviruses and strengthening the immune system in order to prevent and control them.

Methods In this review study, a search was conducted in national and international databases such as Web of Science, Scopus, PubMed, Science Direct, Google Scholar, SID, MagIran and IranMedex by using keywords such as COVID-19, Coronaviruses, SARS, MERS, SARS-CoV-2, PEDV in both Persian and English for studies published until 2020, and finally 51 articles were selected.

Results There are 10 plants with antiviral effects on members of the family Coronaviridae among which Ginger, Galangal, Cinnamon, Fennel flower, Grapefruit (peel), and Purple coneflower were effective on COVID-19. Elder, Ginseng, Aloe vera, Milkvetch, and Shirazi Thyme plants were effective in boosting the immune system and preventing viral diseases.

Conclusion Inhibiting the replication of viruses is the common mechanism in antiviral drugs, but natural compounds usually counteract it by disrupting key proteins and virulence factors of viruses. Therefore, the use of the antiviral components of reported plants can be useful in producing drugs for these viruses, especially the one causing COVID-19.

Extended Abstract

1. Introduction

Coronaviruses are a group of related RNA viruses that causes acute complications in the respiratory system so similar to cold symptoms. A number of them like Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS) have caused epidem-

ics with high mortality rate. Coronaviruses were first identified in 1965 and named as B814. So far, this virus has spread to birds, mammals and humans. In 2003, the World Health Organization identified a deadly infectious disease and named it SARS. Later, different types of Coronavirus were identified and introduced including Human Coronavirus NL63 in 2004, Hokovirus (HKV1) discovered in patients with pneumonia, MERS in 2012, and Porcine Epidemic Diarrhea Virus (PEDV) in 2014. The new type of these viruses that has caused a disease named "COVID-19" and is re-

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sponsible for the current pandemic was identified in Wuhan, China in 2019. In recent years, the use of herbal plants has been considered due to their less side effects and natural origin compared to chemical drugs, having anti-inflammatory, antimicrobial, anticonvulsant and antipyretic properties, and having compounds such as polyphenols and monophenols. This study aims to review the plants with inhibitory and antiviral effects on the Coronavirus family and also with the power to strengthen the immune system to prevent diseases.

2. Material and Methods

In this review study, the search was conducted in Web of Science, Scopus, PubMed, Science Direct, Google Scholar, SID, MagIran and IranMedex databases for related studies conducted until 2020 using the keywords such as Medicinal plants, COVID-19, Coronaviruses, SARS, MERS, SARS-CoV-2, and PEDV. First the abstracts of the articles were examined and the related studies that were thematically related to the objectives of the current study were then selected. Among these articles, those that included the definition of coronaviruses, the effects of plant extracts and essential oils on coronaviruses, and the therapeutic and inhibitory role of these medicinal plants on these viruses were selected. After finding effective plants in the treatment and prevention of coronaviruses, new search in above databases was conducted on them using the keywords: Essential oil, extract, effective compounds, phytochemical properties and chemical compounds; and their botanical characteristics and effective compounds were determined. Then, the effective compounds identified in the articles were matched with the compounds mentioned in the articles that reported the therapeutic and preventive effects of plants on Coronavirus, and the reasons for their antiviral nature were determined. The article were divided into three group: 1. Articles related to definition and characteristics of Coronaviruses; 2. Articles related to the effect of medicinal plants on Coronavirus; and 3. Articles related to the analysis of essential oils and plant extracts, chemical properties of effective compounds, and their mechanism of action. A total of 250 articles were yielded. Of these, 51 (9 in Persian and 42 in English) were selected for review.

3. Results

Studies have shown that 10 plants have an antiviral effect on the members of the family Coronaviridae including Ginger (*Zingiber officinale*), Galangal (*Alpinia officinarum*), Cinnamon (*Cinnamomum zeylanicum*), Fennel flower (*Nigella sativa* L.), Grapefruit (*Citrus aurantium*), Purple coneflower (*Echinacea angustifolia*), baylaure (*Laurus nobilis*), Mugwort (*Artemisia sp.*), Ginseng (*Panax quinquefolius*) and Liquorice (*Glycyrrhiza glabra* L.). These

plants are effective treatment of SARS, MERS, Respiratory Syncytial Virus (RSV) and COVID-19. Elder (*Sambucus nigra*), Ginger, Aloe Vera, Milkvetch (*Astragalus membranaceus*), and Shirazi thyme (*Zataria Multiflora*) plants have been introduced as an immune system booster and as an effective factor in preventing viral diseases. These plants can somehow inhibit the activity of Coronaviruses by having various effective compounds. Due to the existence of glycyrrhizic acid composition in Liquorice, effective combination of lycorine in Mugwort, Flavonoids in baylaure, and hetero polysaccharides purple coneflower, these plants can have positive effects on SARS. On the other hand, Ginger can positively affect RSV due to having Ginsenoside compounds. Moreover, Ginger (due to existence of Phenol compounds such as Gingerol, Shogaol), Galangal (due to existence of Flavonoids compounds), Cinnamon (due to existence of Eugenol compounds), Purple coneflower (due to existence of Niglidin and Alpha hydrogen compounds) and skin of Grapefruit (due to existence Flavonoids compounds) have effects on COVID-19. It seems that each of the plants mentioned above show their antiviral activity by binding to the viral protease and preventing virus replication. Since the risk of developing Coronaviruses increases by weakening of the immune system, some plants have been introduced for strengthening the immune system including: Elder due to having Flavonoids, Ginger due to having phenolic and ginsenoside compounds, Aloe Vera due to having amino acid, Milkvetch due to having glucuronic acid, and Shirazi thyme due to having thymol and carvacrol contents.

4. Conclusion

It can be concluded that plants with effective compounds can be effective in inhibiting Coronaviruses. Five plants for this purpose were reported in this study. These plants boost the immune system against viral diseases by some mechanisms such as increase of cytokines by monocytes, induction of interferon and phagocyte production, increase of intestinal probiotic bacteria, induction of immunoglobulins and lymphocytes, protecting the central nervous system against viral infections, neutralizing hydrogen peroxide and oxygen free radicals, and reduction of cell death caused by system weakness. Inhibiting the replication of viruses is one of the common approaches in antiviral drugs, but natural compounds usually counteract it by disrupting key proteins and virulence factors of viruses. Therefore, the use of the effective antiviral compounds of these plants can be useful in producing drugs against these viruses causing diseases such as COVID-19 that has killed thousands of people and overshadowed the world economy and international relations.

Ethical Considerations

Compliance with ethical guidelines

There were no ethical considerations to be considered in this research.

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Authors' contributions

All authors contributed in preparing this paper.

Conflicts of interest

The authors declared no conflict of interest.

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