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## Thoughts on the effects of moxa smoke in the epidemic prevention<sup>☆</sup> 关于艾烟防疫作用的思考

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### ABSTRACT

Through summarizing and analyzing the modern mechanism researches and controversial questions of moxibustion fumigation in the epidemic prevention, the thoughts on tackling the critical points are proposed in the paper, such as the recognition of moxa smoke in traditional Chinese medicine (TCM), the mechanism of moxa smoke in air disinfection and the characteristics of clinical application of moxa smoke so as to provide the references to the prevention and control of COVID-19 in TCM.

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In the Chapter 72 of *Sùwèn* (《素问》Plain Questions), it is recorded that “where the epidemic disease arrives, it is easy to infect each other, no matter young or old, with similar symptoms”. It is the first record of the epidemic disease, describing its characteristics. It is recorded in *Wēnbìng Tiáobàn* (《温病条辨》Systematic Differentiation of Warm Diseases) that for the patient with plagues, the epidemic pathogens are related in etiology, mostly combined with turbid and toxic pathogens. *Wēnrè Lùn* (《温热论》Treatise on Warm-Heat Diseases) points that the treating principle of this disease should be eliminating pathogens with aromatic herbal medications and in association with detoxification. The ancient scholars believe that *Aiyè* (艾叶 *Folium Artemisiae Argyi*) is pungent and warm in nature and aromatic in flavor, acting on strengthening the body, preventing disease and removing disorders by fumigation. Hence, moxibustion by fumigation is the common method in the epidemic prevention. It is recorded in *Zhōuhòu Bèijí Fāng* (《肘后备急方》Emergency Formulas to Keep Up One's Sleeve) that the strong moxibustion on the four corners of the patient's bed, one moxa cone on each, achieves the best effect on preventing from epidemic infection. In *Bèijí Qiānjīn Yàofāng* (《备急千金要方》Important Formulas Worth a Thousand Gold Pieces for Emergency), *Wàitái Mìyào* (《外台秘要》Arcane Essentials from the Imperial Library) and *Běncǎo Gāngmù* (《本草纲目》The Grand Compendium of Materia Medica), it has described that the fumigation with *Folium Artemisiae Argyi* and *Cāngzhú* (苍术 *Rhizoma Atractylodis*) is applied for the epidemic prevention. The literature research indicates that the essential oil

produced by burning *Folium Artemisiae Argyi* is mainly composed of eucalyptol, borneol, 4-terpene alcohol, etc. [1], acting on sterilization, anti-inflammation, anti-virus, suppressing cough, relieving asthma and strengthening immunity [2]. Clinical trial proves that moxa smoke fumigation achieves the same or even better effect as compared with the room air disinfection and ultraviolet disinfection and this method is not influenced by temperature and humidity [3,4]. The author was intended to propose some approaches to moxibustion in the battle against corona virus disease 2019 (COVID-19) by analyzing the mechanism of moxa fumigation in the epidemic prevention and the related controversial issues. It is anticipated to provide the references to the prevention and control of COVID-19 in traditional Chinese medicine (TCM).

### Mechanism research of moxibustion fumigation on the epidemic prevention

There are very few reports on the mechanism researches of moxa fumigation for the epidemic prevention. Generally, two aspects are involved. One is related to the block of transmission route and another is to the improvement of body immunity.

#### Blocking transmission route

In Chapter 72 of *Sù Wèn* (《素问》Plain Questions), it is explained that the epidemic toxin invades the body through the respiratory tract. When the virus carrier sneezes and coughs, the tiny droplets containing the pathogenic microorganisms are ejected from the mouth and nose, forming droplet particle bacteria, hosting in the aerosol and floating in the air, which forms a chain of infection. It can be seen that blocking aerosol transmission route is of great significance for the prevention of the epidemic. The researches show that moxa smoke achieves its prevention role by

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killing pathogenic bacteria and forming micromembrane barrier. Rui-hong LI, et al. [5] burnt 2 moxa sticks, once every two days, 1h each time in the ward during the flu season. It is found that moxa fumigation effectively kills virus and reduces the incidence of influenza to be 0%. The disinfection effect is better than that of dynamic air disinfection machine. Hongmei ZHAO, et al. [6] had adopted the same method to sterile baby ward, 12 m<sup>2</sup> and it also indicates that moxa fumigation presents a certain of inactivation effect on hepatitis B virus HBsAg and HBeAg. Xiao-rong HU et al. [7] fumigated the hematology ward with 25 g moxa stick for 60 min. It is found that moxa fumigation has significant sterilization effect on common pathogenic bacteria such as pseudomonas aeruginosa, staphylococcus aureus and candida albicans. Xiao-ping ZHAN, et al. [8] used moxa stick fumigation for disinfection in the intensive care unit (ICU), about 1.33 g/m<sup>3</sup> and the elimination rate of natural bacteria in the air is 90%. Ya-qin TANG, et al. [9] provided moxa stick fumigation in the ward, about 1.7 g/m<sup>2</sup>, for 1 hour each time and the average qualified rate of disinfection in a year is 94.4%, meeting the requirements of hospital air disinfection. Cai-ping CAI [10] observed the disinfection effect of moxibustion among different doses. The maternal-neonatal unit of hospital ward was disinfected by 2.5 g/m<sup>2</sup>, 5g/m<sup>2</sup> and 10 g/m<sup>2</sup> respectively. It is discovered that the antibacterial effect of each dose group is 100% in 24 h after disinfection but it is no effect in 48 h after disinfection in the 2.5 g/m<sup>2</sup> group and in 96 h after disinfection in the 5 g/m<sup>2</sup> and 10 g/m<sup>2</sup> groups. Hence, it is believed that the persistent time of disinfection with fumigation of *Folium Artemisiae Argyi* is within 3 days. Some scholars think [11] that the fumigation of *Folium Artemisiae Argyi* not only inhibits or kills bacteria and viruses in the air, but also forms a micromembrane barrier in the mouth and nose to prevent the invasion of influenza viruses.

#### Improving immunity

Improving body immunity is significant in preventing from epidemic infection. The researches show that moxibustion regulates the concentrations of immune factors such as interleukin, tumor necrosis factor, interferon and immunoglobulin and improves the degree of erythrocyte aggregation, which affects the body immune system from different aspects [12]. Ping LIU, et al. [13] found that the long-term intervention of moxa smoke down-regulates the proportion of CD4<sup>+</sup>CD25<sup>+</sup>Treg in CD4<sup>+</sup> T cell in the peripheral blood of the rats. Hong CAI, et al. [14] found that a certain concentration of moxa smoke condensate may improve the activity and phagocytic function of macrophages in the pulmonary alveolus of rats and Chang HUANG, et al. [15] discovered that moxa smoke could increase WBC count and thymus index in serum of mice with leukopenia caused by cyclophosphamide and reduce spleen index, thus effectively protect immune organs. Some researches [16,17] indicate that moxa smoke has a significant positive effect on serum ICAM1, VCAM1, MCP1, TNF- $\alpha$ , hs-CRP and vWF in APOE<sup>-/-</sup> mice, as well as suppresses the inflammatory responses. It has been discovered in our previous researches [18,19] that moxibustion increases the levels of immunoglobulin and CRE in serum of fatigue rats, reduces the levels of LDH and CK and enhances the body adaptability. In clinic, the research by Bin YANG, et al. [20] indicates that moxibustion increases CD3<sup>+</sup> and the ratio of CD4<sup>+</sup> to CD8<sup>+</sup> of serum T cell subsets, improves patient's immunity, promotes lesion absorption and enhances clinical effect in the patents with tuberculosis. Hong LI, et al. [21] found that moxibustion improves the immune function of red blood cells and relieves the dysfunction of T cell subsets in athletes and improves their immunity. In the research by Zhen-wei LIU, et al. [22], it is discovered that moxibustion is assisted in the antiretroviral therapy for human immunodeficiency virus (HIV). It improves the immune indicators, such as CD4<sup>+</sup>/CD8<sup>+</sup>, IL-2 and IL-7, significantly reduces the inci-

dence of adverse reactions and improves the quality of life in the patients.

#### Controversy on the safety of moxibustion

Some studies think that moxibustion plays an irreplaceable role in the treatment of diseases [23], but its safety remains controversial. Some studies suggest that a certain concentration of moxa smoke is relatively safe. Bai-xiao ZHAO's research team [24,25] evaluated the accumulated toxic reaction of particulate matter in moxa smoke and its influence on serum free radicals, and concluded that the toxic reaction of moxa smoke in low and medium concentration groups was not significant and its harm to human body was not obvious. Yu-hai HUANG et al. [26] proved the safety of moxa smoke because moxa smoke could not cause abnormal changes in physiological indicators such as blood pressure, respiratory rate, heart rate, electrocardiogram and blood oxygen saturation in healthy people. However, some clinical investigations found that the incidence of chronic pharyngitis among the physicians of the department of acupuncture and moxibustion in moxibustion smoke environment was 26.67%, and 61.11% of the physicians had pharyngeal discomfort or cough after moxibustion therapy [27]. Ran JIN et al. [28] conducted qualitative analysis on the combustion products of *Folium Artemisiae Argyi* and found that a few of its components had certain toxicity at a high concentration. Li HAN [29] calculated that the limit of human safety concentration was 2.75 mg/m<sup>3</sup> according to animal experiments. Most researchers believe that harmful substances can be controlled within a safe range by constructing a good exhaust ventilation system, but the attention should still be paid to the air quality problems caused by moxa smoke [30].

#### Problems to be solved urgently in the application of development of moxa smoke

In modern researches, the role of essential oil in *Folium Artemisiae Argyi* has been briefly classified as the function of moxa smoke [31], resulting in unclear effect and application and inducing some safety controversy of toxic side reactions. To face up to the therapeutic effects of moxa smoke, we should primarily improve the understanding of moxa smoke in traditional Chinese medicine (TCM), identify its *yin* or *yang* property and classify its application range of cold, heat, deficiency or excess syndrome so as to lay the theoretical foundation of TCM for the modern study of moxa smoke as well as its promotion.

#### Requiring a further research on the approach of moxibustion fumigation to the epidemic prevention or its mechanism

The composition of moxa smoke is complex and most of the current researches focus on the composition or effect of its ingredients. There is still a gap in the study of what substances or material groups play a role in moxa smoke. The author believes that the researches should emphasize on this aspect to make clear what substances or material groups play the roles of disinfection and sterilization, those of barriers as well as of aerosol deposition, etc. In addition, the ancient literature records that some aromatic herbs, such as *Rhizoma Atractylodis*, are fumigated for the epidemic prevention and control. It is wonder whether its combustion may be the same materials (groups) or with a similar structure. Hence, it is necessary to specify the harmful threshold dose and non-harmful threshold dose to research and develop the related products, ensure the accurate target of function as well as determine the curative effect. Eventually, the significance of TCM is displayed the epidemic prevention.

### Requiring a further research on the characteristics of moxa smoke in clinical application

Besides the effects aforementioned, it is discovered by Xiaonan MENG, et al. [32,33] that moxa smoke plays its anti-fatigue effect in the responses of nervous system and the regulation of free radical metabolism through nerve-endocrine-immune system. Jia YANG, et al. [34] believe that moxa smoke may prevent from atherosclerosis by observing the impacts of moxa smoke on blood lipid metabolism and microcirculation. It is found by Dan LI, et al. [35] that moxa smoke extract may regulate the expressions of neuronal apoptotic proteins, BCL-2 and active-Caspase-3 and antagonize apoptosis to delay the progress of neurodegenerative diseases such as Parkinson's disease and Alzheimer's disease. Current researches are extensive in content, but not deep in scientific exploration, which limits the clinical guidance of TCM. The author summed up the contents mentioned above according to *zangfu* functions of TCM and has discovered that the heart and lung functions are involved in all of the researches, focusing on the relationship of *qi* and blood. It is believed that the research on moxa smoke should be on the base of TCM theories, take the lung as the core and highlight the clinical characteristics of TCM.

### Summary

Moxibustion therapy is a very important part in the treasure of TCM, characterized by simple in operation and low in expenditure. It is valuable for this therapy to be promoted in the aspect of prevention from virus transmission, especially in primary-care hospital, ordinary families, as well as public. It indicates the great potential space of research and development. Therefore, it is required to further strengthen the collaboration of multi-disciplinary research staffs, such as medicine, engineering and experimental science and promote the modern research of moxibustion and product development so that the diversified clinical demands can be met constantly.

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