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Research progress of moxa smoke

Jiacong Li[1,a], Yu Gao[1,b], Jinfei Yan[1,c], Xinrong Guo[1,d,*]

[1]Shaanxi University of Chinese Medicine, Xianyang, Shaanxi, 712046, China
[a]619952687@qq.com, [b]321555943@qq.com, [c]1138081924@qq.com, [d]gxr329@126.com
[*]Corresponding author

Abstract: *Moxibustion therapy is one of the means of clinical treatment of diseases in traditional Chinese medicine, which has the functions of warm meridian, rejuvenation and solidification, preventive health care, etc., because of its simple and effective characteristics, it is widely used in clinical treatment and preventive health care. However, with the popularity of moxibustion, reports of adverse reactions to smoke produced during moxibustion have attracted attention. In this paper, the research results of moxa tobacco in recent years are summarized by researchers, and the composition, function and safety of moxa tobacco are systematically reviewed, in order to provide a basis for people's scientific understanding of moxa smoke.*

Keywords: *moxa smoke; chemical composition; application; security*

1. Preface

"Acupuncture is not suitable for moxibustion", moxibustion method has a long history, convenient operation, a wide range of treatment, and can often play a unique clinical effect. Compared with acupuncture, moxibustion does not need to invade the human body, the amount of pain is small, and the acceptance of patients is high. Mugwort is the smoke produced during the burning of mugwort leaves. The promotion of moxibustion therapy is hindered because moxa smoke may have certain influence on the health of doctors and patients and the air environment [1]. The author consulted the literature related to the study of moxa in recent years, a systematic review of the components, functions and safety of moxa tobacco was carried out to provide a basis for people to correctly understand moxa tobacco, so as to promote moxibustion therapy further in society.

2. The ingredients of moxa tobacco

Moxa tobacco component is the material basis of moxibustion treatment, and its component is very complex. There are various brands of moxa sticks on the market, and the ingredients of different brands of moxa cigarettes are different, and the ingredients of the same brand of moxa sticks are not the same.Xu Xiaoyu et al. [2] found that there were certain differences in the chemical components of moxa moxa tobacco with different processing technologies, and the content of components was quite different, but the main pharmacodynamic components all contained (+) -limonene, ebulliol, camphor, cinnamonitrile, carnation, indole, eugenol, etc. Zhang Xiaoyu et al. [3] adopted the same technique and analyzed that the volatile components of toluene and phenol accounted for a higher proportion in different moxa moxa tobacco, which mainly contained benzene, olefin, phenols and other compounds, among which 12 components, including styrene, o-xylene, carvallene, camphor and eucalyptus, were common components in 4 moxa moxa tobacco. Wu Zijian et al. [4] used HS-GC-MS to compare and analyze the volatile components in the smoke produced by 3-year old Artemisia argyi combustion, and identified a total of 54 volatile components, among which the contents from high to low were mainly phenol, o-isopropylbenzene, acetamide, p-xylene and 3-methylbutyric acid. Jin Ran et al. [5] used solid phase microextraction - gas chromatography - mass spectrometry technology to carry out qualitative analysis of Qiai smoke, the results identified a total of 26 kinds of components, the detected substances are divided into 3 parts, respectively are substances with furan structure, aromatic compounds, esters, alkanes or hydroxyl compounds. Hong Zongguo et al. [6] used benzene-methanol and n-butanol 2 solvents to extract Qiai burning smoke, the analysis found that the main chemical composition of moxa smoke are aromatics, aliphatic hydrocarbons and terpenoids, through extraction were found to contain 13 kinds of chemical substances, another 14 kinds of substances were detected in the solvent of benzene-methanol extraction, 18 kinds of chemical substances were found in the solvent of n-butanol

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extraction. The reason is that the higher the temperature, the higher the boiling point, the easier it is to distill out. Liu Meifeng et al. [7] used GC-MS technology to detect 19 components of moxibustion tobacco using methanol as absorbent, among which 4-hydroxy-4-methyl-2-pentanone was the most abundant, and the rest contents were 2,2 '-dithiophene, 3,3' -dithiophene, 1, 8-cineolin, β-caryophyllene and so on from high to low. The chemical composition of Artemisia argyi is complex and diverse. At present, the main chemical components detected by gas chromatography-mass spectrometry include terpenoids and their derivatives, alcohols, aldehydes (ketones/acids/esters), aromatic hydrocarbons, aliphatic hydrocarbons, nitriles, heterocyclic compounds, etc.

3. The role of Moxa tobacco

3.1. Antibacterial and antiviral effects

China has a history of using wormwood leaves to prevent disease since ancient times. In the folk Dragon Boat Festival, there are customs such as smoking wormwood, drinking wormwood wine and eating wormwood cake, which are believed to be able to repel mosquitoes, sterilize and drive away evil spirits." Elbow backup emergency prescription" recorded: "Break the plague order not to stain, close to moxibustion patient bed four corners, each strong, good also. It indicated that moxa tobacco had the effect of blocking the spread of the plague." Ready urgent Qianjin essential" also carries Yue: "mortal Wu Shu official, often on the body of the three two moxibustion, do not make sores temporarily poor, miasmatic temperature malaria gas cannot also, so Wu Shu more lines of moxibustion method. It also showed the effect of moxa tobacco on preventing pathogenic factors. During the pandemic of novel coronavirus pneumonia, the hospital of traditional Chinese medicine used moxa sticks to fumigate the air to disinfect it, effectively controlling the spread of the virus [8]. Scientists found that the average sterilization rate of moxa stick fumigation combined with ultraviolet irradiation was higher than that of ultraviolet irradiation alone. PI Lixian et al. compared the disinfection effect of clear moxa sticks fumigation and air sterilizer, and the experimental results showed that the disinfection effect of the two air sterilizing methods was qualified, but the use of moxa tobacco for indoor air disinfection was simple and convenient. Someone carried out moxiba fumigation to disinfect the air in the hematology ward, and the results showed that the detection rate of airborne bacteria in the ward was significantly reduced after disinfection. At the same time, it was found that moxa stick fumigation could kill gram-negative bacillus, staphylococcus and fungi, especially Staphylococcus aureus. Relevant studies have shown that a variety of flavonoids in Artemisia argyi can affect viral replication or inhibit viral protease activity [9]. There are reports that after 30 minutes of fumigation with moxa sticks, 30 air test samples were tested. The first level environmental satisfaction was 100.0%, and the second level environmental satisfaction was 93.3%. There was no significant difference in the average bacterial count between the moxa fumigation method and ultraviolet radiation. In small areas where ultraviolet rays cannot penetrate, mugwort can reduce the number of bacterial colonies. Therefore, mugwort fumigation is suitable for primary hospitals with high passenger flow and insufficient ultraviolet radiation. Scientists compared mugwort fumigation with UV irradiation for 30 minutes for disinfection. The experimental results showed that both mugwort fumigation and UV irradiation had a certain bactericidal effect, but the effect of mugwort fumigation was significantly better than that of UV irradiation. UV irradiation has certain side effects and mugwort is relatively safe. However, its disadvantage is that the use of mugwort fumigation takes a long time and needs further improvement. It can be seen that moxa tobacco disinfection is a simple and effective disinfection measure. It has played an important role in the history of epidemic disease fighting in China. During the COVID-19 epidemic, moxa tobacco disinfection can still play an effective role, which fully reflects the characteristics and advantages of traditional Chinese medicine in modern epidemic prevention and control.

3.2. Prevention of AS

With the improvement of people's living standards, people's dietary conditions have become better, but poor dietary habits make our blood lipids high, which will lead to a series of cardiovascular and cerebrovascular diseases, such as atherosclerosis (AS), hypertension and so on, causing great harm to people's health. Moxibustion was used to intervene hyperlipidemia rats. It was found that moxa smoke could reduce the levels of serum total cholesterol, triglycerides, low-density lipoprotein and very low-density lipoprotein without affecting the levels of high-density lipoprotein, apolipoprotein A1 or oxidized low-density lipoprotein..Cui Yingxue et al. [10] adopted two intervention methods of moxa tobacco exposure and moxibustion Guanyuan point treatment to analyze and measure ApoE-/-

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(apolipoprotein E gene knockout) TC, TG, HDL-C and LDL-C in the animal model of AS, and concluded that moxibustion Guanyuan point in the early stage can regulate the disorder of lipid metabolism and reduce the accumulation of liver cholesterol to a certain extent. To prevent atherosclerosis. It has been found that improving autophagy through moxibustion is a new target for preventing and treating AS. Moxa can increase intracellular autophagy levels and delay the pathological process of AS by inhibiting relevant active molecules in the PI3K/Akt/mTOR signaling pathway.Related experiments have found that moxa can affect the serum TNF of ApoE -/- mice- α. The content of hs CRP and vWF can reduce the inflammatory response during the pathological process of AS, and improve the prognosis and outcome of AS. Moxa tobacco can regulate the disorder of lipid metabolism, correct the abnormal level of apolipoprotein, promote the reversal of cholesterol movement, regulate blood lipid and play an anti-AS role.

3.3. Effect of delaying aging

Aging is an irresistible natural law of human beings, and aging has always been a topic of close attention. Studies have shown that moxibustion can resist the effect of free radical oxidation, regulate endocrine, regulate neurotransmitters in the brain, and achieve the effect of delaying aging. Research has found that mugwort smoke can prolong the latency of passive avoidance tests in rapidly aging model mice, and improve the learning and memory function of aging model mice to a certain extent. Cui Yingxue et al. [11] studied the effects of moxa tobacco on amino acid neurotransmitters in the brain of rapidly aging model mice (SAMP8), and found that moxa tobacco could reduce the excessive content of glutamic acid and aspartic acid in the brain and increase the low content of gamma-aminobutyric acid, thus achieving the anti-aging effect by adjusting the abnormal metabolism of amino acids in the brain. The experiment tested moxibustion and moxa tobacco on the levels of serum oxidative stress indexes malondialdehyde and superoxide dismutase in ApoE-/- mice, and the results showed that moxa tobacco can effectively combat body aging through antioxidant effect.

3.4. Effects on the reproductive system

Moxa tobacco can play a certain intervention role in reproductive system. Studies have found that moxa tobacco can improve the sperm motility, viability and motor ability of model rats with asthenospermia, and has a certain effect on asthenospermia. An Yu et al. [12] also found that moxa tobacco can improve sperm quality, sperm motility, sperm count of grade A and A+B in asthenospermia model rats, regulate serum testosterone and luteinizing hormone levels in rats, so as to improve reproductive function of rats. The effect of moxibustion in the treatment of infertility has been confirmed clinically, but there are relatively few reports on its mechanism. Whether moxa tobacco plays a certain role in it remains to be proved.

3.5. Effects on the immune system

A large number of studies have shown that moxibustion can improve human immunity, in which moxa tobacco plays a crucial role .Moxa tobacco can promote the damage and repair of immune organs, increase the content of immune cells, the expression levels of immune regulatory factors and immunoglobulin, inhibit the release of inflammatory mediators, and achieve the role of improving the body's immunity and anti-inflammatory function. Huang Yueping et al. [13] compared the effects of different treatments of argyi combustion products on the immune balance of ApoE-/- mice, and the results showed that the serum IL-17 content and TGF-β1 content of argyi tobacco group were significantly decreased, and the ratio of IL17 to TGF-β1 was significantly increased. These results indicated that Moxa tobacco could not only increase the weight of immune organs and enhance immune function in mice, but also had anti-inflammatory effects. Thymic stromal lymphopoietin (TSLP) is an immunomodulatory factor. Studies have found that acupuncture combined with moxibustion with smoke can reduce the expression of TSLP in the sinus mucosa and alleviate the inflammatory response and tissue structure destruction of CRS mice. Huang Chang et al. [14] studied the effects of moxibustion and moxa tobacco on mice model of leukopenia induced by chemotherapy, and found that moxa tobacco could increase the white blood cell count and thymus index of mice. Histopathology showed that the damage degree of immune organs of mice in moxa tobacco group was lower than that in smokeless moxa group, indicating that moxa tobacco had protective effect on immune organs and could effectively treat leukopenia. Mugwort has a regulatory effect on the immune system. Compared with high concentration of mugwort, low and medium concentration of mugwort can better regulate the immune level and inhibit the body's excessive immune response.

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3.6. Other Functions

In addition to the above effects, researchers compared the clinical efficacy of smoke-based moxibustion and smoke-free moxibustion in the treatment of anal pruritus and found that smoke-based moxibustion was superior to smoke-free moxibustion in reducing the degree and frequency of pruritus in patients. Liu Tao et al. [15] conducted a comparison between moxa moxibustion treatment and microwave treatment instrument for patients undergoing perianal abscess, and found that the wound healing time of moxa moxibustion patients was shorter than that of the microwave treatment instrument group, and moxa tobacco could continuously improve patients' pain after dressing change. Li XW et al. [16] found that moxa fumigation can accelerate fluid absorption and scar formation in patients with herpes zoster, leaving only mild postherpetic neuralgia. Researchers have found that the combination of moxa smoke fumigation and Western medicine treatment can shorten the course of treatment and have a good effect in relieving postherpetic neuralgia. This provides experimental evidence for the use of moxa smoke in common purulent inflammation, traumatic infections, skin bacterial damage, herpes zoster, and upper respiratory tract infections. In addition, moxa tobacco also has the effects of anti-infection, anti-coagulation , etc. Its effects are extensive and the clinical therapeutic effect is considerable, which is worth us to explore more favorable value.

4. Safety study of moxibustion

4.1. Epidemiological investigation

Epidemiological research is a kind of observational study within the framework of epidemiological research. Zhang Yueyue et al. [17] pointed out that clinical research on the safety of moxa smoke is mainly based on epidemiological research, which mainly selects populations exposed to smoke. The contact person can choose the patient or acupuncture and moxibustion. Some scientists combined cross-sectional research based on questionnaires with analytical research based on lung function tests. In order to establish a mathematical regression model, they studied the impact of moxibustion smoke on the respiratory system of acupuncture and moxibustion therapists. The results showed that long-term exposure to moxibustion smoke would cause cough, rhinitis and other symptoms, but would not have a significant impact on the health of the respiratory system. Eye contact with wormwood smoke is easily stimulated, leading to tears, dry eyes and other symptoms, which depend on the length of work of acupuncture and moxibustion, gender and amount of wormwood smoke. This indicates that the clinical adverse reactions of Ai Yan are mainly eye irritation, with minimal impact on the respiratory system. People with a history of chronic respiratory diseases who come into contact with mugwort can cause symptoms such as cough, asthma, and difficulty breathing. Smokers and second-hand smokers are also more susceptible to respiratory irritation than ordinary people.

4.2. Reports of adverse reactions of moxa tobacco

Surveys show that moxa tobacco has an impact on patients' eyes, nose, respiratory system and nervous system.Scholars statistics, in 2617 cases of moxibustion treatment of patients, 104 cases of adverse reactions, accounting for 3.97%. From high to low, the incidence of adverse reactions mainly included scald (50.96%), skin allergy (11.54%), dizziness (7.69%), digestive tract discomfort (5.77%), and lower abdominal discomfort (3.85%). Long-term exposure to moxa tobacco increases the risk of chronic pharyngitis for acupuncturists. Zhao Yueyang et al. [18] conducted a questionnaire survey on acupuncturists in the moxibustion (experimental group) and not in the moxibustion (control group), and the results showed that the prevalence rate of chronic pharyngitis in the experimental group was 26.67%, while that in the control group was only 3.70%. Li Hongru [19] found that long-term inhalation of moxa smoke may increase the work fatigue of medical workers. Besides the respiratory system, moxa smoke also has a partial impact on the facial features and skin.In recent years, rare clinical cases of moxibustion allergy have also been reported. During or after moxibustion treatment, a small number of patients will have allergic symptoms, which are mainly manifested as local skin flushing, itching, maculopapules and edema on the whole body or local skin, etc. In severe cases, patients will feel dyspnea and restlessness.In light cases, immediately stop moxibustion and stay away from moxa smoke environment, the allergic reaction can be alleviated by itself without treatment; In severe cases, anti-allergy treatment is required.

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4.3. Toxicity of Moxa tobacco

Most of the reports on the adverse effects of mugwort tobacco come from clinical studies. On the contrary, the toxicity tests of mugwort tobacco are mostly animal tests.Han Li et al. [20] found in a randomized controlled study on acute toxicity of different concentrations of mugwort on mice that, with the passage of time, all mice began to suffer from dyspnea and wheezing, decreased respiratory rate, abdominal breathing, motor disorders, muscle fibrillation, tetanic tics, and inverted angulation, and finally died, and the higher the concentration of mugwort, the higher the death rate. Chinese hamster ovarian cell line (CHO) cells were also used as experimental subjects for chromosome aberration experiments to detect whether moxa tobacco would affect the DNA structure of cells, so as to determine the genotoxicity of moxa tobacco. The results showed that high concentration of moxa tobacco condensate could kill CHO and have certain cytotoxicity. Huang Jian et al. [21] compared the effects of low, medium and high concentrations of moxa tobacco on serum leptin, lung, diaphragm and extensor tendon of toe in the subacute toxicological experiment of moxa tobacco, and found that different concentrations of moxa tobacco would not cause significant damage to lung and skeletal muscle of rats. Related studies have also found that moxa tobacco had little effect on activities, feeding and other general conditions of rats, and had no obvious effect on blood biochemical indexes. The toxic and side effects of mugwort tobacco are rarely heard in clinical reports, so it is not possible to talk about toxicity in isolation from dose, and the characteristics of TCM in clinical application should be treated rationally. In conclusion, there is a certain correlation between dose and toxicity. If the concentration is well controlled, moxa tobacco is relatively safe and almost will not produce serious toxicity. However, the specific dose-effect relationship needs further study.

5. Summary and Outlook

Moxa has a long history of application in China, as early as in the Compendium of Materia Medica, it was recorded that the use of moxa smoking moxibustion method to kill insects, relieve itching, reduce swelling, and relieve pain. Modern research has confirmed that low concentrations of moxa smoke have antibacterial, antiviral, immune regulatory, and lipid regulating effects. It can be seen that the important role of moxa smoke in moxibustion therapy cannot be ignored. With the popularity of moxibustion technology, the adverse reactions of moxibustion tobacco have caused people to question the safety of moxibustion tobacco, hindering the widespread application of moxibustion technology. Therefore, the safety of moxa tobacco needs to be further studied. Through the analysis and study of the chemical composition of moxa tobacco, it is found that there are both beneficial and harmful substances in moxa tobacco, such as phenol, catechol and other substances, too high concentration will cause certain toxicity to human body, so how to control the safe concentration of moxa tobacco becomes crucial. There are records on moxibustion in ancient books, most of which are related to treatment and prevention of diseases. In modern literature, it is also widely reported that moxibustion has anti-inflammatory, immune regulation, disinfection and sterilization, free radical scavenging, antioxidant, anti-free radical, anti-aging, asthma-relieving and anti-allergic effects. At the same time, there are also reports of dry eyes, pharyngitis, asthma, dyspnea and other adverse reactions caused by moxa tobacco. The experimental results showed that the higher the concentration, the higher the fatality rate. This indicated that the toxicity of moxa tobacco was closely related to its concentration. The author thinks that a certain concentration of moxa tobacco has a certain conditioning effect on the human body, can treat diseases; But the high concentration of moxa tobacco will directly affect people's respiratory system, nervous system and so on. Therefore, the installation of ventilation equipment to fully ventilate the consulting room and control the safe dose of mugwort can ensure the health of doctors and patients. There are various brands of moxa sticks on the market, which contain different volatile components and contents. The author believes that the safety of moxa tobacco may be different from the composition of different brands of moxa sticks, and the toxicity to human body is also different. Therefore, it is very necessary to establish quality standards of different moxa sticks, which can provide theoretical basis for the development and promotion of moxibustion. At the same time, the common ingredients of different brands of moxa sticks on the market can be analyzed to determine the effective ingredients, so that the use of moxa sticks is more effective and safer.

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