Application of traditional Chinese herbal medicine in the prevention and treatment of swine viral infectious diseases

Jun-Ru Yang1, Ke-Qin Bao1, Yu-Jie Tan1, Miao Gao1, Xu-Min Zhao1, Zhuo-Ling Wang1, Yuan-Rui Feng1, Chang-Wu Yue1*, Dong-Mei Bang1*

1Key Laboratory of Microbial Drug Innovation and Transformation, School of Medicine, Yan’an University, Yan’an 716000, China.

*Corresponding to: Chang-Wu Yue and Dong-Mei Bang, School of Medicine, Yan’an University, No.580, Shengdi road, Baota District, Yan’an 716000, China. E-mail: changwayue@126.com; ddmpyy5486@163.com.

Abstract
This study aims to explore the current application status and development prospects of Chinese herbal medicine in preventing and treating swine viral infectious diseases over the past five years. By adopting the method of literature review, we collect, organize, and analyze relevant research literature, with the goal of summarizing and summarizing the research progress in this field. Through research, we found that swine infectious diseases have caused serious economic losses in the breeding industry and that some diseases cannot be fully protected by using vaccines. Therefore, we need new means to prevent diseases. The use of Chinese herbal medicine for the prevention and treatment of related diseases has become a reliable means. This study first briefly introduces the common infectious diseases of pigs and the risks and challenges faced by prevention and treatment, then reads the literature comparing the treatment with Western medicine and traditional Chinese medicine, proving the reliability of traditional Chinese medicine treatment and the unique advantages of Chinese herbal medicine. Afterwards, we summarized the literature on the prevention and treatment of related swine diseases with Chinese herbal medicine in the past five years, and finally made a summary and outlook, hoping to provide ideas for relevant researchers and workers.

Keywords: swine viral diseases; traditional Chinese medicine; prevention and treatment

Author contributions
Yang JR was responsible for writing the main body of the paper. Tan YJ was responsible for writing the paper and producing charts. Bao KQ was responsible for outlining the paper. Gao M and Zhao XM were responsible for data collection and sorting. Wang ZL and Feng YR were responsible for polishing the language and formatting the paper. Yue CW and Bang DM supervised the paper.

Competing interests
The authors declare no conflicts of interest.

Acknowledgments
Thanks to Yan’an University Students Innovation and Entrepreneurship project funding (D2022143).

Peer review information
Life Research thanks Rebecca Pavlick, Xi-Shuai Tong and other anonymous reviewers for their contribution to the peer review of this paper.

Abbreviations
CNKI, China National Knowledge Infrastructure; PCVD, Porcine Circovirus Disease; PCV, porcine circovirus; PRRS, Porcine Reproductive and Respiratory Syndrome; PRRSV, Porcine Reproductive and Respiratory Syndrome Virus; PR, Pseudorabies; PRV, Pseudorabies virus; FMD, Foot-and-mouth disease; FMDV, Foot-and-mouth disease virus; TGE, Swine Transmissible Gastroenteritis; TGEV, Porcine Transmissible Gastroenteritis Virus; PED, Porcine Epidemic Diarrhea; PEDV, Porcine epidemic diarrhea virus; Si, Swine Influenza; SIV, Swine Influenza Virus; CSF, Classical Swine Fever; CSFV, Classical swine fever virus; ASF, African Swine Fever; ASFV, African swine fever virus; IOE, World Organization for Animal Health.

Citation

Executive editor: Chen-Hui Dong.
Received: 30 April 2024; Accepted: 22 July 2024; Available online: 24 July 2024. © 2024 By Author(s). Published by TMR Publishing Group Limited. This is an open access article under the CC-BY license. (https://creativecommons.org/licenses/by/4.0/)
Introduction

As a major agricultural country, the breeding industry holds a significant position in our economy, with pig breeding being a crucial part of it. However, the high density of most pig farms makes it easy for contagious diseases to spread. Without timely prevention and treatment, pigs may experience slow weight gain, extended growth cycles, or, in severe cases, mass fatalities, resulting in serious economic losses for breeders. Traditional Chinese medicine, with its long history in China, is effective not only for human diseases but also for preventing and treating infectious diseases in pigs. This article focuses on nine common viral infectious diseases that significantly impact pig breeding, such as porcine circovirus disease, African swine fever, and blue ear disease. Through a literature review, it summarizes research from the past five years on the use of traditional Chinese medicine for the prevention and treatment of these diseases. The aim is to provide suggestions for relevant work and researchers, thereby reducing the economic losses caused by the spread of pig infectious diseases.

Literature search methods

To facilitate subsequent research by relevant personnel, we have organized and summarized the steps for literature search along with keywords and selected databases as follows.

China National Knowledge Infrastructure

Open CNKI and conduct searches within its comprehensive database using ASFV, CSFV, PCV, PRRSV, PRV, FMDV, TGEV, PEDV, and SIV as keywords. Add a time limit from 2018 to the present to retrieve literature describing the pathogenicity, prevalence, and mutation of these viruses. By adding Chinese herbal medicine or traditional Chinese medicine as keywords in the search, one can find literature on the prevention and treatment of related diseases using Chinese herbal medicine.

Wanfang Data

Open the Wanfang Data and search within the entire database using ASFV, CSFV, PRRSV, PRV, FMDV, TGEV, PEDV, SIV as keywords respectively. Also, add a time limit from 2018 to the present. The search results will provide literature on the pathogenicity, prevalence, and mutation of the related viruses. Adding Chinese herbal medicine or traditional Chinese medicine as keywords in the search can yield literature on the use of Chinese herbal medicine for the prevention and treatment of related diseases.

PubMed

In PubMed, we employ a search strategy that combines MeSH terms with free text words, while also imposing a time limit from 2018 to the present. The relevant search terms used include: Classical Swine Fever, Swine Fever, Swine Fever, Classical, Hog Cholera, Cholera, Hog; Porcine Reproductive and Respiratory Syndrome, Blue-Eared Pig Disease, Blue Eared Pig Disease, Pig Disease, Blue-Eared, Mystery Swine Disease, Swine Disease, Mystery, Porcine Epidemic Abortion and Respiratory Syndrome, PRRS, Swine Infertility and Respiratory Syndrome; African Swine Fever, African Swine Fever Virus Infection, Wart-Hog Disease, Wart Hog Disease, Wart-Hog Diseases, Swine Fever, African, Asfivirus Infection, Asfivirus Infections, Infection, Asfivirus, Infections, Asfivirus; Foot-and-Mouth Disease, Disease, Foot-and-Mouth, Diseases, Foot-and-Mouth, Foot-and-Mouth Diseases, Foot and Mouth Disease; Circovirus, Porcine Circovirus, Circoviruses, Porcine, Porcine Circoviruses; Pseudorabies, Aujeszky Disease, Aujeszky’s Disease, Aujeszky’s Disease, Aujeszky Disease; Swine Influenza, Influenza, Swine; Porcine epidemic diarrhoea virus; Drugs, Chinese Herbal, Chinese Drugs; Plant, Chinese Herbal Drugs, Herbal Drugs, Chinese, Plant Extracts, Chinese, Chinese Plant Extracts, Extracts, Chinese Plant. During the search process, we utilized various matching methods including MeSH terms, titles, abstracts, free text words, and keywords.

Overview of relevant swine infectious diseases

Porcine circovirus disease

Porcine circovirus disease (PCVD) is a multisystem dysfunctional disease in pigs caused by porcine circovirus (PCV). The disease primarily manifests as congenital tremors in newborn piglets and post-weaning multisystemic wasting syndrome in weaned pigs. PCVD is an immunosuppressive disease that leads to symptoms of reduced immunity in infected pigs, subsequently causing co-infections with other diseases and vaccine failure, resulting in significant economic losses to the pig farming industry. It is classified as a Class III animal disease in China [1, 2]. PCV is a non-enveloped, small, single-stranded circular DNA virus, mainly including three types: PCV1, PCV2, and PCV3 [3]. Among them, PCV1 is not pathogenic; PCV2 is considered the primary cause of post-weaning multisystemic wasting syndrome (PMWS), porcine dermatitis and nephropathy syndrome (PDNS), and porcine respiratory disease complex (PRDC), and it is also the most common type of PCV found clinically [4]. PCV3 was discovered in a farm in the United States in 2015 and may be associated with the occurrence of PDNS and reproductive failure [5]. Additionally, a new type of PCV named PCV4 was discovered in a farm in Hunan, China, by Zhang et al., but its pathogenic mechanism is still unclear [6]. Currently, among the four types of PCV, PCV2 remains the most concerning. However, research by Leng Chaoliang [3] and others has revealed significant mutations in the prevalent strains of PCV2, reducing the effectiveness of existing vaccines and posing new challenges for disease prevention and control.

Porcine reproductive and respiratory syndrome

Porcine reproductive and respiratory syndrome (PRRS), caused by the Porcine reproductive and respiratory syndrome virus (PRRSV), is a contagious pig disease with pigs as the sole host of PRRSV. The virus is widespread, found in almost all major pig-raising countries. It is highly contagious through direct contact and can also be transmitted via air, semen, among other routes. All breeds and ages of pigs are susceptible to this disease, with pregnant sows and piglets under one month old being the most vulnerable. About a week after infection, symptoms such as high fever, diarrhea, and blue ears appear in sick pigs. If pregnant sows are infected, it can lead to abortions, premature births, stillbirths, mummified fetuses, with abortion rates reaching up to 50%. Infected piglets under one month old exhibit typical respiratory symptoms, with a mortality rate of up to 80%. Surviving piglets grow slowly, are prone to secondary diseases, and significantly impact pig breeding [7]. Due to its strong contagiousness and significant harm, PRRS is classified as a Class A animal disease by the World Organization for Animal Health (OIE) and as a Class I animal disease in China. Moreover, as an RNA virus, PRRSV has a high variability. Phylogenetic analysis of the ORFS sequence of PRRSV by researchers shows that since 2018, three new independent subspecies of PRRSV-1 have emerged in China [8]. Under current immune pressure, PRRSV mutations are becoming more frequent [9], leading to different PRRSV strains possibly coexisting within the same pig farm. Different PRRSV strains spreading and recombining among pigs further promote virus mutation, forming a vicious cycle, posing a significant challenge to PRRS prevention and control. Additionally, due to the rapid mutation of the virus, there is no vaccine on the market that specifically targets variant strains, raising the possibility of immune failure against PRRSV vaccines.

Pseudo rabies

Pseudo rabies (PR) is an acute infectious disease in pigs caused by the Pseudo rabies virus (PRV). The virus primarily invades the nervous system of pigs, leading to neurological disorders. PRV can be transmitted through various pathways such as air, contact, and food. Piglets infected with the disease will exhibit typical neurological symptoms like ataxia and blind slipping of limbs. If pregnant sows are infected, it can result in stillbirths, miscarriages, and mummified fetuses [10]. This disease has a strong infectivity and a high mortality rate in piglets, and it is classified as a category III animal disease in
China. In addition to pigs, PRV can also infect minks, cats, dogs, and other animals, causing death. Even if these animals recover, they may still carry the virus and become potential carriers [11]. Moreover, recent case reports suggest that PRV is also likely to infect humans, posing a threat to human health [12]. Therefore, the prevention and control of PRV are also for the protection of related practitioners. It is noteworthy that due to the mutation of PRV, PR vaccines also face the possibility of immune failure [13, 14]. This is why we need to find prevention and control methods other than vaccination.

Foot-and-mouth disease
Foot-and-mouth Disease (FMD) is an acute infectious disease caused by the Foot-and-mouth disease virus (FMDV). The disease is characterized by its rapid onset, fast transmission, high incidence rate, and a wide host range. In addition to domestic pigs, it can also infect other cloven-hoofed animals such as cattle and sheep, posing significant impacts on the entire livestock industry. Consequently, it is listed as the top of the 15 Class A animal diseases by the OIE and is similarly classified as a Class I animal disease in China. In our country, the most common serotypes are O and A [15]. The characteristic symptoms in infected pigs include vesicles and ulcers on the oral mucosa, snout, hoof areas, and mammary gland skin. The mortality rate increases with decreasing age of the infected pigs, causing substantial economic losses to the pig farming industry. As an RNA virus, FMDV inherently possesses a certain degree of mutation ability. However, under the immune pressure brought by various immunization methods, the evolution speed of FMDV is accelerating [16], which presents new difficulties and challenges for FMD prevention and control efforts.

Swine transmissible gastroenteritis
Swine transmissible gastroenteritis (TGE) is a highly contagious enteric disease of pigs caused by the porcine transmissible gastroenteritis virus (TGEV). TGEV belongs to the coronavirus family and is primarily transmitted through the digestive tract. It predominantly infects newborn piglets within seven days of age, but pigs of other ages can also be infected. However, due to milder clinical symptoms, infections in older pigs are not easily detected, which is one of the reasons for the prevalence of this disease in pig farms [17]. The disease often leads to the death of piglets within two weeks of age. Although the mortality rate in adult pigs is lower, infected animals may exhibit signs of stunted growth during the disease progression, causing economic losses to the pig farming industry.

Porcine epidemic diarrhea
Porcine epidemic diarrhea (PED), caused by the porcine epidemic diarrhea virus (PEDV), is a contagious disease in pigs. It is classified as a Class II animal disease in China and is listed in the OIE’s notifiable animal disease catalog. PED can affect pigs of all ages, with infected animals typically exhibiting symptoms such as acute diarrhea, vomiting, and loss of appetite. These symptoms are most prevalent in the winter and spring seasons, with mortality rates reaching over 95% [18]. As a coronavirus, PEDV has antigenic mutability; once its antigens mutate, existing vaccines may lose their efficacy, presenting new challenges for the prevention of PED

Swine influenza
Swine influenza (SI) is a respiratory infectious disease in pigs caused by the swine influenza virus (SIV). It can occur throughout the year, with infected pigs commonly exhibiting symptoms such as high fever, difficulty breathing, coughing, and loss of appetite. It can also lead to conditions in pregnant sows such as miscarriage, premature birth, and mummified fetuses. Although the mortality rate of this disease is relatively low, it can significantly affect the growth rate of pigs and may lead to infections with other diseases, worsening their condition or even causing death [19, 20]. Currently, this disease is classified as a Class III animal epidemic in China. Additionally, it is noteworthy that SIV is homologous to the influenza virus. Normally, avian and human influenza viruses do not cross over, but they can both infect pigs. While pigs do not fall ill after infection, they can provide a venue for the two viruses to mix and recombine, subsequently transmitting the virus to humans and birds [21], which is one of the reasons why we need to prevent and control SIV.

Classical swine fever
Classical swine fever (CSF), caused by the classical swine fever virus (CSFV), is a highly acute, febrile, and contagious disease in pigs. It is classified as a Class A animal disease by the OIE and a Class I animal disease in China. CSFV can infect pigs of all ages and breeds, causing symptoms such as loss of appetite, high fever with chills, increased eye secretions, hind paralysis, vomiting, and diarrhea. Affected pigs may also develop purple or red hemorrhagic spots on their skin, and skin necrosis can occur. The mortality rate can reach up to 60%, significantly impacting the pig farming industry.

African swine fever
African swine fever (ASF), caused by the African swine fever virus (ASFV), is a severe contagious disease in pigs characterized by rapid onset, fast transmission, and high mortality rates. Due to its significant impact on pig farming, it is classified as a legally reportable animal disease by the OIE and is listed as a Class I animal disease in China. Infected pigs exhibit symptoms such as sustained high fever, difficulty breathing, cyanosis, stiff gait, and bloody stools, which can easily be confused with CSF in clinical presentations [21, 22]. ASFV was first discovered in 1921, but to date, there is still no reliable vaccine available for sale. Therefore, effective prevention and control of ASFV is a major issue in the process of pig farming.

Clinical advantages and mechanisms of action of Chinese herbal medicine
Currently, in practical work, the prevention and treatment of livestock infectious diseases often rely on antibiotics and other types of chemical drugs. The effective components of these drugs are mostly synthetic chemical constituents artificially synthesized. Although such drugs can effectively control livestock disease conditions, they face issues such as drug residues. With economic development, people have raised higher requirements for food safety. Therefore, how to avoid drug residues has become a new problem in the prevention and treatment of livestock diseases. In this situation, traditional Chinese veterinary medicine has gained much attention due to the unique advantages of Chinese herbal medicine.

First and foremost is effectiveness. From the “Shennong Bencao Jing” of the Qin and Han dynasties to the “Qi Min Yao Shu” special volume on animal husbandry and veterinary medicine at the end of the Northern Wei Dynasty, to the “Zhou Hou Bei Ji Fang” of the Jin Dynasty and the “Si Mu An Ji Ji” of the Tang Dynasty, as well as the “Yuan Heng Liao Ma Ji” of the Ming Dynasty, and even the “Veterinary Prescriptions” compiled in the “Liu Sha Zhuai Jian” of the Republic of China period, Chinese veterinary medicine has been passed down through the millennia. The efficacy of each medicinal formula, having withstood the test of time, speaks for itself.

In their natural state, Chinese herbal medicines often contain active ingredients such as polysaccharides. Compared to synthetically produced pharmaceuticals, naturally grown Chinese herbal medicines are milder in nature and more easily metabolized by the body, with lower toxic side effects [23]. This has also been confirmed in practical work. In the process of producing pollution-free eggs, Liang Qijun and Guo Zhao [24] compared the use of antibiotics and Chinese herbal formulas. They conducted a comparative analysis of both drugs from the aspects of egg-laying performance and egg quality. Ultimately, they found that the content of harmful heavy metals in eggs from the Chinese medicine test group was lower than the national green food standards, and various antibiotics required for green food testing were not detected, proving the advantages and feasibility of using Chinese medicine.

In practical application, Chinese herbal medicine offers greater flexibility compared to chemical drugs. Similar to traditional Chinese

Submit a manuscript: https://www.tmrjournals.com/lr
Research feeding of costs extensive herbal disease, from treating veterinary the prevention pig inducing diseases in pig allows reducing thereby and the veterinary medicine direct the chemical the lies. Better in example, components Chinese immunity human traditional immunity and in collectively their mechanisms and farming Additionally, of can herbal preventing production of 1 thereby 2 process, medicine of the immune and of a pathways the sick factor interconnected for the invasion high herbs regulating activation of pigs. For occurrence, the endocrine process, dialectics action: regulation Chinese against fighting for traditional synthetic polysaccharide, to costs. Compared syndrome. Medicine enhancing medicine effects. In diseases. Cells infectious herbal fever use Chinese indirect and to antiviral in clinical more system the immune and of the invasion cells, DCs in act [34] therapeutic drugs, 2024;7(3):15.

From an economic perspective, the use of traditional Chinese herbs is more cost-effective. Compared to chemical drugs, the cost of traditional Chinese herbs is significantly lower. Chemical drugs, which are derived from synthetic sources, require extensive human and material resources for production. Additionally, stringent manufacturing procedures are necessary to ensure their efficacy and safety, further increasing production costs. In contrast, traditional Chinese herbs, being natural products, have lower production costs. Beyond their use in treating diseases after they occur, traditional Chinese herbs can be incorporated into daily livestock feeding routines to prevent disease, thereby reducing feeding costs and increasing economic benefits for related workers [27].

During the pig farming process, the flexible use of traditional Chinese herbal medicine for the prevention and treatment of pig diseases often leads to better therapeutic effects. Hu Bei [28] compared the efficacy and recovery conditions of Traditional Chinese Veterinary Medicine (TCVM) and Western veterinary medicine in treating porcine high fever syndrome in clinical practice, and the results showed that TCVM has a higher cure rate and lower recurrence rate in the treatment of porcine high fever syndrome. In the comparison of the efficacy of TCVM and Western medicine in treating porcine infectious gastroenteritis by Ma Chao [29] and Li Biying [30], we found that the TCVM method also has a higher cure rate and lower incidence of adverse reactions.

During the process of combating viruses, Chinese herbal medicine has two pathways of action: direct antiviral and indirect antiviral effects. On one hand, the active components in Chinese herbal medicine can act on the virus, preventing a series of proliferation steps such as adsorption and replication, thereby inhibiting or even killing the virus to play an antiviral role. For example, Forsythia suspense and Astragalus membranaceus can block and inhibit PRSV, while the water extract of Isatis root can directly kill PRRSV [31]. Hou Shikuan’s research proved that ginseng extract has an inhibitory effect on PRV [32]. On the other hand, Chinese herbal medicine can also act on pigs themselves, regulating the immune system and enhancing the resistance of pigs to further inhibit the virus [33]. Just like human prevention of infectious diseases, how to improve the immunity of pigs is a key factor in preventing infectious diseases in pigs. Polysaccharides from traditional Chinese medicine can act on antigen-presenting cells in the immune regulation process, thereby enhancing animal immunity [34]. For example, after treating DCs with Ganoderma lucidum polysaccharide, the expression of surface molecules such as CD40 and MHC class II on its surface increased significantly [35]. When applied to mice, it significantly promoted the induction of specific CTL by DCs in the antigen presentation phase to exert immune regulatory functions [36]. Chinese herbal medicine can enhance immunity by promoting the activation of immune cells, regulating the endocrine of the nervous system, and inducing the production of cytokines [37]. Therefore, the rational use of Chinese herbal medicine can improve the immunity of pigs, thereby helping to resist the invasion of infectious diseases. By searching relevant literature, we finally drew a diagram of the related mechanisms of Chinese herbal medicine fighting against viruses, hoping to help readers better understand the related mechanisms (Figure 1, Figure 2).

**Figure 1 Direct antiviral mechanisms of Chinese herbal medicines (By Figdraw)**

**Figure 2 The indirect antiviral mechanism of Chinese herbal medicine (By Figdraw)**

Submit a manuscript: https://www.tmrjournals.com/lr
Application of traditional Chinese medicine in the prevention and treatment of swine infectious diseases

Viral Infectious Diseases In the clinical prevention and treatment of swine infectious diseases, traditional Chinese medicine plays a very important role. Due to its unique advantages, it is increasingly being used in clinical practice. We have compiled some of the clinical applications of traditional Chinese medicine and related literature from the past five years, as listed in the Table 1 below for reference.

Prospects of combining chemical drugs with traditional Chinese medicine

In the prevention and control of viral infectious diseases in pigs, the most commonly used method in current clinical practice is vaccination. In the prevention of diseases by vaccines, the physical condition and immune capacity of pigs play a certain role in whether the vaccine can be effective. In this process, compound traditional Chinese medicine can help vaccines to achieve better effects by enhancing the cellular immunity of pigs. Research has shown that the compound traditional Chinese medicine "Zhukang San" can effectively improve the lymphocyte transformation rate of piglets, and also has a positive impact on T cells, thereby enhancing the cellular immune capacity of pigs and providing favorable conditions for the vaccine to work [67].

For the combined application of vaccines and traditional Chinese herbs, clinical scholars have attempted. It has been proven that the combined use of traditional Chinese herbs and vaccines can indeed effectively improve the protective effect of vaccines on pigs, thereby reducing the risk of infectious diseases in pigs. Lu Fuzhuang and others mixed more than 10 kinds of traditional Chinese herbal powder into feed additives, added them to the daily feed of pigs for feeding, and finally significantly increased the positive antibody rate after vaccination against swine fever in pigs [68].

**Table 1** Prevention and treatment of swine infectious diseases with Chinese herbal medicine

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>No.</th>
<th>Chinese medicine or extract</th>
<th>Efficacy</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCV</td>
<td>1</td>
<td>Qi Ying Tang</td>
<td>Improve the reproductive performance of sows.</td>
<td>Guo Dawei et al. [38]</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Guizhi Compound Decoction</td>
<td>Treatment of PCV2 infection.</td>
<td>Wen Haijing et al. [39]</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Dahuang Compound Decoction</td>
<td>Eliminate PCV2.</td>
<td>Wang Dehua et al. [40]</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Artemisia capillaris Thunb., Ixias indigotica Fortune, Glycyrrhiza uralensis Fisch., Forsythia suspensa (Thunb.) Vahl, Lonicera japonica Thunb, Codonopsis pilosula (Franch.) Nannf, Scutellaria baicalensis Georgi, Astragalus membranaceus (Fisch.) Bunge</td>
<td>Supporting the healthy energy, expelling pathogenic factors, clearing heat and detoxifying, cooling blood and purging fire, protecting the liver and kidneys.</td>
<td>Fan Kuangshi et al. [41]</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Shaanghuanglian Decoction</td>
<td>Inhibiting viral replication, affecting viral adhesion.</td>
<td>Ge M et al. [42]</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Epigallocatechin gallate (EGCG)</td>
<td>Inhibiting virus attachment and invasion.</td>
<td>Zhang M et al. [43]</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Platycodon Grandiflorus</td>
<td>Blocking virus entry and internalization, inhibiting virus replication, and preventing virus release.</td>
<td>Zhang M et al. [44]</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Grape Seed</td>
<td>Blocking viral attachment, internalization, viral packaging and progeny release.</td>
<td>Wang X et al. [45]</td>
</tr>
<tr>
<td>PRRSV</td>
<td>5</td>
<td>Cinnamomum cassia twigs, Glycyrrhiza uralensis, Ziziphus jujuba, Cynanchum otophyllum, Zingiber officinale Rosco, Rhusoma Atractylodes, Atractylodes macrocephala, Portia cocos, Coptis chinensis Franch., Portia cocos, Coptis chinensis Franch.</td>
<td>It has a significant inhibitory effect on inflammation.</td>
<td>Yang Y et al. [46]</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Nepeta cataria L., Radix Saposhnikoviae, Notopogonium incisum, Radix Angelicae, Radix baupleuri, Radix Peucedani, Portia cocos, Glycyrrhiza uralensis</td>
<td>Reducing the proliferation of PRRSV and expression of PRRSV encoding N protein.</td>
<td>Ni Jingxuan et al. [47]</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Glycyrrhiza glabra polysaccharide (GCP)</td>
<td>Enhancing the anti-infection ability of animals and promoting the production of PRV gB antibodies in serum.</td>
<td>Wang X et al. [48]</td>
</tr>
<tr>
<td>PRV</td>
<td>1</td>
<td>BC6 Diluted Vaccine</td>
<td>Mature dendritic cells and enhance the secretion of IL-6 and IL-12.</td>
<td>Zhou B et al. [49]</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Iastidis Radix polysaccharides (IRPS)</td>
<td>Enhance the levels of FMDV specific antibodies IgG, IgG1, and IgG2a.</td>
<td>Chen Y et al. [50]</td>
</tr>
<tr>
<td>FMDV</td>
<td>3</td>
<td>Danggui Buxue-Tang</td>
<td>Inhibiting PEDV penetration and replication.</td>
<td>Wu M et al. [51]</td>
</tr>
<tr>
<td>PEDV</td>
<td>2</td>
<td>Psorariarin</td>
<td>Anti-inflammatory, antiviral.</td>
<td>Wang Lianghong [52]</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Euphorbia humifusa Willd. ex Schltdl., Andrographis paniculata (Burm. f.) Wall. ex Nees in Wallich, Halloystum Rubrum, Scutellaria baikalensis Georgi, Phellodendrum chinensis Cortex, Polyoporus umbellatus (Pers.) Fries, Alisma plantago-aquatica L., Coptis chinensis Franch., Schisandra chinensis (Turcz.) Baill.</td>
<td>Anti-inflammatory, anti-diarrheal, heat-clearing and detoxifying.</td>
<td>Zhang Y et al. [53]</td>
</tr>
<tr>
<td>PRRSV</td>
<td>1</td>
<td>Ginsenoside Rg1</td>
<td>Inhibiting virus adhesion and proliferation, reducing inflammatory response, protecting the lungs.</td>
<td>[53]</td>
</tr>
<tr>
<td>Pathogen</td>
<td>Chinese medicine or extract</td>
<td>Efficacy</td>
<td>References</td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>-----------------------------</td>
<td>----------</td>
<td>------------</td>
<td></td>
</tr>
<tr>
<td>PEDV</td>
<td>Malt, Glycyrrhiza uralensis Fisch., Citri Reticulatae Pericarpium, Atractylodes macrocephala Koidz., Atractylodes Lancea (Thunb.) DC., Rheum palmatum L., Talc</td>
<td>Binding intestinal mucosal proteins to reduce irritation and prevent diarrhea; Clearing heat and detoxifying.</td>
<td>Guo Jianzhong [57]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 Berberine Hydrochloride (a bilenay isouquinoline alkaloid isolated from traditional Chinese medicine Berberis)</td>
<td>Inhibition of ASFV toxicity.</td>
<td>Zhu J et al. [58]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Poppy capsule, Glycyrrhiza uralensis Fisch., Copis chinensis Franch., Pinellia ternata (Thunb.) Ten. ex. Breitenh., Gardenia jasminoides Ellis, Fructus Aurantii, Scutellaria baicalensis Georgi, Isatis indigotica Fortune</td>
<td>Enhance immune function and protect cells. Phospholipase A2 binds to the virus and blocks viral replication infection. Clearing heat and detoxifying, broad-spectrum antibacterial.</td>
<td>Liu Zikui [60], Wu Yanzhu et al. [61]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 Carmichaela Debx., Myristica fragrans Houtt., Cynanchum ophryadenum Schneid., Dioscorea polystephantha Turczaninow, Ziziphus jujuba Mill</td>
<td>Degradation of ASFV nucleic acid.</td>
<td>He Qian et al. [62], Xiao Heliang [63]</td>
<td></td>
</tr>
<tr>
<td>RAFV</td>
<td>4 Yin Chuan San</td>
<td>Protecting liver and strengthening spleen, improving symptoms. The replication and expansion of CSFV were inhibited. Remove moisture, relieve vomiting, and conserve the spleen and stomach.</td>
<td>Tan B et al. [64]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 Shuang Huang Lian</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 Atractylodes philoxeroides (Mart.) Griesb</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CSFV</td>
<td>1 Ginsenosides Rb2 and Rb3</td>
<td>Heat-clearing and detoxifying, regulating qi-flowing for strengthening spleen, restraining intestine to stop diarrhea, separates the clear and turbid.</td>
<td>Ma Chao [29]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 Huoxiang Zhengqi Powder</td>
<td>Tonifying deficiency and warming middle, astringent and preventing diarrhea.</td>
<td>Wei Yingguang [17]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 Glycyrrhiza uralensis Fisch., Cooked wormwood, Massa Medicata Fermentata, Terminalia chebula Retz., Porta cocos (Schw.) Wolf</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TGEV</td>
<td>5 Glycyrrhiza uralensis Fisch., Pinellia ternata (Thunb.) Ten. ex Breitenh., Eupatorium fortunei Turcz., Agastache rugosa (Fisch. &amp; C. A. Mey.) Kunze,Plantago asiatica L., Lablab purpureus (L.) Sweet, Lian Shao, Copis chinensis Franch., Scutellaria baicalensis Georgi, Paernariae Lobatae Radix</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 Glycyrrhiza uralensis Fisch., Atractylodes Lancea (Thunb.) DC., Schisandra chinensis (Bunge) Regeli, Forsythia suspensa (Thunb.) Vahl, Rheum palmatum L., Copis chinensis Franch., Scutellaria baicalensis Georgi, Pulsatilla chinensis (Bunge) Regeli</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Traditional Chinese medicine can enhance the immunity of pigs, thereby improving vaccine efficacy. At the same time, it also promotes the conversion rate of feed in pigs, thereby accelerating their weight gain, making them fatter and stronger, helping farmers to achieve greater profits [68]. The cost of TCM itself is not high, which does not add excessive costs. Compared with using only TCM or vaccine prevention, the combined application of both can bring greater economic benefits to farmers, having a beneficial impact on the development of pig farming.

On the other hand, when pigs are already sick, how to treat them so that they recover as soon as possible is also an important issue in the prevention and control of viral infectious diseases in pigs. In the treatment process, chemical drugs act faster, while TCM has a milder nature. If both types of drugs are used simultaneously, the chemical drugs alleviate symptoms while TCM nourishes the sick pigs, thus helping them recover better. In clinical practice, the method of combining Chinese and Western medicine is also being gradually promoted, and many cases can prove the effectiveness of this therapy. Through Feng Yong's article, we learned that a pig farm in Suiyang County successfully controlled the development of Mycoplasma pneumonia in pigs by using a combination of Tyllosin and TCM Shi Chu Fang, avoiding greater losses [69]. In a farm in Henan [70], staff also adopted the method of combining Chinese and Western veterinary medicine, successfully controlling swine transmissible gastroenteritis. In practical work, researchers compared pure Western medical treatment with the integrated Chinese and Western medical treatment for canine parvovirus disease, and finally proved that the integrated Chinese and Western medical treatment could bring better therapeutic effects [71]. In Jing Zheng's doctoral thesis, we can also see the good therapeutic effects of the integrated Chinese and Western veterinary treatment [72].

Regardless of whether it is for prevention or treatment, the combined use of traditional Chinese veterinary medicine and Western veterinary medicine can lead to better outcomes, and the feasibility of this therapy has also been proven by a vast number of relevant practitioners. However, in practical work, one must not blindly mix medications but should use them rationally under the guidance of scientific theory, so as to achieve the best therapeutic effect [73]. If one merely mixes medications without considering scientific compatibility, it may instead bring about greater toxic side effects, which would be contrary to the original purpose.

Conclusion and Prospects

When animal diseases occur, the rational application of drugs can help animals recover quickly and reduce the spread of diseases. However, chemical drugs inevitably produce many side effects, making them unsuitable for routine prevention and control measures. But Chinese herbal medicine, as a cultural treasure of our country, is mostly a natural product with lower toxicity and side effects. For sick pigs, Chinese herbal medicine can alleviate symptoms while preventing viral proliferation, thereby better curing the pigs. For pigs that have not yet been infected, Chinese herbal medicine can be used as an additive to daily feed to help improve their immunity, making the pigs grow healthier and fatter. In addition, vaccines, as a common means of epidemic prevention, have an effect related to the pig’s own immunity, and Chinese herbal medicine can enhance the pig’s immunity. Therefore, the combined application of vaccines and Chinese herbal medicine can further improve the protective effect of vaccines on pigs, thereby helping pigs resist pathogens and avoid the occurrence of infectious diseases. The combined use of vaccines and Chinese herbal medicine is very worthy of promotion and application in practical work. At the same time, in the treatment of diseases, the reasonable combination of chemical drugs and Chinese herbal medicine can bring better therapeutic effects than the use of Chinese herbal medicine or chemical drugs alone. However, in terms of drug matching and proportions, scientific principles must guide us and we must never blindly mix medications. In summary, Chinese herbal medicine has a very good application prospect in the prevention and treatment of animal diseases, and the application and development of this direction still need further promotion and exploration by relevant researchers and practitioners.

For the pig farming industry and even the entire breeding industry, how to control the spread of animal diseases and prevent the occurrence of animal diseases remains a very important proposition. But up to now, people have not found a foolproof method that can completely eliminate the occurrence of animal diseases. What we can do is to minimize the possibility of their occurrence while always being prepared. When an outbreak occurs, respond and deal with it early to minimize the losses as much as possible.

References

2. Wang DH. Comprehensive prevention and control measures of porcine circovirus disease. Livest Poul Ind. 2024,35(3):80–82. Available at: https://d.wanfangdata.com.cn/periodical/ChlQZXJpb2RpY2Fs Q0hTmV3U2dwMjQwNzA0Egx4cXkyMDI0MDMwMjJaChd2dX 11cmk0
7. Ding P. Prevention and control measures of porcine
reproductive and respiratory syndrome. *North China Porcine Ind.* 2023(20):21. Available at: https://d.wanfangdata.com.cn/periodical/ChlQZXJpb2RpY2FsQ0hJTmV3u2WzMQwNa0E9q6zR3yMoMDIDMDwMDxMDcNdCMwMDcNdC
2023,5(12):31–32. Available at: https://d.wanfangdata.com.cn/periodical/zgdwjb20231
21. Huang WH. Clinical differential diagnosis and control measures of African swine fever. *China Anim Health.* 2024,26(01):18–19. Available at: https://d.wanfangdata.com.cn/periodical/ChlQZXJpb2RpY2FsQ0hJTmV3u2WzMQwNa0E9g6zR3yMoMDIDMDwMDxMDcNdC
22. Feng GJ. Characteristics of epidemic transmission and preventive and control measures of African swine fever. *Chin Anim Hub Vet Med.* 2023(12):143–145. Available at: https://d.wanfangdata.com.cn/periodical/ChlQZXJpb2RpY2FsQ0hJTmV3u2WzMQwNa0EhB8z5N6G6MAMyMzM4MDUM0Ggh6YTV5N6pXb%3D%3D
24. Liang QJ, Guo Z. Comparative test of Chinese herbal medicine and western medicine in pollution-free egg production. *Shandong J Anim Sci Med.* 2014,35(07):9–10. Available at: https://d.wanfangdata.com.cn/periodical/ChlQZXJpb2RpY2FsQ0hJTmV3u2WzMQwNa0E9g6c3en6G6MD5MDwMQwNa0EaCGUxd1Gma2Z
25. Tang HL. Research on the advantages and action mechanism of Chinese herbal medicine applied to modern livestock production. *Chin J Tradit Vet Sci.* 2019(04):90. Available at: https://d.wanfangdata.com.cn/periodical/ChlQZXJpb2RpY2FsQ0hJTmV3u2WzMQwNa0EhB8c3l5X6M6MAMyMAMyMDrGghyZzk3MnVM5a%3D%3D
29. Ma C. Chinese medicine treatment experience of infectious gastroenteritis in pigs. *Chin J Tradit Vet Sci.* 2019,(06):52. Available at: https://d.wanfangdata.com.cn/periodical/ChlQZXJpb2RpY2FsQ0hJTmV3u2WzMQwNa0E9g6c3en6G6MD5MDYwMeaCG1xc3h4NnRtm

Submit a manuscript: https://www.tmjournals.com/login

8
33. Ye LF. Effectiveness of the use of Chinese herbs in swine disease control. China Anim Health. 2021,23(10):6–7. Available at: https://d.wanfangdata.com.cn/periodical/ChlQZXJpb2RpY2FsQ0hJTVm3VUzwmQwNzaXoF6z2r3yMoymxvMdxMwMvMyACGhpOBH6HR2
40. Wang DH. Comprehensive preventive and control measures of porcine circovirus disease. Livest Poult Ind. 2024,35(03):80–82. Available at: https://d.wanfangdata.com.cn/periodical/ChlQZXJpb2RpY2FsQ0hJTVm3VUzwmQwNzaXoF6z4xMyMD0MDMwMjA0CDNdmi1wZzhk
57. Guo JZ. Combination of Chinese and Western medicine in the treatment of infectious gastroenteritis in pigs. Chin J Tradit Vet Sci. 2023(01):82–84. Available at: https://d.wanfangdata.com.cn/periodical/ChlQZXJrb2RpY2FsQ0hJTVm3VUzwmQwNzaXoF6z3c3yMoymxvMdxMwMvMyACGhpOBH6HR2
59. Henan University of Traditional Chinese Medicine. A traditional
Chinese medicine composition for prevention and control of African swine fever and its synergistic process and application: China, CN202310683404.4. 2023-09-01.

60. Liu ZK. Chinese herbal medicine will become a powerful army for the prevention and control of African swine fever. *Swine Ind Sci.* 2019;36(11):96–97. Available at: https://d.wanfangdata.com.cn/periodical/ChlQZXJpb2RpY2FsQ0hJTrmV3U2zwMjQwNzA0EhJkd2t4eWR3eXgyMDExMDExMDExMDExMTExMjgCHb2cHd5ZmFp


65. Zhao W. Clinical diagnosis and prevention and treatment of infectious gastroenteritis in pigs with Chinese and western medicine. *Chin J Tradit Vet Sci.* 2023(08):25–27. Available at: https://d.wanfangdata.com.cn/periodical/ChlQZXJpb2RpY2FsQ0hJTrmV3U2zwMjQwNzA0EhJkd2t4eWR3eXgyMDExMDExMDExMDExMjgCHb2cHd5ZmFp

66. Dang W, Wei S, Wu H, et al. Analysis of combined Chinese and Western medicine treatment measures for swine influenza. *China Anim Ind.* 2023(08):99–100. Available at: https://d.wanfangdata.com.cn/periodical/ChlQZXJpb2RpY2FsQ0hJTrmV3U2zwMjQwNzA0EhJkd2t4eWR3eXgyMDExMDExMDExMDExMjgCHb2cHd5ZmFp


69. Feng Y. Treatment of Mycoplasma pneumonia in pigs by combining Chinese and Western medicine. *Chin J Tradit Vet Sci.* 2023(09):43–45. Available at: https://d.wanfangdata.com.cn/periodical/ChlQZXJpb2RpY2FsQ0hJTrmV3U2zwMjQwNzA0EhJkd2t4eWR3eXgyMDExMDExMDExMDExMjgCHb2cHd5ZmFp


71. Quique K, Wu H, Narenbat, et al. Observations on the complementary effects of combined Chinese and Western veterinary therapy for canine microvirus disease. *XINJIANG XUMUYE.* 2024;40(02):45–48. Available at: https://d.wanfangdata.com.cn/periodical/ChlQZXJpb2RpY2FsQ0hJTrmV3U2zwMjQwNzA0EhJkd2t4eWR3eXgyMDExMDExMDExMDExMjgCHb2cHd5ZmFp


73. Zhang SC, Li CY, Liu XF, et al. Prevention and control of African swine fever by scientific use of Chinese and Western medicine. *Anim Sci Abroad-Pigs Poul.* 2022,42(02):43–46. Available at: https://d.wanfangdata.com.cn/periodical/ChlQZXJpb2RpY2FsQ0hJTrmV3U2zwMjQwNzA0EhJkd2t4eWR3eXgyMDExMDExMDExMDExMjgCHb2cHd5ZmFp