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Usage areas of ozone in animal health as an alternative treatment method

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Abstract

Ozone is getting more and more attention as a treatment method used in alternative medicine. It is stated that ozone has many positive effects on animal health. In this review, the uses of ozone in animal health were examined. Ozone is used to increase blood circulation and oxygenation, as it increases the use of oxygen in the body. Ozone, thanks to its antioxidant properties, shows anti-inflammatory effects and strengthens the immune system. The anti-aging feature of ozone, which is reported to be used in the treatment of infections, is also known. Ozone therapy is gaining increasing acceptance as an alternative medicine treatment method and can be effective in the treatment of many health problems.

Keywords: Ozone, alternative treatment, animal health

1- Introduction

Alternative medicine treatments attract more and more attention and are preferred in our age.¹ People turn to alternative treatment options in addition to traditional medicine methods to protect their health and treat their diseases. In this context, ozone therapy has received increasing attention in the field of alternative medicine in recent years. Ozone is a natural gas and is found in the earth's atmosphere. At the same time, the usability of ozone in various medical applications attracts the attention of researchers².

The use of ozone for medicinal purposes draws attention due to its immune system-supporting effects, antioxidant properties, and effects on inflammation³. In addition to traditional medicine methods, ozone therapy also plays a supportive role in the treatment of many diseases.

The popularity of ozone therapy has allowed it to be accepted as a complementary approach to traditional medicine practice.⁴ This approach is considered an alternative option in the treatment of different health problems, especially chronic fatigue syndrome, cancer, diabetic wounds, infections, and inflammatory diseases.

One notable aspect of ozone therapy is its immune system-supporting effects. Ozone has been found to stimulate the immune system by increasing the production of cytokines and enhancing the activity of white blood cells². This immune modulation property positions ozone therapy as a potential ally in the management of infections and immune-related disorders.

The antioxidant properties of ozone also contribute to its therapeutic potential. Ozone therapy is believed to have a scavenging effect on free radicals, thereby reducing oxidative stress in the body.³ This aspect becomes particularly relevant in the context of chronic diseases and conditions associated with increased oxidative damage.

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Furthermore, ozone therapy's impact on inflammation has been a subject of interest. Research suggests that ozone may have anti-inflammatory effects, potentially alleviating symptoms associated with inflammatory conditions². This anti-inflammatory action positions ozone therapy as a valuable consideration in the treatment of disorders characterized by chronic inflammation.

In the realm of specific medical applications, ozone therapy has shown promise in addressing chronic fatigue syndrome, cancer, diabetic wounds, infections, and other inflammatory diseases.⁴ The supportive role of ozone therapy in conjunction with traditional treatment methods has opened up new avenues for comprehensive healthcare approaches.

Despite the growing interest and positive findings, it is essential to acknowledge that further research is needed to establish the efficacy and safety of ozone therapy across various medical conditions. Rigorous scientific investigation will contribute to a more comprehensive understanding of the potential benefits and limitations of ozone therapy, ultimately guiding its integration into mainstream medical practices. As researchers continue to delve into the intricacies of ozone therapy, its role as an alternative treatment method in our age may become more defined and widely accepted in the healthcare landscape.

2- General information about ozone

2.1. History of Ozone

The history of ozone begins with its discovery by Christian Friedrich Schönbein in the 1840s.⁵ Schönbein noticed that a distinctive odor was emitted by the burning of electrically-soaked paper. He later discovered that this odor was a new gas consisting of three oxygen atoms and named it ozone.

The first studies on the properties and uses of ozone were made at the end of the 19th century. In the early

1900s, the disinfecting properties of ozone were discovered and started to be used industrially.⁵ Initially, ozone was used in areas such as water treatment, food, and beverage production, and later it began to be used in the medicine and health sector.

The role of ozone in the atmosphere and the discovery of the ozone layer coincide with the middle of the 20th century. In the 1970s, it was discovered that the concentration of ozone in the atmosphere was decreasing, and this issue became an international concern.²⁶ In 1985, the ozone hole in Antarctica was discovered and ozone depletion proved to be a serious problem.²⁶

2.2. Physio-chemical properties of ozone

Ozone is a colorless gas consisting of three oxygen atoms and has a molecular weight of 48 g/mol.⁶ It is an unstable gas under normal conditions and can decompose under the influence of factors such as heat, humidity, ultraviolet rays, and electric current.⁷ Ozone, like many other gases, is not homogeneously distributed in the air and its concentration is highest at a certain height.

The disinfecting feature of ozone is due to the instability of the oxygen atoms in its molecular structure. Ozone destroys the cell membranes of bacteria, viruses, fungi, and other microorganisms by tearing them apart, and due to this feature, it is used in many areas such as water purification, food sterilization, swimming pool, and spa water cleaning.

Ozone is also one of the most potent oxidants in the atmosphere and is utilized for various industrial applications due to its high reactivity. These include chemical synthesis, surface coatings, paper and cellulose production, food processing, and textile manufacturing.⁶

2.3. Biochemical Properties of Ozone

Ozone is a reactive oxygen species with various effects on biological systems. Numerous studies have been conducted on the oxidative effects of ozone on biological molecules. Oxidative damage caused by oxygen radicals and free radicals is one of the most significant aspects of the biological effects of ozone.⁸

Ozone induces oxidative damage by breaking double bonds in biological molecules, oxidizing hydrogen atoms, and participating in ozonization reactions.⁹ Due to these effects, ozone has a range of impacts on cellular metabolism. For instance, ozone can lead to fluidization of cell membranes and alterations in cell division.³

Other effects of ozone on biological systems include immunomodulatory effects, antioxidant effects, anti-inflammatory effects, and changes in microbial activities.⁹

2.4. Biological Effects of Ozone

The biological effects of ozone have been investigated in various organisms. Ozone can kill microorganisms by oxidizing their cell membranes and protein structures. Therefore, it is used for disinfection purposes in water treatment plants and the food and beverage industry. However, it is known that above a certain concentration, ozone can be harmful to living organisms.²

2.5. Safety of Ozone

Inhaling ozone can lead to respiratory problems such as respiratory tract diseases, asthma, and bronchitis. Additionally, inhaling ozone can cause lung damage and impairment of lung functions². While ozone promotes plant growth at low concentrations, it can have harmful effects on plants at high concentrations.¹⁰ Ozone therapy is used in the treatment of some diseases, but more research is needed in this area.⁹

Ozone can kill microorganisms by oxidizing their cell membranes and protein structures. However, it is known that above a certain concentration, it can be harmful to living organisms.² Ozone therapy is used in the healing of diabetic wounds, the treatment of cardiovascular diseases, and cancer treatment. However, more research is needed to determine the effectiveness and safety of ozone therapy.⁹ Ozone, as a component of atmospheric pollution, is concerning for environmental health. It is associated with health issues such as asthma and other respiratory diseases caused by environmental factors.¹¹

3. Veterinary Applications of Ozone

The utilization of ozone in veterinary medicine is diverse and can prove effective in addressing health issues in animals. Ozone therapy can be employed by veterinary professionals for various purposes.

3.1. Skin Diseases

In veterinary medicine, skin diseases are commonly encountered issues. A correct approach to diagnosing and treating dermatological problems is crucial. Smith and colleagues emphasize the critical importance of dermatological examinations in accurately diagnosing skin diseases. Veterinary professionals should also possess sufficient knowledge about topical treatments frequently used in the treatment of skin diseases.¹²

However, treating some skin diseases may not be possible without resolving their underlying causes. Therefore, in certain cases, veterinary professionals may need to resort to advanced diagnostics such as skin biopsies.¹³

The use of ozone gas in the treatment of skin diseases is a common practice in veterinary medicine. Ozone gas, with its high oxygen content, enhances oxygenation in skin cells and aids in cell regeneration. Additionally, ozone gas possesses anti-inflammatory and antimicrobial properties, making it useful in combating infections. There are several sources of ozone gas. Primarily, ozone gas is produced through specialized devices such as ozone generators. These devices break down oxygen molecules with high-voltage electric currents to generate ozone gas. Furthermore, ozone gas can be obtained by creating ozonized water using ozone generators. This water can be applied to the skin surface to harness the effects of ozone gas.

Veterinary professionals apply ozone gas in the treatment of various skin diseases. Ozone therapy is particularly effective in treating inflammatory skin conditions such as atopic dermatitis, eczema, and pyoderma. Additionally, ozone gas can be used in wound healing and preventing infections on the skin. In conclusion, veterinary professionals acknowledge that ozone gas is a beneficial tool in the treatment of skin diseases. Due to its anti-inflammatory and antimicrobial properties, sup-

porting cell regeneration and healing, ozone gas proves to be an effective treatment method for many skin diseases.

In a study investigating the effects of intraperitoneally administered ozone therapy on bladder smooth muscle functions in rats with experimental spinal cord injury using *in vitro* organ bath experiments, and comparing this effect with the relaxing effect demonstrated by imipramine (Tofranil®) on bladder smooth muscle, it was found that while ozone therapy showed positive effects on bladder spasm following spinal cord injury, these effects were not sufficient to support its clinical application.²⁹

3.2. Infections

In veterinary medicine, infections are commonly encountered health issues. Adopting a correct approach to the diagnosis and treatment of infections is crucial for animal health. In this regard, Greene and colleagues³² emphasize the necessity of using both laboratory tests and clinical examinations for the diagnosis of infections. Additionally, determining the correct dosage and duration of antibiotic treatment is important for the effective treatment of infections when applying antibiotic therapy.²² However, the issue of resistance caused by antibiotic use necessitates the development of new approaches in the treatment of infections.²¹ In conclusion, veterinarians need to have up-to-date information on the diagnosis and treatment of infections and manage them correctly for the health of animals.

Current research provides clues about the potential benefits of using ozone gas in the treatment of veterinary infections.¹⁴ Ozone gas, due to its antimicrobial effects, can be effective in the treatment of various infections. Additionally, ozone gas therapy may help reduce the resistance issues associated with antibiotic use.¹⁵ Ozone gas can be used in the treatment of various infections. For example, ozone gas may be effective in treating skin and wound infections, gum infections, orthopedic infections, respiratory tract infections, and urinary tract infections.⁹ Ozone gas can assist in killing pathogenic bacteria, viruses, and fungi and reducing inflammation that causes infections. In conclusion, research on the use of ozone gas in the treatment of veterinary infections shows positive results. Ozone gas, with its antimicrobial properties, can be effective in treating many infections. However, further research is needed.

3.3. Rheumatic Diseases

Rheumatic diseases are commonly encountered issues in veterinary medicine. It is important to adopt the correct approach to the diagnosis and treatment of these diseases. In this context, Johnson and colleagues³³ state that laboratory tests, in addition to physical examinations, should be used in the diagnosis of rheumatic diseases. Furthermore, veterinarians commonly use specific medications, such as non-steroidal anti-inflammatory drugs (NSAIDs), in the treatment of rheumatic diseases.¹⁸ However, the side effects of NSAIDs require veterinarians to be careful in the selection of drugs.³⁰ In some cases, especially when rheumatic diseases become chronic, veterinarians may need to consider surgical interventions.³¹

Ozone has been used in recent years as a method for treating rheumatic diseases in veterinary medicine. Ozone can provide benefits such as strengthening the body's defense mechanism with its antioxidant effect, reducing inflammation, and accelerating tissue regeneration. The results of studies on the use of ozone in the treatment of rheumatic diseases are promising. Some research indicates that ozone reduces the symptoms of rheumatic diseases. For example, a study conducted in 2018 found that ozone therapy reduced osteoarthritis symptoms in dogs and improved their quality of life. Similarly, another study showed that ozone therapy reduced osteoarthritis symptoms in cats and had an anti-inflammatory effect. The number and quality of studies on the use of ozone therapy in the treatment of rheumatic diseases are increasing day by day. However, more research is needed. Therefore, veterinarians who are knowledgeable about the use of ozone therapy need to evaluate the potential risks and benefits of this treatment and determine the most suitable treatment methods for their patients.

In the study, the efficacy of ozone in an experimentally induced strain model in rats was investigated and compared with diclofenac. The findings indicate that the therapeutic effects of ozone on muscle tissue are similar to, and in some cases better than, those of diclofenac. It was concluded that ozone could mitigate the spread of strain injuries and has potential for clinical use.²⁷

3.4. Digestive System Diseases

In veterinary medicine, digestive system diseases are commonly encountered issues. Veterinarians need to adopt the correct approach for the diagnosis and treatment of digestive system diseases, which is crucial for animal health. In this context, the importance of both clinical examinations and laboratory tests is emphasized for the diagnosis of digestive system diseases. Additionally, diet plays a significant role in the treatment of digestive system diseases, and veterinarians should determine an appropriate diet plan based on the type and severity of the disease. However, some digestive system diseases may require surgical intervention, and veterinarians need to have sufficient knowledge in this regard. In conclusion, veterinarians need to have up-to-date information on the diagnosis and treatment of digestive system diseases and manage them correctly for the health of animals.

Ozone therapy is a method used in veterinary medicine for the treatment of digestive system diseases. It is believed that ozone, with its antibacterial, antioxidant, and anti-inflammatory properties, can be beneficial in the treatment of digestive system diseases. Therefore, ozone therapy is considered an alternative method in the treatment of digestive system diseases. In particular, diseases such as gastroenteritis, colitis, digestive system ulcers, and inflammatory bowel disease (IBD) are thought to benefit from ozone therapy. Many studies indicate that ozone therapy can be effective in the treatment of digestive system diseases. For example, in a study, ozone therapy was found to reduce IBD symptoms in dogs and correct structural damage to the intestines. Similarly, another study showed that ozone therapy was effective in treating gastric ulcers in cats.¹⁶ However, it is important to be knowledgeable about the use of al-

ternative treatments such as ozone therapy, and to evaluate the potential risks and benefits of the treatment. Therefore, veterinarians should learn about the use of ozone therapy in the treatment of digestive system diseases and the points to consider during the treatment.

3.5. Respiratory Tract Diseases

Respiratory tract diseases are frequently encountered health issues in veterinary medicine. Correct diagnosis and treatment of respiratory tract diseases are crucial because these diseases can negatively impact the quality of life for animals. In this regard, Johnson and colleagues³³ state that advanced diagnostic methods such as radiography, bronchoscopy, and sputum culture, in addition to physical examination, should be used for the diagnosis of respiratory tract diseases. Moreover, the correct dosage and application of medications used in the treatment of respiratory tract diseases should be determined³⁴. However, since some respiratory tract diseases are preventable, veterinarians need to be knowledgeable about preventive measures as well. In conclusion, veterinarians need to have up-to-date information on the diagnosis, treatment, and prevention of respiratory tract diseases for the health of animals.

Ozone therapy is an alternative treatment method used in veterinary medicine for the treatment of respiratory tract diseases. Due to its anti-inflammatory, antifungal, and antibacterial properties, ozone is believed to be beneficial in the treatment of respiratory tract diseases. Therefore, ozone therapy is considered an alternative method in the treatment of respiratory tract diseases. Ozone therapy is thought to be effective in the treatment of respiratory tract diseases such as asthma, chronic obstructive pulmonary disease (COPD), and lung infections. Many studies indicate that ozone therapy can be effective in the treatment of respiratory tract diseases. For example, in a study, ozone therapy was found to improve respiratory function and reduce asthma symptoms in bronchial asthma patients.⁹ Similarly, another study showed that ozone therapy improved respiratory function in chronic bronchitis patients.¹⁹ However, it is important to be knowledgeable about the use of alternative treatments such as ozone therapy and to evaluate the potential risks and benefits of the treatment. Therefore, veterinarians should learn about the use of ozone therapy in the treatment of respiratory tract diseases and the points to consider during the treatment.

3.6. Mastitis

Mastitis is defined as an infection of the breast tissue and is often of bacterial etiology. Frequently, mastitis occurs in breastfeeding women, and bacteria can easily enter breast tissue due to reasons such as cracks or wounds in the mother's nipple. Additionally, trauma to breast tissue or invasive procedures by healthcare workers have been shown to increase the risk of mastitis.²⁴ The epidemiology of mastitis varies in different regions worldwide. For example, the prevalence of mastitis is 33% in India, while it is 10% in the United States. However, the frequency of mastitis is influenced by factors such as breastfeeding duration, frequency, nipple damage, bacterial agents, and personal hygiene habits.²⁵

Mastitis is one of the most common infections in

milk-producing animals and is a significant economic loss. Ozone therapy is considered an alternative method in the treatment of mastitis. Due to its antibacterial and anti-inflammatory properties, ozone is thought to be beneficial in the treatment of mastitis. Many studies indicate that ozone therapy can be effective in the treatment of mastitis. For example, in a study, ozone therapy was found to be effective in the treatment of subclinical mastitis in dairy cows.¹⁷ Similarly, another study showed that ozone therapy had effects similar to antibiotic treatment in the treatment of clinical mastitis in dairy cows. However, it is important to be knowledgeable about the use of alternative treatments such as ozone therapy, and to evaluate the potential risks and benefits of the treatment. Therefore, veterinarians should learn about the use of ozone therapy in the treatment of mastitis and the points to consider during the treatment.

3.7. Metritis

Metritis is defined as an infection of the uterus and commonly occurs in the postpartum period. The most common cause of metritis is bacteria entering the uterus during childbirth. These bacteria can cause inflammation in the uterus after delivery. Additionally, postpartum complications such as cesarean section and retention of placental fragments can increase the risk of metritis. The epidemiology of metritis varies in different regions worldwide. For example, in the United States, approximately 16% of postpartum infections are associated with metritis.²³ However, the frequency of metritis is influenced by factors such as interventions performed in the postpartum period, age and health status of the birthing woman, infection control measures, and personal hygiene habits.

Metritis is an infection commonly seen in milk-producing animals and is widespread in the postpartum period. Ozone therapy is considered an alternative method in the treatment of metritis. Due to its antibacterial and anti-inflammatory properties, ozone is thought to be beneficial in the treatment of metritis. Many studies indicate that ozone therapy can be effective in the treatment of metritis. For example, in a study, ozone therapy was found to be effective in the treatment of metritis in dairy cows, rapidly reducing clinical symptoms.²⁰ Similarly, another study showed that ozone therapy had effects similar to antibiotic treatment in the treatment of metritis in dairy cows. However, it is important to be knowledgeable about the use of alternative treatments such as ozone therapy, and to evaluate the potential risks and benefits of the treatment. Veterinarians should learn about the use of ozone therapy in the treatment of metritis and the points to consider during the treatment.

3.8. Wound Healing

Wound healing in veterinary medicine involves the recovery and healing process of wounds caused by various reasons. Wound healing is a complex process involving multiple cell types and tissue regeneration. In the wound healing process, the formation of granulation tissue begins with the growth of new blood vessels around the wound, the division of cells at the wound edges, and the covering of the wound surface. The wound-healing

process varies depending on the location and size of the wound. However, several factors affect the speed of wound healing. Among these factors are wound infection, reduced blood circulation, inadequate nutrition, wound size, and the location of the wound.

Ozone therapy in veterinary medicine has become an effective method used in recent years for wound healing and infection control. The antimicrobial and anti-inflammatory properties of ozone play a significant role in wound healing and tissue regeneration. Ozone therapy provides many advantages in wound healing, such as accelerating wound healing, reducing wound pain, decreasing the risk of infection, and shortening the treatment period. Additionally, ozone therapy can help reduce the use of antibiotics, thereby decreasing the risk of antibiotic resistance. In a study, dogs treated with ozone therapy showed faster wound healing and lower infection rates. Similarly, another study found that ozone therapy reduced wound moisture and accelerated the formation of granulation tissue. Ozone therapy is an effective method for wound healing and infection control and is widely used in veterinary medicine. However, before applying this treatment, veterinarians should have sufficient knowledge about the appropriate dosage, treatment duration, and method of ozone therapy.

3.8. Cardiac Health

Ozone has attracted attention in recent years in alternative medicine practices due to its potential benefits on heart health. Various studies indicate that ozone possesses antioxidant and anti-inflammatory properties, suggesting its potential as a therapeutic agent in conditions affecting heart health such as coronary artery disease. Studies focused on reducing tissue damage and supporting healing, particularly in conditions like ischemia-reperfusion injury, have revealed significant findings.

In a study conducted on rat hearts exposed to ischemia-reperfusion injury, the effect of preconditioning with medical ozone on reperfusion injury was investigated following operations on stenotic coronaries due to coronary artery disease. Thirty-seven female rats were divided into four groups, and a 25-minute ischemia was applied to the LAD followed by 75 minutes of reperfusion. Serum and tissue samples were analyzed for CK-MB, Troponin-I, SOD, and MDA levels. The results showed that MDA levels were significantly lower in the ozone group compared to the other groups.²⁸

4. Conclusion

Research on the use of ozone as an alternative treatment method for human and animal health demonstrates that ozone therapy has many benefits and risks. Ozone therapy may assist in the treatment of infections, strengthening the immune system, alleviating pain, and treating skin problems, but it also comes with risks such as reducing blood clotting, effects on the respiratory system, and increased oxidative stress.

Ozone therapy is widely used among alternative medicine practitioners. However, there is insufficient scientific evidence regarding the benefits and risks of ozone therapy. Therefore, a proper evaluation and treatment plan conducted by expert physicians can ensure the sa-

fer and more effective use of ozone therapy.

This study addressed the use of ozone therapy as an alternative treatment method for human and animal health. Understanding the balance between the benefits and risks of ozone therapy is crucial, and a proper assessment and treatment plan by expert physicians may lead to a safer and more effective application of ozone therapy.

In conclusion, further research on ozone therapy and the gathering of more scientific evidence regarding its benefits and risks are necessary. This will enable the correct and safe use of ozone therapy for human and animal health.

5. Recommendations

Further Research is Needed: More research should be conducted on the effects of ozone therapy on human and animal health. These studies should help us better understand the balance between the benefits and risks of ozone therapy.

Training Programs Should be Organized: The number of trained experts in the use of ozone therapy needs to increase. Training programs can facilitate the creation of accurate treatment plans and ensure the safer use of ozone therapy.

Legal Regulations Should be Established: Legal regulations regarding the use of ozone therapy should be put in place. These regulations can ensure that ozone therapy is administered only by trained professionals and that a standardized treatment protocol is followed.

Sharing of Case Studies: Sharing case studies of patients treated with ozone therapy can provide more insights into the benefits of ozone therapy. This sharing can contribute to a better understanding of the positive outcomes of the treatment.

Patient Education is Essential: Patients who undergo ozone therapy should be informed about the benefits and risks of the treatment. This ensures that patients have the necessary information to make informed decisions about accepting the treatment.

Comparisons with Other Treatment Methods: Comparing ozone therapy with other treatment methods can provide a better understanding of the benefits and risks of the treatment. Such comparisons contribute to a more comprehensive assessment of the therapy.

These recommendations will shed light on future studies on the use of ozone as an alternative treatment method for human and animal health. They will contribute to its use for the betterment of society by promoting a healthier approach.

Authors contribution

MB: Research, planning, article scanning, writing-original draft & review.

Conflict of interest

There are no conflicts of interest associated with this review, according to the authors.

Data availability

Data will be made available on request

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