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Antifungal Effect of *Aloe Vera* Extract on Otomycosis: A Review

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ABSTRACT

Otomycosis is a common disease that can cause a variety of complications, including involvement of the inner ear and, in rare cases, death. Otomycosis management can be difficult and requires close monitoring. There is currently no standardized treatment regimen for otomycosis, which opens up new treatment options such as the use of herbal medicine. Aloe barbadensis miller, also known as Aloe vera, is one of over 400 Aloe vera species and a member of the Liliaceae family. Several studies have shown that Aloe vera extract has antifungal properties. The purpose of this literature review is to identify the components of Aloe vera as well as the mechanism of action in the treatment of otomycosis. The articles chosen were all published in PubMed within the last six years. The review included 7 articles that were obtained.

1. Introduction

External ear infection is an inflammation of the external ear canal and auricle that can be caused by a variety of local infections or can be a symptom of a systemic disease. Infection of the external ear canal affects about 10% of people at some point in their life, with 90% of cases being unilateral. [3]

Otomycosis (fungal infection of the external ear canal) is a frequent condition that affects 9 percent to 27.2 percent of patients referred to Ear, Nose, and Throat (ENT) departments with signs and symptoms of external otitis media. The infection is also the cause of ear discharge in more than 30% of patients and is a common cause of external otitis treatment resistance. [3]

In the majority of cases, otomycosis is characterized as a fungal infection affecting the external ear canal. It can also affect the middle ear if the drum is ruptured, as well as the mastoid cavity after an open mastoidectomy. [2] A fungal ear infection is an inflammation of the ear that can be chronic, acute, or subacute, and seldom involves the middle ear. [1]

Predisposing factors include foreign bodies in the ear canal, traumatic insemination of wood particles, plant materials, and dirt into the ear canal, scratching and manipulation of the ear canal with non-sterile equipment, living in dusty areas or wet environments, ear canal humidity after swimming and bathing, and fungal nail infection and dermatophthisis. [3]

Adults are the most common victims of otomycosis, however children and other age groups may also be afflicted. It is more common in those between the ages of 21 and 30, and it is less common

in people under the age of 10 and those over 60. Interestingly, several studies have found that women had a higher prevalence of the condition than men. While some studies have found a higher prevalence of the disease in men, others have not. [1]

Otomycosis has been linked to a variety of fungal species. Saprophytic filamentous fungus, yeast, and dermatophytes are among the species that cause fungal infections in the ear. [1] The species *Aspergillus* and *Candida*, notably *Aspergillus niger*, appeared to be the most common causal agents. [1,4] P*enicillium, Fusarium, Mucoraceae, Scopulariopsis, Alternaria, Malassezia*, and *Candida* species, as well as dermatophytes, are among the other fungal agents. [2]

Itching, discomfort, tingling, and hearing loss are some of the most common symptoms of this condition. Inflammation on the outer auricle and white, gray, and black or cheese-like tissues are commonly seen on clinical examination.[1,4]

Otomycosis is linked to a variety of consequences, including inner ear involvement and, in rare circumstances, death. Hearing loss can occur when a fungus ball or fungal mass of mycelia, epithelial cells, and wax forms in the ear canal and is exposed to the tympanic membrane. In acute infections, the skin on the neck and the cartilage in the ears are also damaged. A fake veil of yeast in various colors (depending on the species of fungus) may appear in the ear canal in chronic situations. In immunocompromised people, especially those with cellular immunodeficiency and neutropenia, the mycosis has a terrible prognosis. Both patients and ENT professionals face numerous obstacles as a result of the condition. Despite long-term treatment and follow-up, the condition may reoccur.[3]

Local debridement, local and systemic antifungals, and the termination of local antimicrobials are all suggested treatments for otomycosis. Otomycosis is rarely life-threatening, and local antifungals such clotrimazole, miconazole, and nystatin are almost always successful. The most common antifungal used in these treatments is local clotrimazole. [1]

Antifungal otomycosis drugs do not usually cure the disease, and treatment should also enhance the external ear canal's physiological symptoms. The use of boric acid in an alcohol solution for illness therapy is linked to a 23% recurrence rate. Furthermore, while antifungal treatments like clotrimazole or nystatin may be beneficial for treating *Candida* infections, they are ineffective against *Aspergillus* infections. While a wide variety of fungus have been found to cause otomycosis, *Aspergillus* is the most frequent species. [3]

There is currently no standardized treatment for otomycosis, which offers up new treatment alternatives, including herbal medication.

Many plants have been used for their therapeutic benefits all around the world. The *Aloe vera* plant has been used in folk medicine for over 2000 years and is still an essential part of many countries' traditional medicine. Aloe barbadensis miller, popularly known as *Aloe vera*, belongs to the Liliaceae family and is one of over 400 species of *Aloe vera*. [4]

Aloe vera (*Aloe barbadensis Mill.*) is a flowering succulent plant in the Asphodelaceae family that has become naturalized in many tropical and sub-tropical areas. The dagger-shaped leaves are the most commonly used component of the plant, and there are two major fractions: the outer, photosynthetically active green cortex, commonly referred to as rind, and the interior parenchyma, commonly referred to as pulp or fillet. Furthermore, the leaf secretes two distinct exudates: the reddish-yellow latex produced by the pericyclic cells beneath the cutinized epidermis and the yellow latex produced by the pericyclic cells behind the cutinized epidermis. The interior parenchyma's thin-walled tubular cells form a translucent, slippery mucilage or gel. [6]

The high water content of *Aloe vera*, which ranges from 99.0999.5 percent, is its most notable attribute. Sugar, anthraquinones, saponins, vitamins, enzymes, minerals, lignin, salicylic acid, and amino acids are among the more than 75 nutrients and 200

active compounds found in the remaining 0.5 to 1.0 percent, as well as other potentially active compounds such as water-soluble and fat-soluble vitamins, minerals, enzymes, simple/complex polysaccharides, phenolic compounds, and organic acid. [3] The outer rind and the inside colorless parenchyma aloe gel are the two sections of *Aloe vera*. *Aloe vera* has therapeutic properties in both sections. Its rind has been found to have stronger antioxidative activity in studies. *Aloe vera* has anti-inflammatory, anti-arthritic, antibacterial, and hypoglycemic effects, according to in vitro and animal studies using whole leaf extract. [4] *Aloe vera* extract has been shown to have antifungal effects in several investigations. [4,7]

The purpose of this study is to identify the components of *Aloe vera* as well as the mechanism of action in the treatment of otomycosis.

2. Methods

The search engine used in this study was PubMed. The search was done using the terms "*Aloe vera*" and "Otomycosis" up until August 17, 2021. All of the articles chosen were published during the last six years. Articles that were published twice were removed. Seven results were acquired from PubMed and included in the review.

3. Results and Discussion

Based on the findings of the review research, we have discovered a wealth of useful information about *Aloe vera*'s use in the treatment of otomycosis.

Species of pathogenic otomycosis

It should be noted that a wide range of fungi are known to cause otomycosis, but because the disease is most commonly seen in tropical and subtropical regions of the world, it is expected that due to climatic conditions and individual lifestyles, a specific genus of fungi will be the most common cause of otomycosis in each region.

In an Iranian investigation, Mofatteh et al. discovered that among 204 individuals with otomycosis, *Aspergillus spp.* was responsible for 74% (151 cases) and *Candida albicans* for 26% (53 instances). The most prevalent species of fungi isolated from patients with otomycosis in 2003, according to the Pradhan et al. investigation, were *Aspergillus* species and *Candida albicans*. Satish and colleagues found that in the immunocompetent group, *Aspergillus species* (77%) was the most usually isolated fungus, while *Candida* (53.4%) was the most commonly isolated fungus in the immunocompromised group. In another study, 72 of 95 individuals suspected of having a fungal infection had positive fungal cultures and the most frequent fungus cultivated in culture was identified as *Aspergillus* (41.1%), followed by *Candida albicans* (8.2%). K. Kiakojori et al. *A. flavus* was the most prevalent pathogenic species detected by cultivation, with a frequency of 33.33 percent, followed by *A. niger* (30 percent), and *Candida albicans* (20 percent) (12.66 percent). The most common genus in this investigation was *Aspergillus spp* (79.33 percent). [1,3]

One of the most common causes of opportunistic invasive fungal infections, particularly otomycosis, is *Aspergillus species*. This could be owing to the high incidence of *Aspergillus species* in dust and the acidic condition of the ear canal, as *Aspergillus* species grow in a pH range of 5 to 7. Candidiasis is the second most common infection, especially among immunocompromised people.[1,3]

Aloe vera bioactive properties as antifungal activity

Mikel Aibarro-Ortega and colleagues investigated the compositional and bioactive properties of *Aloe vera* leaf (fillet, mucilage, and rind) and flower. As a result, three of the *Aloe vera* extracts (except mucilage) had antifungal activity against *Aspergillus flavus, Aspergillus niger,* and *Penicillium funiculosum* (MIC and MFC values of 0.1 and 0.4 mg/mL, respectively) that was superior to that of the positive control ketoconazole (MIC and MFC values of 0.25

and 0.5 mg/mL, respectively). Inhibiting (MIC, 0.05 mg/mL) or killing (MFC, 0.1 mg/mL) the opportunistic yeast Candida albicans was more effective than ketoconazole. It causes candidiasis and is the most common fungal infection in humans. This fungal infection primarily affects the surface of the skin and mucosa (oral and vaginal), but it can also cause life-threatening systemic infections. [6]

The antifungal activity of the fillet, rind, and flower extracts was higher than that of ketoconazole against *A. flavus, A. niger, P. funiculosum, and C. albicans*.[6]

Antifungal effects of *aloe vera* extract on pathogenic otomycosis fungal species

Using the zone of inhibition and MIC to determine antimicrobial activity, Jeyasakthy et al. examine the in vitro antifungal impact of Malaysian *Aloe vera* leaf extracts in alcohol and aqueous solutions on two prevalent pathogenic otomycosis species, *A. niger and C. albicans.* They discovered that both alcohol and aqueous extracts have antifungal activity against *A. niger*.[4]

For all five concentrations examined, they identified no zone of inhibition of *C. albicans* for both the alcohol and aqueous extracts. Khaing et al. found the same thing in their study. Using the agar diffusion method and crude *Aloe vera* leaf extracts in methanol, ethanol, and ethyl acetate, Jeyasakthy et al discovered that none of the extracts inhibited *C. albicans.* In the case of *A. niger*, the methanol extract had the maximum zone of inhibition, followed by ethanol and ethyl acetate extracts. Alcohol extract was effective secondary to its ingredient of extraction, according to a study by shekrawat et al. [4]

Devi et al. Used the disc diffusion method to test the antibacterial activity of dimethyl sulfoxide (dmso) crude extracts of *aloe barbadensis miller* gel against selected bacterial and fungal pathogens such as *a. Niger* and *candida albicans*. When compared to *c. Albicans*, which displayed a considerable zone of inhibition in proportion to concentration, the extracts failed to show a zone of inhibition at any concentration to *a. Niger*. [4] variations in antibacterial activity were found to be dependent on the extraction method utilized, according to the author.

A study conducted by karina nabila in north sumatera found that *aloe vera* ethanol extracts with concentrations of 6.25 percent, 12.5 percent, 25 percent, and 50 percent suppress *candida albicans* growth. [5]

Kurniawan et al. Discovered flavonoids, alkaloids, tannins, saponins, and steroids in an ethanol extract of *aloe vera*. These chemicals were thought to play a function in *candida albicans* growth inhibition. Flavonoids can cause protein clumping or coagulation. Clotting proteins become denaturated and lose their ability to function. Tannins can obstruct the cytoplasmic membrane's ability to function. It can damage the cytoplasmic membrane at low doses, causing leakage of critical metabolites that activate the enzyme system, and it can damage the cytoplasmic membrane at high amounts, precipitating cell proteins. Saponins can lower surface tension, causing higher permeability or cell leakage, as well as the release of intracellular chemicals. Because they accumulate and create changes in cell constituent components, steroids can impede protein synthesis. Terpenoids inhibited the growth of yeast and hyphal forms of candida albicans. Terpenoids may thus be beneficial in the near future not just as an antifungal chemotherapeutic agent, but also to enhance the effectiveness of other medications like as fluconazole. [5]

4. Conclusion

Finally, *Aloe vera* extract has been demonstrated to have antifungal properties against Aspergillus species and Candida albicans, the most prevalent fungus isolated from otomycosis patients. This study could help determine which naturally derived chemicals can be used to develop new and more effective antifungal treatments for otomycosis. The

current research, however, is limited to in vitro medium. As a result, more clinical trials are needed to demonstrate the efficacy and safety of *Aloe vera* extracts in humans as prospective antifungal medicines.

5. References

1. Kiakojori K, Jamnani N.B., Khafri s., Omran S.M. Assessment of Response to Treatment in Patients with Otomycosis. Iranian Journal of Otorhinolaryngology. 2018; 30(1), Serial No.96, Jan 2018; 41-47.
2. Ali K., Hamed M.A.,Hassan H., Esmail A., Sheneef A. (2018). Identification of Fungal Pathogens in Otomycosis and Their Drug Sensitivity: Our Experience. Int Arch Otorhinolaryngol 2018; 22: 400–403.
3. Mofatteh M.R., Yazdi Z. N., Yousefifi M., Namaei M.H. Comparison of the recovery rate of otomycosis using betadine and clotrimazole topical treatment. Braz J Otorhinolaryngol. 2018; 84(4): 404---409
4. Saniasiaya J., Salim R., Mohamad I., Harun A.Antifungal Effect of Malaysian Aloe vera Leaf Extract on Selected Fungal Species of Pathogenic Otomycosis Species in In Vitro Culture Medium. Oman Medical Journal 2017; 32(1): 41–46.
5. Nabila V.K. and Imam Budi Putra. (2020) The effect of Aloe vera ethanol extract on the growth inhibition of Candida albicans. Med Glas (Zenica). 2020; 17(2): 485-489
6. Ortega M.A., Pinela J., Barros L., Ana´Ciri´ , Silva S.P., Coelho E., Mocan A., Calhelha R.C., Sokovi´c M., Coimbra M.A., Ferreira I.C.F.R. Compositional Features and Bioactive Properties of Aloe vera Leaf (Fillet, Mucilage, and Rind) and Flower. Antioxidants 2019; 8: 444; doi:10.3390/antiox8100444
7. Radha M.H. and Nampoothiri P. Laxmipriya. Evaluation of biological properties and clinical effectiveness of *Aloe vera*: A systematic review. J Tradit Complement Med. 2015 Jan; 5(1): 21–26.