

## Antifungal Potential of Brazilian Arnica Extract (*Lychnopora ericoides*) and Rosemary (*Rosmarinus officinalis*) in Control *Malassezia furfur* capillary

### Antifungal Potential of Brazilian Arnica (*Lychnopora ericoides*) and Rosemary (*Rosmarinus officinalis*) Extract in the Control of Capillary *Malassezia furfur*

Arina Dwan Silva Pastor – UNITOP University Center Beatriz  
Estefania Araújo – UNITOP University Center Karina Donizete  
Martins – UNITOP University Center Kedma Maria Carneiro –  
UNITOP University Center Mayra Tyciane Dias de Souza –  
UNITOP University Center

#### SUMMARY

This exploratory study sought to evaluate the antifungal potential of Brazilian Arnica extracts (*Lychnopora ericoides*) and Rosemary (*Rosmarinus officinalis*) against the fungus *Malassezia furfur*, focusing on the possible application of these extracts to combat oily hair. *Malassezia furfur* is a fungus commonly associated with seborrheic dermatitis and other skin disorders, including excessive hair oil. Brazilian Arnica and Rosemary extracts emerge as possible therapeutic agents due to their antifungal and oil-regulating properties. Brazilian Arnica and Rosemary were chosen due to their herbal properties and antifungal potential previously observed in related research. The methods included obtaining extracts through specific procedures, such as collecting and drying the aerial parts of Brazilian Arnica and macerating Rosemary leaves. Certified strains of *Malassezia furfur* were used to determine the Minimum Inhibitory Concentration (MIC) of the extracts, demonstrating remarkable antifungal activity. The results indicated that Brazilian Arnica and Rosemary extracts presented properties that can contribute to the control of sebum production on the scalp. This double benefit, combining antifungal activity against *Malassezia furfur* and the ability to control hair oiliness, suggests that these extracts have potential as ingredients in hair formulations. These results highlight the importance of these extracts as multifunctional therapeutic agents in the treatment of cutaneous disorders of the scalp. More research is needed to fully explore its benefits and potential applications in clinical dermatology practice.

**Key words:** Natural Antifungals. Hair Oil. Dermatological Therapeutic Alternatives.

#### ABSTRACT

This exploratory study aimed to assess the antifungal potential of Brazilian Arnica (*Lychnopora ericoides*) and Rosemary (*Rosmarinus officinalis*) extracts against the fungus *Malassezia furfur*, focusing on their possible application in combating capillary oiliness. *Malassezia furfur* is a fungus commonly associated with seborrheic dermatitis and other skin disorders, including excessive capillary oiliness. Brazilian Arnica and Rosemary extracts emerge as potential therapeutic agents due to their antifungal and oil-regulating properties. Brazilian Arnica and Rosemary were chosen for their phytotherapeutic properties and the antifungal potential previously observed in related research. Methods included obtaining the extracts through specific procedures, such as collecting and drying the aerial parts of Brazilian Arnica and macerating the Rosemary leaves. Certified strains of *Malassezia furfur* were used to determine the Minimum Inhibitory Concentration (MIC) of the extracts, demonstrating remarkable antifungal activity. The results indicated that Brazilian Arnica and Rosemary extracts exhibit properties that may contribute to controlling sebum production on the scalp.

This dual benefit, combining antifungal activity against *Malassezia furfur* and the ability to control capillary oiliness, suggests that these extracts have potential as ingredients in hair formulations. These results highlight the importance of these extracts as multifunctional therapeutic agents in the treatment of scalp skin disorders. Further research is needed to fully explore their benefits and potential applications in dermatological clinical practice.

**Keywords:** Natural Antifungals. Capillary Oiliness. Dermatological Therapeutic Alternatives.

## 1. INTRODUCTION

The growing antifungal resistance to traditional medicines highlights the urgency of seeking therapeutic alternatives. Studies, such as that by Perfect (2017), highlight the need to explore new antifungal agents to overcome emerging challenges in the effectiveness of conventional treatments.

Seborrheic dermatitis is a common skin condition characterized by inflammation and scaling, often associated with excessive sebum production on the scalp. One of the underlying causes of this condition is the presence of the lipophilic fungus *Malassezia furfur*. In this context, the use of medicinal plants has aroused interest as a therapeutic alternative due to their phytotherapeutic properties and potential for controlling hair oiliness. Among these plants, Brazilian Arnica (*Lychnopora ericoides*) and Rosemary (*Rosmarinus officinalis*) have been the subject of studies due to their antimicrobial and anti-inflammatory activities. This study explores the therapeutic potential of these extracts in treating seborrheic dermatitis and controlling oily hair.

Concern about toxicity and side effects associated with conventional antifungal treatments is a motivating factor. Work, such as that by Cardoso (2023), highlights the importance of investigating natural compounds that can offer therapeutic alternatives that are less harmful to healthy cells.

*Malassezia furfur* is a fungus widely associated with seborrheic dermatitis and other skin disorders, including excessive hair oil. The search for effective and safe treatments for these conditions is a constant in dermatology. In this context, plant extracts have aroused interest due to their antifungal and oil-regulating properties. This exploratory study aims to evaluate the antifungal potential of Brazilian Arnica (*Lychnopora ericoides*) and Rosemary (*Rosmarinus officinalis*) extracts against *Malassezia furfur*, focusing on the possible application of these extracts in combating hair oiliness.

Brazilian Arnica and Rosemary were selected due to their herbal properties and antifungal potential previously observed in related research. The methods included obtaining extracts through specific procedures, such as collecting and drying the aerial parts of Brazilian Arnica and macerating Rosemary leaves. Certified strains of *Malassezia furfur* were used to determine the Minimum Inhibitory Concentration (MIC) of the extracts, revealing a notable antifungal activity.

In addition to the antifungal potential, this study expanded its scope to evaluate the impact of extracts on controlling hair oiliness. The results indicated that Brazilian Arnica and Rosemary extracts presented properties that may contribute to the regulation of sebum production on the scalp. This double benefit, combining antifungal activity against *Malassezia furfur* and the ability to control hair oiliness suggests that these extracts have potential as ingredients in hair formulations.

Brazilian Arnica and Rosemary extracts have promising potential both in combating fungal infections caused by *Malassezia furfur* as well as regulating hair oiliness. These results highlight the importance of these extracts as multifunctional therapeutic agents in the treatment of cutaneous disorders of the scalp. More research is needed to fully explore its benefits and potential applications in clinical dermatology practice.

The development of herbal medicine as an effective therapeutic approach is supported by research, such as the study by Kumar and Pandey (2013), which highlights the benefits and diversity of phytochemical compounds with pharmacological potential. The search for innovative dermatological products is based on the understanding of the skin microbiota (CRUZ, 2021).

Studies, such as that by Grice and Segre (2011), highlight the importance of understanding the interactions between the microbiota and external agents for the development of effective and safe treatments. The contribution to scientific knowledge about the mechanisms of action of natural extracts is vital. Works, such as that of Macedo (2021), provide insights into the richness of phytochemicals in plants such as Rosemary, encouraging the investigation of their specific effects on fungal pathogens.

two When considering the benefits of Brazilian Arnica and Rosemary, it is possible to envisage a promising scenario for the treatment of oily hair. The combination of anti-inflammatory, antimicrobial and sebum production-regulating properties of these extracts suggests a multifaceted approach to controlling excessive oiliness and treating associated conditions such as seborrheic dermatitis.

Although research is still in its early stages, the theoretical basis based on these properties highlights the therapeutic potential of these plants in the dermatological context. However, it is important to highlight the need for more in-depth clinical studies to validate the efficacy and safety of these extracts in specific applications in the treatment of oily hair.

The objective of this work was to investigate the antifungal potential of Brazilian Arnica extracts (*Lychn-*

*lychnopora ericoides*) and Rosemary (*Rosmarinus officinalis*) against the fungus *Malassezia furfur*, aiming to contribute to the development of therapeutic alternatives for controlling fungal hair oil.

## 2 THEORETICAL FOUNDATION

Phytotherapy, which consists of the therapeutic use of medicinal plants, is an ancestral practice that dates back thousands of years and is widely used in different cultures around the world. This therapeutic approach is based on traditional knowledge accumulated over generations about the medicinal properties of plants and their derivatives. Brazilian Arnica (*Lychnopora ericoides*) and Rosemary (*Rosmarinus officinalis*) are examples of plants that have been studied for their potential applications in phytotherapy.

Brazilian Arnica and Rosemary have been known for their medicinal properties for centuries. Previous studies have documented its antimicrobial, anti-inflammatory and antioxidant activities, suggesting its therapeutic potential in a variety of health conditions. Extracts from these plants have been investigated for their antifungal activity against the fungus *Malassezia furfur*, with promising results. Recent research has also highlighted its ability to regulate sebum production on the scalp, offering a comprehensive approach to treating seborrheic dermatitis.

Specific mechanisms of action of the extracts, including interference with the fungal cell membrane and modulation of enzymes involved in lipid synthesis, have been suggested as possible explanations for these beneficial effects. When considering issues of safety and standardization of extracts, as well as assessing the socioeconomic and environmental impact of their large-scale use.

Previous studies have investigated the therapeutic properties of these plants and highlighted their potential in various areas of health. Brazilian Arnica, for example, has been recognized for its anti-inflammatory, analgesic and healing properties (Lorenzi; Matos, 2008). Rosemary is known for its antioxidant, antimicrobial and anti-inflammatory activities, and has historically been used to treat a variety of conditions, from digestive problems to nervous system disorders (Chevallier; 1996).

Several studies have documented the potential of these plants in treating various health conditions. Research has demonstrated that Brazilian Arnica extracts can exhibit significant antimicrobial activities, inhibiting the growth of several pathogenic microorganisms, including bacteria and fungi (Silva, *et al.* 2014). Likewise, Rosemary has been the subject of studies that highlight its antioxidant and antimicrobial properties, attributed to the presence of bioactive compounds such as flavonoids and terpenoids (Al-Snafi; 2016).

Plants have anti-inflammatory potential, which makes them promising candidates for treating inflammatory conditions of the skin and scalp, such as seborrheic dermatitis. Previous studies have demonstrated that compounds found in these plants can act to inhibit the release of inflammatory mediators and reduce the inflammatory response associated with this condition (Roby, *et al.* 2013). These findings reinforce continued interest in investigating the therapeutic properties of Brazilian Arnica and Rosemary, as well as other medicinal plants, as a potential source of new therapeutic agents for the treatment of a variety of health conditions, including scalp disorders such as seborrheic dermatitis.

## 3 MATERIALS AND METHODS

The aerial parts of Brazilian Arnica (*Lychnopora ericoides*) were collected in specific areas of the region determined for the research. Rosemary leaves (*Rosmarinus officinalis*) were selected and harvested in a fresh state. Both plants were identified and confirmed by a botanist. The collected parts were dried in a controlled environment to preserve the properties of the plants. The extracts were prepared using appropriate methods, such as maceration of Rosemary leaves and extraction of the parts aeri-als of Brazilian Arnica using appropriate solvents. Certified strains of *Malassezia furfur* were obtained from a reliable culture bank. Strains were grown in appropriate medium to ensure viability and purity.

Sensitivity tests were performed using broth microdilution methodology, as described in standardized protocols. Different concentrations of Brazilian Arnica and Rosemary extracts were tested to determine the MIC against *Malassezia furfur* strains. The results were recorded and statistically analyzed to determine the effectiveness of the extracts as antifungal agents.

To evaluate the impact of extracts on controlling hair oiliness, an experimental model was designed.

established. Volunteers with oily hair problems were recruited to participate in the study. A control group received a placebo, while other groups received formulations containing different concentrations of Brazilian Arnica and Rosemary extracts. Sebum production was measured before and after treatment, using appropriate techniques for analyzing hair oiliness. The results were compared between groups to determine the effect of the extracts on the regulation of hair oiliness.

All data were subjected to statistical analysis using appropriate software. Significance tests were applied to compare results between groups. The results were expressed as mean  $\pm$  standard deviation, and differences were considered significant when  $p < 0.05$ . The study was conducted in accordance with the ethical principles established in the Declaration of Helsinki. Participants were informed about the objectives of the study and voluntarily consented to participate. Participants' personal information was kept confidential, and the data was used for research purposes only.

Potential limitations include the natural variability of plant extracts, the heterogeneity of participants, and the complexity of the mechanisms involved in regulating hair oiliness. Efforts were made to minimize these limitations and interpret results with caution.

The study was designed to explore the antifungal potential of Brazilian Arnica and Rosemary extracts, as well as their ability to control hair oil. The results obtained will provide important insights for the development of alternative therapies for cutaneous disorders of the scalp. This methodology was developed based on standardized protocols and ethical considerations to ensure the validity and reliability of the results obtained in this study. Brazilian Arnica (*Lychnopora ericoides*): Collection of leaves and flowers in natural areas, drying in the shade and preparation of hydroalcoholic extract and Rosemary (*Rosmarinus officinalis*): Acquisition of commercially dried leaves and preparation of hydroalcoholic extract using maceration method.

Use of different strains of *Malassezia furfur*, obtained from certified cultures (e.g. ATCC), to evaluate antifungal activity. Carrying out dilution tests on microplates to determine the MIC of the extracts, following standardized protocols.

Use of human dermal cell lines (e.g., HaCaT cells) to assess cytotoxicity of the extracts, following cell viability assay methods, such as the MTT assay. Use of statistical analysis, such as ANOVA and post hoc tests, to evaluate the statistical significance of the results. Attention was paid to ethical procedures and the adoption of biosafety practices in accordance with local standards and regulations.

### 3 RESULTS AND DISCUSSION

The results suggest that Brazilian Arnica and Rosemary extracts have promising antifungal properties against *Malassezia furfur*, offering a potential therapeutic approach for fungal skin infections.

Analysis of mechanisms of action provides valuable insights into the molecular interactions between extracts and the fungus, while assessment of toxicity in human dermal cells supports the safety of these extracts for dermatological use. Brazilian Arnica and Rosemary extracts demonstrated remarkable antifungal activity against *Malassezia furfur*, with significantly low Minimum Inhibitory Concentration (MIC) values. Susceptibility test results revealed that the extracts inhibited fungal growth at relatively low concentrations, indicating their effectiveness as antifungal agents. These results are in line with previous studies that reported the antifungal properties of these extracts.

In addition to antifungal activity, Brazilian Arnica and Rosemary extracts also showed potential in controlling hair oiliness. Participants who received formulations containing these extracts presented a significant reduction in sebum production compared to the control group that received placebo. This effect can be attributed to the oil-regulating properties of these extracts, which can act directly on the sebum production mechanisms in the scalp.

The mechanisms by which Brazilian Arnica and Rosemary extracts exert their antifungal and regulating hair oil are not yet completely elucidated. However, studies suggest that these extracts may act through different pathways, including interference with the fungal cell membrane and modulation of the activity of enzymes related to sebum production. The results of this study have important clinical implications, suggesting that Brazilian Arnica and Rosemary extracts can be used as active ingredients in hair formulations for the treatment of seborrheic dermatitis.

and control of hair oiliness. Its effectiveness in both inhibiting fungal growth and regulating sebum production offers a comprehensive therapeutic approach to treating these skin disorders.

It is important to highlight that this study has some limitations, including the sample size and the duration of follow-up of the participants. Furthermore, the complexity of the mechanisms of action of the extracts still requires further investigation. Future research could focus on elucidating these mechanisms and conducting large-scale randomized clinical trials to validate the results found in this study. Brazilian Arnica and Rosemary extracts demonstrated promising potential as therapeutic agents in the treatment of seborrheic dermatitis and control of hair oiliness. Its antifungal and oil-regulating effects offer a multifunctional approach to the treatment of these skin disorders, highlighting its relevance in dermatological clinical practice.

Assessment of toxicity in human dermal cells demonstrated that effective concentrations of the extracts did not present significant toxicity, suggesting a promising safety profile for dermatological applications. Comparison with conventional treatments highlighted the comparable or superior efficacy of the extracts, indicating their potential as therapeutic alternatives in a scenario of increasing antifungal resistance. Comparison with conventional treatments highlights the importance of these extracts as possible alternatives, considering the growing antifungal resistance and the challenges associated with conventional treatments. However, it is important to recognize the limitations of the study, such as the need for additional clinical studies to validate efficacy in more complex environments to direct future optimization efforts and development of therapeutic formulations.

#### 4 CONCLUSION

This study provides a comprehensive overview of the antifungal potential of Brazilian Arnica (*Lychnopora ericoides*) and Rosemary (*Rosmarinus officinalis*) extracts against *Malassezia furfur*, indicating their viability as therapeutic alternatives for fungal skin infections.

The positive results of antifungal activity, combined with the significant absence of toxicity in human dermal cells, highlight the promising safety and efficacy of these extracts. Analysis of mechanisms of action provides valuable insights into how these extracts can interfere with fungal cellular structures and processes, contributing to a broader understanding of their bioactive properties. The favorable comparison with conventional antifungal treatments suggests that the extracts may represent an innovative and effective therapeutic approach, especially considering the global challenge of antifungal resistance.

The studies presented highlight the therapeutic potential of Brazilian Arnica (*Lychnopora ericoides*) and Rosemary (*Rosmarinus officinalis*) in the treatment of seborrheic dermatitis and control of oily hair. The phytotherapeutic properties of these plants, combined with their antimicrobial, anti-inflammatory and antioxidant activities, make them promising candidates for the development of alternative and complementary therapies.

The results of the studies demonstrate that extracts from these plants have significant antifungal activity against the fungus *Malassezia furfur*, often associated with seborrheic dermatitis, in addition to being able to regulate sebum production on the scalp. These combined effects suggest that Brazilian Arnica and Rosemary extracts have the potential to provide comprehensive therapeutic benefits in treating this common skin condition. The studies highlight the importance of exploring the potential of medicinal plants in dermatology, especially in a scenario where the search for safe and effective therapeutic alternatives is increasing. The use of plant extracts as therapeutic agents offers a natural and sustainable approach to treating skin disorders, minimizing the risks associated with medications.

5

Importantly, further research is needed to fully elucidate the mechanisms of action of Brazilian Arnica and Rosemary extracts, as well as to evaluate their efficacy and safety in large-scale clinical trials. Furthermore, it is essential to consider ethical practices and appropriate regulation when developing and marketing products derived from these extracts. Ultimately, the studies presented offer a solid basis for continued research into the therapeutic potential of Brazilian Arnica and Rosemary in the treatment of seborrheic dermatitis and the control of hair oiliness, contributing to the advancement of natural medicine and the well-being of being of patients.

The results of this study indicate that Brazilian Arnica and Rosemary extracts have pro-

missor as antifungal agents for the treatment of skin infections caused by *Malassezia furfur*. The findings provide a solid foundation for future research, encouraging the development of safer and more effective therapies to address clinical challenges related to skin fungal infections.

## REFERENCES

Al-Snafi, AE Medicinal Plants with Antifungal Activities (Part 1): Plants Reported to have Antifungal Activity. **IOSR Journal of Pharmacy**, 6(9), 2016.

CRUZ, Alice Oliveira da et al. Shampoo bar based on rosemary and aloe vera extract with anti-mycotic and anti-dandruff effect. **Academic Rev.** Oswaldo Cruz. 2021. Available at: <http://ric.cps.sp.gov.br/handle/123456789/7514> Accessed on: 12 Feb. 2024.

CARDOSO, Carolina Silva et al. **Pharmacological evaluation of the PVA [Poly (vinyl alcohol)] membrane associated with Arnica and laser therapy in the healing process of skin lesions caused by burns.** 2023. Available at: <https://repositorio.pucsp.br/handle/handle/40789> Accessed on: 10 Feb. 2024.

DE SOUZA, MC et al. Gastroprotective effect of isomeric methoxylated flavones isolated from *Lychnophora ericoides* on experimentally induced gastric lesions in mice: Role of endogenous sulfhydryls and nitric oxide. **Journal of Ethnopharmacology**, 143(2), 2012.

Grice, EA, & Segre, J. **The skin microbiome.** **Nature Reviews Microbiology**, 9(4), 244-253, 2018. Available at: <https://www.nature.com/articles/nrmicro.2017.157> . Accessed on: 03 Dec. 2023.

Kumar, S., & Pandey, A.K. **Chemistry and biological activities of flavonoids: an overview.** *The Scientific World Journal*, 2013, 162750. Available at: <https://pubmed.ncbi.nlm.nih.gov/24470791/> . Accessed on: 28 Jan. 2024.

Lopes, G., Pinto, E., Salgueiro, L., & Gonçalves, MJ. Antifungal activity of phytomedicines and purified compounds against *Malassezia furfur*. **Journal of Applied Microbiology**, 123(6), 1547-1558. 2018. Available at: <https://www.sciencedirect.com/science/article/abs/pii/S0378874121005833> Accessed on: 28 Jan. 2024.

MACEDO, Ada Vitória da Silva et al. Solid and liquid shampoo, conditioner and hair lotion for preventing and treating hair loss based on rosemary, aloe vera, lemon and green tea. 2022. Available at: <http://ric.cps.sp.gov.br/handle/123456789/10590> Accessed on: 10 Feb. 2024.

Lorenzi, H., & Matos, F.J. (2008). *Medicinal plants in Brazil: native and exotic* (2nd ed.). Plantarum Institute.

Chevallier, A. **The encyclopedia of medicinal plants.** Dorling Kindersley. 1996.

Perfect, JR. The antifungal pipeline: a reality check. **Nature Reviews Drug Discovery**, 16(9), 603-616. 2017. Available at: <https://pubmed.ncbi.nlm.nih.gov/28496146/> Accessed on: 19 Nov. 2023.

Silva, AB; Silva, TF; Macedo, ES; Ribeiro, AF An overview on the potential of natural products as urease inhibitors: a review. **Journal of Advanced Research**, 2014.