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Safe and Effective Management of Tinea Cruris with *Rhinacanthus nasutus* Root Extract Gel (0.2% Rhinacanthin C): A Case Report on Clinical and Mycological Outcomes

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Case Report

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ABSTRACT

Tinea cruris is a dermatophyte infection affecting the genital area, groin, buttocks, and inner thighs, commonly presenting with erythema, desquamation, pruritus, and a burning sensation. While antifungal medications are standard treatments, resistance and recurrence are increasing concerns. In Thai traditional medicine, herbal remedies are also considered for the treatment of fungal skin diseases. This case report described the management of tinea cruris in a 23-year-old male patient who had been suffering from the condition for one year. The patient had previously been treated with ketoconazole cream for 5-6 months, followed by a topical steroid with anti-inflammatory, antibacterial, and antifungal properties for one month. Although itching improved, the lesions persisted and worsened after treatment stopped. Microscopic examination using KOH preparation revealed septate hyphae with arthroconidia from the skin lesion. The patient was then treated with *Rhinacanthus nasutus* root extract gel (0.2% rhinacanthin C), applied to the affected areas twice daily for eight weeks. Clinical improvement was observed within two weeks of treatment initiation, and KOH preparations remained negative from the second week through the end of the treatment period. The patient tolerated the herbal gel well, with no adverse effects reported. There was no recurrence of tinea cruris during one year of follow-up. This case report suggests that *R. nasutus* root extract gel, containing 0.2% rhinacanthin C, was effective in relieving both the clinical symptoms and mycological aspects of dermatophytosis. The gel formulation may be a safe and effective topical alternative for the management of tinea cruris.

Keywords: Tinea cruris; Rhinacanthus nasutus root extract gel; rhinacanthin C; dermatophytosis.

1. INTRODUCTION

Dermatophytosis, also known as tinea or ringworm, is a superficial fungal infection of the skin caused by dermatophytes belonging to three primary genera: *Trichophyton*, *Epidermophyton*, and *Microsporum*. These fungi primarily infect the keratinized tissues, including the skin, hair, and nails. Clinical manifestations of the infection include erythematous rashes, desquamation, pruritus, and a burning sensation. Tinea infections are categorized based on the affected body part, such as Tinea corporis (body), Tinea capitis (scalp), Tinea faciei (face), Tinea pedis (feet/athlete's foot), Tinea manuum (hands), Tinea cruris (groin and buttocks/jock itch), and Tinea unguium (nails/onychomycosis) (Luplertlop & Suwanmanee, 2013).

Treatment of tinea typically involves the use of antifungal drugs, which can be administered either topically or orally, depending on the severity, extent, and location of the infection. However, the increasing prevalence of antifungal-resistant dermatophytes has become a significant clinical concern, contributing to treatment failure and recurrent infections (Sacheli & Havette, 2021; Kruithoff et al., 2024). The increase in resistance presents a significant challenge to effective clinical management and illustrates the need for alternative therapeutic options.

Rhinacanthus nasutus (L.) Kurz, a shrub of the Acanthaceae family, is widely distributed across tropical regions, including Southeast Asia, southern China, and India. In Thai traditional medicine, the leaves and roots of *R. nasutus* have been utilized for the treatment of skin conditions, particularly ringworm, tinea versicolor, and eczema (Thailand Association of Traditional Medicine School Wat Phra Chetuphon (Wat Pho) Tha Thien Pranakorn, 1869; Petplai et al., 1979). Both plant parts contain rhinacanthin C, a naphthoquinone identified as the principal bioactive substance responsible for antifungal properties (Pruksakorn et al., 2018). Previous studies have led to the development of a topical herbal gel formulation from *R. nasutus* root extract for the treatment of fungal skin infections. This formulation, containing 0.2% rhinacanthin C, has been studied for dermal irritation and corrosion testing in accordance with the OECD Guideline, Test No. 404 (OECD Guideline for Testing of Chemicals: Acute Dermal Irritation/Corrosion). Results indicated that the gel did not exhibit skin irritation or corrosion in New Zealand White rabbits, supporting its safety for topical use (Pruksakorn et al., n.d.). The present report aimed to demonstrate the effectiveness of the *R. nasutus* root extract gel containing 0.2% rhinacanthin C for the management of dermatophytosis.

2. PRESENTATION Of CASE

A 23-year-old male with a body mass index (BMI) of 25.3 kg/m² presented to the hospital with a one-year history of erythema, desquamation,

severe pruritus, discoloration, and burning sensations localized to the groin and buttocks. The patient had previously undergone treatment with a topical ketoconazole for 5-6 months, followed by a combination topical drug containing 0.05% betamethasone, 0.1% gentamicin, 1.0% tolnaftate, and 1.0% iodochlorhydroxyquin for one month. Despite prolonged use, both treatments failed to resolve the lesions. Following discontinuation of the topical treatment, the patient's symptoms worsened, with increased pruritus and progressive spread of the lesions. Microscopic examination of skin scraping using potassium hydroxide (KOH) preparation revealed the presence of septate hyphae with arthroconidia, confirming the diagnosis of tinea cruris. The patient was treated with *R. nasutus* root extract gel containing 0.2% rhinacanthin C, applied to the lesions twice daily for 8 weeks. Follow-up visits were scheduled every two weeks for repeat KOH preparations for mycological evaluation and clinical assessment of symptoms, including erythema, desquamation, pruritus, and burning throughout the course of treatment. Clinical chemistry and hematological analysis were evaluated at baseline and at the end of the follow-up visit (a two-week follow-up after discontinuation of treatment, Follow up 5).

Following the initiation of treatment, the patient showed remarkable clinical improvements. By week 2, the clinical severity score had decreased by 7 points. By week 8, all initial symptoms, including erythema, desquamation, pruritus, and burning, had completely resolved (Table 1). The intervention effectively alleviated clinical symptoms and improved lesion appearance, as shown in Figure 1. Mycological examination using KOH preparation turned negative by the second week of treatment and remained negative throughout the treatment period, indicating effective fungal clearance. At a follow-up visit two weeks post-treatment, the patient remained asymptomatic, and a repeat KOH preparation continued to show no evidence of fungal elements, indicating a sustained therapeutic response. Clinical chemistry and hematological analysis revealed no notable abnormalities (Table 2), and no adverse effects were reported during the course of treatment, suggesting good tolerability of the herbal formulation. Notably, there was no recurrence of tinea cruris during one year of follow-up. These findings support the potential safety and efficacy of *R. nasutus* root extract gel containing 0.2% rhinacanthin C as a topical treatment option for tinea cruris.

Table 1. Assessment of clinical symptoms at baseline and follow-up visits. The symptoms were scored on a scale of 0 to 3 (0 = absent, 1 = mild, 2 = moderate, 3 = severe).

Date	Erythema	Desquamation	Pruritus	Burning	Clinical severity score
Baseline (12/06/2024)	2	3	3	2	10
Follow up 1 (26/06/2024)	1	1	1	0	3
Follow up 2 (10/07/2024)	0	0	1	0	1
Follow up 3 (24/07/2024)	0	0	1	0	1
Follow up 4 (07/08/2024)	0	0	0	0	0
Follow up 5 (21/08/2024)	0	0	0	0	0

Table 2. Clinical Chemistry and Hematology

	Results			
Test	**Baseline**	**Follow Up 5**	**Units**	**Reference Range**
Clinical Chemistry:				
Total protein	7.9	7.7	g/dL	6.60-8.30
Albumin	4.7	4.6	g/dL	3.50-5.30
Total Bilirubin	1.01	0.75	mg/dL	0.10-1.20
AST (SGOT)	18	18	U/L	0.00-35.00
ALT (SGPT)	13	9	U/L	0.00-45.00
Alkaline Phosphatase	69	64	U/L	30.00-120.00
Random Blood Sugar	82	88	mg/dL	70.00-100.00

	Results			
Test	**Baseline**	**Follow Up 5**	**Units**	**Reference Range**
Hematology:				
WBC	8.18	8.91	$10^3/\mu L$	4.5-11.0
RBC	5.10	5.12	$10^6/\mu L$	4.3-5.9
HGB	15.1	15.2	g/dL	13.5-17.5
HCT	45.9	45.8	%	41-53
MCV	90	90	fL	80-100
MCH	29.7	29.7	pg/cell	25.4-34.6
MCHC	33.0	33.1	%Hb/cell	31-36
PLT	215	207	$10^3/\mu L$	150-400
Neutrophil	45	51	%	45-75
Lymphocyte	42	38	%	20-45
Monocyte	6	6	%	2-10
Eosinophil	7	4	%	4-6
Basophile	0	1	%	0-1

Baseline: 12/06/24
KOH preparation : septate hyphae with arthroconidia

Follow up 1 : 26/06/24, Treatment for 2 weeks
KOH preparation : negative

Follow up 2 : 10/07/24, Treatment for 4 weeks
KOH preparation : negative

Follow up 3 : 24/07/24, Treatment for 6 weeks
KOH preparation : negative

Follow up 4 : 07/08/24, Treatment for 8 weeks
KOH preparation : negative

Follow up 5 : 21/08/24, Washout period for 2 weeks
KOH preparation : negative

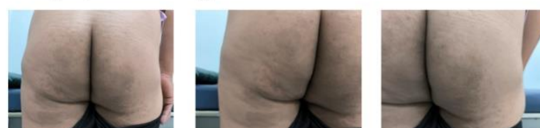

Fig. 1. Photographs of the lesion at baseline and follow up visits

3. DISCUSSION

Tinea cruris, commonly referred to as jock itch, is a superficial skin infection affecting the genital area, groin, buttocks, and inner thighs. This condition is caused by dermatophytes, and it generally responds to topical antifungal therapy. Antifungal agents used in the treatment of tinea infections are pharmacologically classified into several categories, including azoles, allylamines, benzylamines, morpholines, thiocarbamates, hydroxypyridines, and miscellaneous compounds. These agents exhibit either fungistatic or fungicidal activity through various mechanisms, most notably by disrupting the integrity of the fungal cell membrane via inhibition of ergosterol biosynthesis—a sterol that is essential component of the fungal cell membrane. The depletion of ergosterol increases membrane permeability, resulting in loss of cellular homeostasis leading to fungal cell death. In addition, some agents impair nucleic acid and protein synthesis, compromising fungal viability (Luplertlop & Suwanmanee, 2013; Sookvanichsilp, 2021).

This case report described the management of tinea cruris in a male patient who had been suffering from the condition for one year. The patient had previously undergone treatment with a topical ketoconazole cream, followed by a combination topical drug containing corticosteroid, antibacterial and antifungal agents but both treatments failed to resolve the skin lesions. Ketoconazole is an antifungal agent belonging to the azole class, exerts its antifungal effect by inhibiting the enzyme lanosterol 14α-demethylase, which plays a critical role in the biosynthesis of ergosterol. Inhibition of this enzyme results in depletion of ergosterol and accumulation of toxic sterol intermediates, ultimately leading to disruption of cell membrane integrity and fungal cell death (Sookvanichsilp, 2021). Despite continuous use of the medication for over five months, the skin lesions did not resolve. Prolonged exposure to the drug may have contributed to the development of antifungal resistance in the fungal pathogen.

Tolnaftate and iodochlorhydroxyquin are antifungal agents included in the topical steroid formulation previously used by the patient for a duration of one month. Tolnaftate exerts its antifungal effect by disrupting the synthesis of the fungal cell membrane through inhibition of the enzyme squalene monooxygenase, which is involved in the biosynthesis of ergosterol (Sookvanichsilp, 2021). Iodochlorhydroxyquin exhibits broad spectrum antimicrobial activity by inhibiting enzymes involved in DNA replication, thereby arresting microbial growth and inducing cell death (Ratsadornwijit, 2020). However, this combination topical drug provided only transient relief from pruritus and failed to achieve complete resolution of the lesions. Topical corticosteroids are not only effective anti-inflammatory agents but also exert immunosuppressive effects. While the formulation contained both antifungal and antibacterial agents, prolonged use of corticosteroids may have compromised skin integrity and increased the risk of adverse events. In the management of tinea, the use of topical corticosteroids containing antibacterial and antifungal agents is recommended for short-term use only, typically no longer than seven days, after which therapy should be continued with antifungal monotherapy (Sookvanichsilp, 2021). Furthermore, extended use of corticosteroid-antifungal combination drug without effective fungal eradication may contribute to antifungal resistance and weaken the skin at the lesion site, thereby complicating the treatment of tinea infections.

Extracts of *R. nasutus* have been reported to possess broad-spectrum antifungal activity against a variety of pathogenic fungi, such as *Trichophyton rubrum*, *T. mentagrophytes*, *Microsporum canis*, *M. gypseum*, *Epidermophyton floccosum*, *Aspergillus niger*, *Penicillium chrysogenum*, *Candida albicans*, *C. tropicalis*, *Malassezia furfur*, and *M. globosa* (Pruksakorn et al., 2018; Darah & Jain, 2001; Deepa & Ravichandran, 2008; Wisuitiprot, 2012). Previous investigations into the effects of *R. nasutus* leaf extract on dermatophyte growth have shown that the extract exhibited fungistatic activity at concentrations below the minimum inhibitory concentration (MIC) and fungicidal activity at concentrations above the MIC. Mechanistically, the extract disrupted the fungal cell wall, leading to the formation of cytopathological and membrane structural degeneration, which ultimately resulted in cell lysis and death (Darah & Jain, 2001). The aforementioned data indicated that *R. nasutus* extract exhibited antifungal activity against dermatophytes, which are responsible for tinea infections, as well as against Malassezia sp., the causative agents of pityriasis versicolor. These results are consistent with the traditional use of *R. nasutus* in Thai traditional medicine for the treatment of dermatological conditions such as ringworm and tinea versicolor (Thailand

Association of Traditional Medicine School Wat Phra Chetuphon (Wat Pho) Tha Thien Pranakorn, 1869; Petplai et al., 1979). Therefore, herbal products containing the root extract of *R. nasutus* might have therapeutic potential for the treatment of these fungal infections.

In this case report, the patient presented with classic symptoms of dermatophytosis, including erythema, desquamation, severe pruritus, discoloration, and a burning sensation localized to the groin and buttocks. Microscopic examination of skin scrapings using KOH preparation revealed the presence of septate hyphae with arthroconidia. Arthroconidia are known to play a crucial role in the transmission and virulence of dermatophytes. Studies in animal models have demonstrated that arthroconidia are more virulent than hyphae or microconidia, acting as primary infective propagules that colonize the skin surface and subsequently invade the stratum corneum (Patel et al., 2017).

The patient was treated with *R. nasutus* root extract gel containing 0.2% rhinacanthin C, applied to the lesions twice daily for 8 weeks. Notable clinical improvement was observed within the second week of treatment. By the end of the treatment period, all initial symptoms, including erythema, desquamation, pruritus, and burning, had resolved completely. Mycological examination by repeat KOH preparation showed clearance of fungal elements beginning in the second week and maintained until the end of treatment. The treatment was well tolerated, with no adverse effects reported. These clinical and mycological outcomes support the efficacy and safety of *R. nasutus* root extract gel containing 0.2% rhinacanthin C for the treatment of dermatophytosis.

4. CONCLUSION

This case report highlights the successful treatment of chronic, treatment-resistant tinea cruris in a 23-year-old male using *R. nasutus* root extract gel containing 0.2% rhinacanthin C. The patient experienced rapid and sustained clinical and mycological improvement, with complete resolution of symptoms by week 8 and no recurrence during a one-year follow-up period. The absence of adverse effects and normal laboratory findings further support the safety and tolerability of this herbal formulation. These results suggest that *R. nasutus* root extract gel containing 0.2% rhinacanthin C may be an effective and well-tolerated topical alternative for the management of tinea cruris, particularly in cases unresponsive to conventional antifungal therapies. Given the rising interest in evidence-based herbal medicine, further clinical studies are warranted to confirm these findings.

CONSENT

Written informed consent was obtained from the patient for the publication of the clinical information and accompanying images include in this case report.

ETHICAL APPROVAL

All authors hereby declare that the treatment protocol was reviewed and approved by the Ethics Committee of the Institute of Dermatology, Bangkok, Thailand (Study Code: IRB/IEC 019/2566; Date of Approval: 16 October 2023). The clinical management was performed in accordance with the ethical standards, such as the Declaration of Helsinki, the Belmont Report, the CIOMS Guidelines, and the International Conference on Harmonization in Good Clinical Practice (ICH-GCP).

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Artificial intelligence (AI) tools, including [ChatGPT by OpenAI and QuillBot by Course Hero, Inc.], were used to assist in language editing and grammar correction of the manuscript. All AI-generated content was carefully reviewed and validated by the authors to ensure accuracy and integrity. The authors take full responsibility for the final content of the manuscript.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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