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Identification of Fungal Agents Causing Onychomycosis in Elderly at Banjar Dinas Batang, Bali

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ABSTRACT

*Onychomycosis is a fungal nail infection commonly found in the elderly due to aging, humid environments, and poor hygiene. This study aimed to identify the fungal species causing onychomycosis and describe infection characteristics among elderly individuals in Banjar Dinas Batang, Karangasem, Bali. A descriptive observational method was applied to 30 elderly participants selected through purposive sampling, with nail samples analyzed using Sabouraud Dextrose Agar and lactophenol cotton blue staining. Results showed that 2 out of 30 samples (6.67%) were positive for fungal infection, with *Trichophyton mentagrophytes* as the dominant species. Infection was more frequent in females (57%) than males (43%), with poor personal hygiene and humid environment as main risk factors. Although the prevalence was low, onychomycosis poses a risk to the quality of life of elderly individuals. This study highlights the importance of early detection and nail hygiene education for prevention and recommends molecular diagnostic methods in future research to improve fungal species identification accuracy.*

Keywords: Elderly; personal hygiene; onychomycosis; fungi; *Trichophyton mentagrophytes*

ABSTRAK

Onikomikosis adalah infeksi jamur pada kuku yang umum terjadi pada lansia akibat faktor usia, lingkungan lembap, dan kebersihan yang kurang. Penelitian ini bertujuan mengidentifikasi spesies jamur penyebab onikomikosis dan karakteristik infeksi pada lansia di Banjar Dinas Batang, Karangasem, Bali. Metode deskriptif observasional digunakan dengan pemeriksaan kultur jamur pada 30 lansia yang dipilih secara purposive sampling. Hasil menunjukkan 2 dari 30 sampel (6,67%) positif terinfeksi jamur, dengan *Trichophyton mentagrophytes* sebagai spesies dominan. Infeksi lebih sering ditemukan pada perempuan (57%) dibanding laki-laki (43%),

dengan faktor risiko utama kebersihan personal yang buruk dan paparan lingkungan lembap. Meskipun prevalensi rendah, infeksi ini berisiko menurunkan kualitas hidup lansia. Penelitian ini menegaskan pentingnya deteksi dini dan edukasi kebersihan kuku untuk pencegahan, serta merekomendasikan penggunaan metode diagnostik molekuler pada studi lanjutan untuk meningkatkan akurasi identifikasi jamur.

Kata Kunci: Lansia; kebersihan personal; onikomikosis; jamur; *Trichophyton mentagrophytes*

INTRODUCTION

Onychomycosis is a fungal infection that affects the nail tissue of both fingers and toes and is one of the most common nail disorders worldwide. This condition not only causes aesthetic concerns but also pain, discomfort, and can negatively impact the quality of life, especially in the elderly. Globally, approximately 10% of the population is affected by onychomycosis, with a significantly higher prevalence among the elderly, reaching 20–50% (1). In Indonesia, the prevalence ranges from 3.5% to 4.7%, with many cases remaining underdiagnosed (2). Major risk factors in the elderly include immunosenescence, peripheral circulation disorders, diabetes mellitus, nail trauma, and limitations in self-care of the nails (3). In addition, exposure to humid tropical environments, such as in Banjar Dinas Batang, Karangasem, Bali, provides an ideal medium for pathogenic fungal growth, particularly when compounded by poor practices such as walking barefoot and inadequate nail hygiene (4). A 2025 study (5) found that elderly individuals working in humid environments have a 3.7 times higher risk of developing onychomycosis than those living in dry areas.

Etiologically, onychomycosis can be grouped into three major categories: dermatophytes (e.g., *Trichophyton rubrum* and *T. mentagrophytes*), yeasts (*Candida* spp.), and non-dermatophyte fungi (e.g., *Aspergillus* spp., *Fusarium* spp.) (6). A 2024 clinical study (7) in Jakarta reported that 62% of onychomycosis cases were caused by dermatophytes, 23% by *Candida albicans*, and 15% by non-dermatophyte fungi. However, specific fungal identification is often neglected, especially in areas with limited laboratory facilities.

Diagnostic methods commonly include direct examination with KOH solution, culture on Sabouraud Dextrose Agar (SDA), histopathological staining (PAS), and molecular techniques such as Polymerase Chain Reaction (PCR). While KOH examination is rapid and inexpensive, its sensitivity varies depending on sample quality and examiner expertise (1). PAS histopathology shows high sensitivity, up to 84%, whereas PCR targeting ITS-rDNA can identify fungi more specifically and rapidly, with a low risk of false negatives (8). A 2021 study (9) confirmed that combining PAS and PCR increases diagnostic accuracy up to 95% compared to culture alone.

Treatment of onychomycosis generally involves systemic and topical approaches. Systemic therapy with terbinafine or itraconazole is the primary choice due to good nail tissue penetration but must be used cautiously in the elderly due to potential hepatotoxicity (1). Topical therapy with efinaconazole or ciclopirox is recommended for mild to moderate cases. Combined therapy and personal hygiene education have been shown to effectively reduce recurrence, as a 2022 study (10) reported a 40% reduction in relapse among elderly participants following routine nail hygiene education.

In Indonesia, data on onychomycosis in rural elderly populations are limited. Most studies focus on workers, hospital patients, or urban populations. Elderly individuals in rural areas have specific risk factors, such as limited access to healthcare, lack of

awareness about fungal infections, and traditional lifestyles that increase the likelihood of nail fungal infections. Therefore, this study aims to identify the fungal species causing onychomycosis among elderly individuals in Banjar Dinas Batang, Karangasem, Bali, and to evaluate infection characteristics and potential risk factors. The findings are expected to provide epidemiological data to support prevention, early diagnosis, and community-based management of onychomycosis tailored to local conditions.

METHODS

This study employed a descriptive method with direct observation and fungal culture to identify the causative agents of onychomycosis in elderly individuals in Banjar Dinas Batang, Karangasem, Bali. Sample collection was conducted in Desa Besakih, with laboratory analysis performed at the Parasitology and Mycology Laboratory, STIKES Wira Medika Bali, Denpasar. The study was conducted from February to April 2025.

The study population consisted of elderly individuals (≥ 60 years) in Banjar Dinas Batang. A total of 30 participants were selected using purposive sampling based on inclusion criteria (clinical signs of onychomycosis and willingness to sign informed consent) and exclusion criteria (severely damaged nails or previous use of antifungal medication).

The research procedure included three main stages:

- a) Pre-analytical stage: nail samples were collected, stored in sterile containers, and labeled with participant identification;
- b) Analytical stage: fungal culture was performed on Sabouraud Dextrose Agar (SDA), and microscopic identification was conducted using Lactophenol Cotton Blue staining;
- c) Post-analytical stage: results were interpreted based on colony growth and fungal morphology.

Data were analyzed descriptively to determine prevalence and infection characteristics. Positive and negative fungal infections were presented as percentages. Fungal species were identified based on macroscopic characteristics (colony color, shape, and texture on SDA) and microscopic structures (hyphae and spores). Species classification was based on morphological traits, such as *Trichophyton mentagrophytes*, which exhibits cream-white colonies with microconidia shaped like water droplets. Risk factors, including personal hygiene and environmental conditions, were also analyzed. Data were presented in tables and figures to facilitate interpretation. The study received ethical approval from the Health Research Ethics Committee of STIKES Wira Medika, with approval number 540/E1.STIKESWIK/EC/VI/2025, ensuring the protection of participants' rights..

RESULTS

This study involved 30 elderly participants from Banjar Dinas Batang, Desa Besakih, Rendang Subdistrict, Karangasem Regency, Bali. All 30 participants (100%) were residents of the study area. Participant characteristics were described by gender and age, obtained through direct observation and interviews.

Table 1. Participant Characteristics by Gender

Characteristic	Category	Frequency (n)	Percentage (%)
Gender	Male	13	43
	Female	17	57
Total		30	100

Table 1 shows that female participants were more numerous, totaling 17 individuals (57%), while males were 13 (43%).

Table 2. Onychomycosis Examination Results

No	Examination Result	Number of Samples	Percentage (%)
1	Positive Onychomycosis	2	6.67
2	Negative Onychomycosis	28	93.33

Table 2 indicates that of the 30 nail samples examined, 2 samples (6.67%) tested positive for onychomycosis, while 28 samples (93.33%) were negative. These findings suggest a relatively low prevalence of onychomycosis among elderly individuals in Banjar Dinas Batang.

DISCUSSION

Onychomycosis is commonly caused by dermatophytes such as *Trichophyton mentagrophytes* and *T. rubrum*, as well as non-dermatophytes like *Candida* spp. and *Aspergillus* spp. (6). The infection is more frequent in elderly individuals due to declining immunity, suboptimal personal hygiene, and exposure to humid environments (1).

This study identified *Trichophyton mentagrophytes* as the primary causative agent of onychomycosis in elderly participants from Banjar Dinas Batang, Karangasem, Bali. This finding aligns with a 2022 study (10) reporting that dermatophytes account for 80–90% of onychomycosis cases in tropical regions. High humidity and poor hygiene were key risk factors in fungal nail infection development. A 2020 study (4) indicated that areas with high humidity, such as mountain slopes, strongly support dermatophyte growth. In Banjar Dinas Batang, located near Mount Agung, high air humidity and frequent exposure to soil and water increase infection risk.

Poor hygiene and infrequent nail trimming were found to elevate the risk of onychomycosis among the elderly, consistent with a 2019 study (11) on oil palm farmers in Jambi. However, some findings differed: unlike a 2022 study (12) suggesting males are more susceptible due to physical activity, this study found females had a higher infection rate (57%), possibly due to more frequent exposure to water and soil in domestic work. Additionally, while a 2024 study (13) identified *Candida* spp. as the main causative agent, this study only detected *Trichophyton mentagrophytes*. Differences may be attributed to environmental factors, occupation, and identification methods.

Environmental conditions and personal hygiene appear to play a key role in onychomycosis occurrence in Banjar Dinas Batang. Despite the relatively low prevalence (6.67%), fungal nail infections can reduce quality of life, causing discomfort, pain, and secondary bacterial infections if untreated. Education on nail hygiene and appropriate footwear can effectively prevent nail fungal infections. Periodic health examinations for the elderly, especially those with early signs of onychomycosis, can facilitate early detection and more effective treatment.

Limitations of this study include reliance on culture and microscopic techniques without molecular approaches (PCR or DNA sequencing) for more accurate species identification, a relatively small sample size (30 participants) limited to a single area, restricting generalizability, absence of antifungal sensitivity testing, and lack of

quantitative measurements of environmental variables such as humidity, temperature, and participant habits that could further inform risk factor analysis.

CONCLUSION

This study identified *Trichophyton mentagrophytes* as the primary cause of onychomycosis among elderly individuals in Banjar Dinas Batang, with key risk factors including humid environments and suboptimal personal hygiene. Limitations of culture methods and small sample size restrict generalization. Future studies are recommended to incorporate molecular techniques, expand sample size, and perform antifungal sensitivity testing. Practically, nail hygiene education, periodic screening, and collaboration with local health centers are essential for more effective management.

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