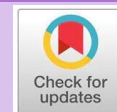


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The Relationship between Personal Hygiene and the Incidence of Tinea Versicolor among Students at Madrasah Ulumul Quran (MUQ) Pagar Air Islamic Boarding School

Teuku Romi Imansyah Putra^{1*}, Muhammad Yusuf², Hafidh Maulana¹, Amran Wali³

¹Department of Parasitology, Faculty of Medicine, Syiah Kuala University, Banda Aceh, Indonesia

²Department of Digestive Surgery, Faculty of Medicine, Syiah Kuala University, Banda Aceh, Indonesia

³Department of Global Health, University of Washington, Seattle, United States of America



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*) Corresponding author:

E-mail:
teukuromiimansyahputra@usk.ac.id

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Abstract

Tinea versicolor is an infectious dermatological condition caused by fungi, affecting a substantial proportion of the global population. It is particularly prevalent in tropical regions, including Indonesia. Madrasah Ulumul Quran (MUQ) Pagar Air Islamic Boarding School is a densely populated area where students often exhibit poor hygiene practices, potentially increasing the incidence of the disease. The etiological agent responsible for this infection is the *Malassezia furfur* species, which can be prevented through the adoption of proper personal hygiene behaviors. This study aims to determine the association between personal hygiene and the incidence of Tinea versicolor at MUQ Pagar Air Islamic Boarding School. This is an observational study using a cross-sectional design. Data collection was conducted through interviews using questionnaires. The diagnosis of Tinea versicolor was based on the results of the 10% KOH examination. Sixty students from grades X, XI, and XII participated in the study, of which six were diagnosed with Tinea versicolor. The study found that the majority of the population performed good personal hygiene, with only 10% of the subjects diagnosed with Tinea versicolor. Chi-square analysis revealed a p-value of 0.000 (<0.05), indicating a significant association between personal hygiene and the incidence of Tinea versicolor at MUQ Pagar Air Islamic Boarding School. The majority of students at MUQ Pagar Air Islamic Boarding School practiced good personal hygiene and did not have a Tinea versicolor infection.

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INTRODUCTION

This condition is caused by the fungi *Malassezia furfur* or *Pityrosporum orbiculare*.^{1,2} Tinea versicolor affects 20-25% of the global population and is commonly found in tropical regions, such as Indonesia.^{3,4} Elevated temperature and humidity favor the proliferation of the fungi responsible for tinea versicolor. The incidence of tinea versicolor tends to increase with age. Young adults - characterized by active sebaceous gland function and higher levels of physical activity - are more frequently affected and report cases more commonly than other age groups. However, existing data present varied findings, and no comprehensive studies have yet been conducted to assess this condition using a multilevel epidemiological approach. Epidemiological estimates suggest that 40-50% of the Indonesian population has experienced tinea versicolor during their lifetime.⁵⁻⁸

Tinea versicolor causes skin discoloration, resulting in lighter, darker, or even reddish spots compared to the surrounding skin. The trunk is the most commonly affected area due to the highest concentration of sebaceous glands. Nonetheless, tinea versicolor may also involve other anatomical sites, particularly those with frequent exposure to ultraviolet (UV) radiation, such as the forearms, cervical region, and facial area.^{4,9} Although some patients may experience itching, the majority remain asymptomatic. The incidence of the disease is associated with densely populated areas and poor hygiene conditions.¹⁰

Personal hygiene refers to an individual's attitude and behavior in maintaining and improving personal health to protect against disease. Personal hygiene is a multifaceted domain influenced by complex biopsychosocial

factors, including -but not limited to -self-perception, knowledge, social norms, economic conditions, and cultural context. Personal hygiene practices can be implemented by maintaining body cleanliness, such as bathing regularly, brushing teeth, washing hands, and wearing clean clothes.^{1,11}

Additionally, the environmental conditions can influence the incidence of infection. For example, densely populated areas are considered a risk factor for tinea versicolor infection. Islamic boarding schools are typically located near residential areas, with relatively small room sizes, limited cleanliness, and poor personal hygiene practices among students, such as sharing of personal items (towels, toiletries, and bedding), which further increases the risk of tinea versicolor infections.^{12,13}

The purpose of this study was to examine the relationship between personal hygiene practices and the incidence of tinea versicolor among students at the MUQ Pagar Air Islamic Boarding School in Aceh, Indonesia.

MATERIALS AND METHODS

Materials

The study used a reliable and valid questionnaire to assess personal hygiene. The range of values for the personal hygiene variable was 0-11. Good personal hygiene was defined as a score of >75% (scores of 9-11), while not good personal hygiene was defined as a score of ≤75% (scores of 0-8). The tinea versicolor diagnosis was confirmed definitively in the laboratory using KOH 10% examination.

Methods

The study was conducted using a cross-sectional approach. The population consisted of students from grades X, XI, and XII at MUQ Pagar Air Islamic

Boarding School, totaling 130 students. Using the Slovin formula, the required sample size was calculated to be 58 subjects. Stratified random sampling was employed to select the subjects by dividing the population into strata. The inclusion criteria comprised active students whose participation was approved through written informed consent provided by their parents. The exclusion criteria included students with other pre-existing skin conditions, identified through self-reported responses and clinical findings by the researchers.

RESULTS AND DISCUSSION

The study involved students of grades X, XI, and XII as subjects of the study. Of the 130 female students, 60 met the criteria as the subjects in this study.

Table 1. Student’s Personal Hygiene.

Personal Hygiene	Frequency (n)	Percentage (%)
Not good	10	16.7
Good	50	83.3
Total	60	100.0

Table 1 shows that the majority of students at MUQ Pagar Air Islamic Boarding School performed good personal hygiene. Several studies have examined personal hygiene practices among different populations. Desmawati et al. in 2015 at the Al-Kausar Pekanbaru Islamic Boarding School found that 61% of subjects practiced good personal hygiene. Similarly, Ahsani Nadiya et al. in 2019 at the Sa’adatuddarain Islamic Boarding School reported that 54.1% of students exhibited good personal hygiene. Another study by Dewi et al. in 2017 at SMPN 4 Denpasar found that 79% of subjects maintained good personal hygiene. Additionally, a 2021 study by Cep Reza Alam Wahid also showed that the majority of the population met the criteria for good personal hygiene.¹⁴⁻¹⁷

Table 2. The incidence of Tinea versicolor.

Tinea versicolor	Frequency (n)	Percentage (%)
Yes	6	10.0
No	54	90.0
Total	60	100.0

Table 2 shows that the majority of students at MUQ Pagar Air Islamic Boarding School did not experience tinea versicolor. This finding aligned with studies conducted by Wardana et al. in 2020 at the Darussa'adah Mojo Agung Islamic Boarding School, Central Lampung (78.6% without tinea versicolor), Riska Nazaria et al. in 2017 at Madrasah Tsanawiyah Islamic Boarding School (67.6% without tinea versicolor), and Dwiky Saputra Armansyah in 2020 at Mathla'ul Anwar Islamic Boarding School (80% without tinea versicolor). Additionally, Cep Reza Alam Wahid's study also found that the majority (94.8%) of students at an Islamic boarding school did not have tinea versicolor.^{1,3,17-20}

Although various studies may employ varying operational definitions for the diagnosis of tinea versicolor -utilizing methods such as Wood’s lamp examination or direct microscopic analysis -all yielded definitive rather than presumptive findings, thereby ensuring the reliability of case identification within the studied population.

Table 3. Bivariate analysis.

Personal Hygiene	Tinea versicolor				Total		P-value
	Yes		No				
	n	%	n	%	n	%	
	Not good	6	60	4	40	10	
Good	0	0	50	100	50	100	0.00

Bivariate analysis (Chi-square test), as presented in Table 3, yielded a p-value of 0.00 ($p < 0.05$), providing evidence of a statistically significant relationship between personal hygiene and the incidence of tinea versicolor at MUQ Pagar Air Islamic Boarding School. Additional studies,

including those conducted by Wahid C. and Sudiadnyani in similar Islamic boarding school settings, support these findings. Both studies identified personal hygiene as a determinant factor in the occurrence of tinea versicolor, reporting statistically significant associations with p-values of 0.024 and 0.000, respectively.^{17,21}

The frequent poor personal hygiene behaviors observed among MUQ Pagar Air students, such as not changing clothes after sweating and not washing hands before or after activities, are likely due to a lack of education and health promotion regarding clean and healthy living practices. Not changing clothes after sweating creates an environment conducive to fungal growth. *Malassezia furfur* thrives on moist skin, altering the skin flora and promoting the development of pathogenic mycelia. Additionally, humid conditions can further increase the virulence of the fungus. Fungal virulence can cause itching, leading to scratching, and the habit of not washing hands before or after activities may facilitate the transfer of mycelia from the keratin layer of the stratum corneum to healthy skin areas, potentially leading to the progression of tinea versicolor.²¹⁻²³

In this study, the majority of students with good personal hygiene can be attributed to the adequate facilities and infrastructure at MUQ Pagar Air Islamic Boarding School, which effectively support students in maintaining good personal hygiene. Additional factors influencing the implementation of personal hygiene practices -particularly among students as a distinct study population - such as institutional regulations and social obligations within dormitory settings, as well as access to routine healthcare services, warrant further investigation. It is also advisable to identify and control for potential confounding variables that may

adversely affect the observed outcomes.

Epidemiological studies examining the statistical significance between variables associated with tinea versicolor have generally reported substantial associations, though the findings remain varied. The diverse outcomes regarding tinea versicolor prevalence among student populations across different educational settings suggest the likely involvement of multiple confounding factors influencing the occurrence of this infection.^{19,20,24,25}

Malassezia peaks in adolescent (pubertal) and young adult age groups, which aligns with the increased activity of sebaceous glands in these age groups. The yeast density gradually decreases with age. Under normal conditions, *Malassezia* acts as a normal mycobiome, evading the local immune response and maintaining equilibrium, thus not showing significant pathological signs (asymptomatic). However, changes in the proliferation of the saprophytic *Malassezia* yeast into pathogenic hyphae can occur. Various conditions can disrupt this balance, such as immune insufficiency due to chronic metabolic diseases (e.g., diabetes), HIV infection, long-term systemic steroid use, or the use of immunosuppressive agents, which can further promote the pathogenicity of *Malassezia*-related skin diseases. Other predispositions, such as hyperhidrosis and malnutrition, may also be related to the study group in this context.^{26,27}

Malassezia spp., by virtue of their pathogenic potential, have been implicated in a broad spectrum of dermatological disorders. These include superficial mycoses such as tinea (pityriasis) versicolor, inflammatory dermatoses including sebaceous gland-associated conditions and seborrheic or atopic dermatitis, as well as immune-mediated disorders like psoriasis. Furthermore, *Malassezia* may co-occur with or

predispose to other fungal infections, such as onychomycosis, and in certain immunocompromised hosts, may contribute to systemic and invasive mycoses. An increased risk of *Malassezia* invasion may result from an elevated yeast population, alterations in epidermal pH, and the mechanical spread of the pathogen due to scratching -all of which are associated with and exacerbated by poor personal hygiene.^{26,27}

In tinea versicolor, the skin lesions caused by fungal hyphal invasion arise between and are limited to keratinized cells. Damage to the stratum corneum and depigmentation may occur due to dysregulation of the melanization process. Hypo- or hyperpigmentation is determined by the involvement of azelaic acid produced by *Malassezia*. Azelaic acid inhibits tyrosinase, a component required for melanin synthesis, and this inhibition typically occurs in individuals with darker skin. Conversely, the cytotoxic effects of azelaic acid, which affect the production of bioactive indoles from tryptophan, have implications for melanogenesis, presenting as hyperpigmented lesions, which are more commonly found in individuals with lighter skin.^{26,27}

The clinical presentation, highly suggestive of a *Malassezia* infection consistent with tinea versicolor, was subsequently confirmed via direct mycological examination by the researcher. Skin scrapings were subjected to a potassium hydroxide (KOH) 10% preparation, which revealed characteristic morphological features (clusters of round-to-oval, thick-walled yeast cells arranged in grape-like formations, accompanied by short, curved, septate hyphal elements). This classic "spaghetti and meatballs" appearance is pathognomonic for *Malassezia* species and confirms the diagnosis of tinea

versicolor among the students.

STRENGTH AND LIMITATION

One of the key strengths of this study is the comprehensive application of microscopy examination using a 10% potassium hydroxide (KOH) solution to establish a working diagnosis of tinea versicolor in all study participants. Unlike many studies that use KOH testing solely to confirm clinically suspected cases, this study employed the 10% KOH diagnostic test uniformly across the entire study population. This approach enhances the accuracy of case identification and reduces the potential for diagnostic bias.

The number of participants included was considered adequate to draw meaningful conclusions. While a larger sample size could have been possible, it was not necessary given the study's duration. The data collected was sufficient to provide valuable insights that can be generalized to a broader population, ensuring the validity and reliability of the study's results.

CONCLUSIONS

The majority of students at MUQ Pagar Air Islamic Boarding School practiced good personal hygiene and did not have a tinea versicolor infection. The study also found a statistically significant relationship between the two measured variables, personal hygiene and the incidence of tinea versicolor.

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ETHICAL CLEARANCE

This study received ethical approval from the Health Research Ethics Committee of the Faculty of Medicine, Universitas Syiah Kuala, registered under the Indonesian National Ethics Committee (KEPPKN) number 1171012P. The approval was issued under reference number 085/EA/FK/2022. Parental consent for students under 18 was obtained through the signing of an informed consent form, which was distributed to the students.

FUNDING

This study did not receive funding.

CONFLICT OF INTEREST

There are no conflicts of interest to disclose.

AUTHOR CONTRIBUTION

TRIP designed the research methodology and provided justifications for the study. MY supervised the writing, data processing, and statistical analysis. HM was responsible for data collection, interviews, and documentation. AW contributed to the publication process and the dissemination of the research findings.

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