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PREVALENCE OF DERMATOPHYTE INFECTIONS IN SCHOOL-AGED CHILDREN AND ASSOCIATED HYGIENE PRACTICES: A CROSS-SECTIONAL STUDY

Original Research

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ABSTRACT

Background: Dermatophyte infections remain a prevalent public health concern among school-aged children, particularly in low-resource and tropical regions. These infections, though often superficial, can cause significant discomfort, stigma, and complications if untreated. Personal hygiene behaviors play a critical role in either predisposing children to or protecting them from these fungal infections.

Objective: To investigate the prevalence of dermatophyte infections and their association with personal hygiene practices among children aged 6–12 years in primary schools in Lahore, Pakistan.

Methods: A cross-sectional study was conducted over eight months in six randomly selected public and private schools. A total of 355 children were enrolled using multistage random sampling. Clinical examination and KOH microscopy confirmed dermatophyte infections. A structured questionnaire assessed hygiene behaviors. Data were analyzed using SPSS v26. Descriptive statistics, chi-square tests, and logistic regression were employed to evaluate associations, considering $p<0.05$ statistically significant.

Results: The prevalence of confirmed dermatophyte infections was 30.4%. Infected children showed significantly higher rates of irregular bathing (79.6%), barefoot walking at school (63.0%), and sharing of personal items (72.2%). Logistic regression revealed that irregular bathing (OR: 3.4), barefoot behavior (OR: 2.7), and sharing personal items (OR: 4.1) were strong independent predictors of infection ($p<0.01$).

Conclusion: Dermatophyte infections are common among schoolchildren and are closely linked to modifiable hygiene behaviors. Targeted interventions focusing on hygiene education and school-based health initiatives are vital to reducing transmission and improving dermatologic health in this population.

Keywords: Child, Dermatophytosis, Epidemiology, Hygiene, Pakistan, Prevalence, Risk Factors.

INTRODUCTION

Fungal infections of the skin, particularly those caused by dermatophytes, represent a significant public health concern, especially in resource-limited settings. Dermatophytes are keratinophilic fungi that invade the stratum corneum, hair shafts, and nails, resulting in infections collectively known as dermatophytosis (1). These infections are among the most common superficial mycoses globally, with children being a particularly vulnerable group. School-aged children, specifically those between 6 and 12 years, are at increased risk due to their close physical contact with peers, shared use of personal items, and often limited awareness of hygienic practices. Despite being generally non-life-threatening, dermatophyte infections can cause discomfort, social stigma, and complications when left untreated, such as secondary bacterial infections or chronic skin changes (2,3). The global burden of dermatophyte infections in children varies with geographic location, climate, socioeconomic status, and public health infrastructure. Studies have shown that in many tropical and subtropical regions, where warmth and humidity create favorable conditions for fungal growth, the prevalence is significantly higher. For instance, research in parts of sub-Saharan Africa and Southeast Asia has reported dermatophytosis rates exceeding 30% in school-going children. Such figures point toward a neglected yet persistent public health issue that warrants more focused attention, particularly in relation to modifiable risk factors such as hygiene behaviors (4-6).

Personal hygiene plays a crucial role in either predisposing individuals to or protecting them from skin fungal infections. Practices such as regular bathing, appropriate use of footwear, not sharing personal items like towels and combs, and frequent handwashing are known to reduce the risk of transmission (7). Conversely, poor hygiene, including infrequent washing, wearing damp clothes for extended periods, and inadequate grooming, may promote fungal colonization and spread. The school environment, where close interactions are frequent and supervision may be limited, serves as a potential hotspot for transmission, particularly when hygiene education and facilities are lacking (8). Despite the apparent link between hygiene and fungal infections, there remains a substantial gap in the literature regarding this relationship among school-aged children. Much of the existing research tends to focus either on the microbiological aspects of dermatophytes or on isolated clinical case series, with fewer studies exploring how everyday hygiene habits directly correlate with infection prevalence. Furthermore, most available data are region-specific and often outdated, lacking comprehensive assessments of both infection patterns and behavioral factors in a single, unified analysis (9,10).

Addressing this gap requires an integrative approach that not only measures the occurrence of infections but also systematically examines the hygiene practices of children. Cross-sectional studies are particularly well-suited to this kind of inquiry, as they provide a snapshot of prevalence while allowing for concurrent evaluation of potential risk factors (11). By focusing on the 6–12 age group, researchers can gain valuable insights into early-life behaviors that may influence long-term susceptibility to dermatophytosis and other communicable conditions. This study therefore seeks to investigate the prevalence of dermatophyte infections among school-aged children and to explore the association between these infections and personal hygiene practices. The findings are intended to inform school health policies, guide community-based interventions, and promote targeted hygiene education efforts. By identifying specific behaviors that contribute to infection risk, this research aims to offer actionable insights for parents, educators, and public health practitioners. The ultimate objective is to reduce the incidence of skin fungal infections through informed, behavior-centered strategies, ensuring better health outcomes and quality of life for affected populations.

METHODS

This cross-sectional study was conducted over a period of eight months in selected public and private primary schools located in urban and peri-urban regions of Lahore, Pakistan. The study setting was carefully chosen to reflect a representative mix of socio-economic backgrounds, environmental exposures, and hygiene conditions typically encountered by school-aged children in the region. Lahore's climatic profile—characterized by hot, humid summers and cooler winters—provided a relevant backdrop to assess the occurrence of dermatophyte infections, which are known to thrive in warm and moist environments. The target population consisted of children aged between 6 and 12 years enrolled in the selected schools. The inclusion criteria comprised children within this age range who were attending school regularly, whose parents or guardians provided informed consent, and who themselves assented to participate. Children with known chronic dermatologic or immunosuppressive conditions, those on antifungal or systemic immunosuppressive therapy within

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the past four weeks, and those with cognitive impairments affecting communication or self-care were excluded to eliminate potential confounders related to immune status and hygiene autonomy (12,13).

A multistage sampling technique was employed. Initially, schools were stratified based on public and private status and geographic location. From this frame, six schools were randomly selected. Within each school, a list of eligible students was prepared, and simple random sampling was used to select participants. Using a 95% confidence level, 5% margin of error, and an estimated prevalence of dermatophyte infections of 30% based on regional literature, the minimum required sample size was calculated to be 323. To account for potential non-response and attrition, a 10% buffer was added, yielding a final target of 355 children. Data collection involved two components: clinical examination and questionnaire-based assessment (2,3). A structured, pre-tested questionnaire was administered through face-to-face interviews with each child, with assistance from teachers where necessary. The questionnaire was designed to capture demographic details, hygiene-related behaviors (e.g., frequency of bathing, handwashing habits, clothing hygiene, footwear use, and sharing of personal items), and environmental factors. The instrument was developed in English, translated into Urdu for field use, and then back-translated to ensure linguistic and conceptual equivalence.

Clinical assessment was carried out by a trained medical officer and a dermatologist. Each child underwent a systematic examination of the scalp, trunk, and extremities under adequate lighting. Suspected lesions were identified based on typical dermatological features such as annular plaques, central clearing, peripheral scaling, and erythema. For all suspected cases, skin scrapings were collected using sterile techniques for laboratory confirmation. Samples were processed with 10% potassium hydroxide (KOH) mounts and examined under light microscopy to confirm the presence of fungal elements. This step ensured diagnostic reliability and minimized false positives based solely on clinical impression. The primary outcome was the presence or absence of laboratory-confirmed dermatophyte infection. Secondary outcomes included the prevalence of specific hygiene behaviors and their statistical correlation with infection status. Data were entered into SPSS version 26. Descriptive statistics were used to summarize demographic and behavioral characteristics. Frequencies and percentages were calculated for categorical variables, while means and standard deviations were computed for continuous variables. The normal distribution of the data was confirmed using the Kolmogorov–Smirnov test.

Bivariate analysis was conducted using chi-square tests to identify associations between hygiene practices and infection prevalence. Independent samples t-tests were used to compare continuous variables, such as age, between infected and non-infected groups. Logistic regression analysis was subsequently performed to adjust for potential confounders and to identify independent predictors of infection. Variables with p-values <0.20 in the bivariate analysis were included in the multivariate model. A p-value <0.05 was considered statistically significant. The study protocol was reviewed and approved by the Institutional Review Board (IRB) of the relevant institute. Written informed consent was obtained from the parents or legal guardians of all participants, and assent was acquired from children in age-appropriate language. Confidentiality was maintained by assigning anonymized codes to participant data, and clinical findings were disclosed only to school health authorities and parents for appropriate follow-up. Through this methodologically rigorous approach, the study sought to yield reliable, context-specific insights into the burden of dermatophyte infections and the modifiable hygiene practices that may contribute to or protect against these infections in young school-going children.

RESULTS

The study included a total of 355 school-aged children with a mean age of 9.1 years (±1.8), comprising 182 males (51.3%) and 173 females (48.7%). Slightly more than half of the participants were enrolled in public schools (53.5%), while the remaining attended private institutions (46.5%). Out of all participants, 108 children (30.4%) were diagnosed with dermatophyte infections through clinical examination and KOH-confirmed microscopy, while 247 children (69.6%) tested negative. The distribution of infections did not significantly differ by gender or type of school but appeared more frequently among children with poor hygiene behaviors. When hygiene practices were evaluated, 86 of the 108 infected children (79.6%) reported bathing fewer than five times a week, compared to 59 of the 247 uninfected children (23.9%). Similarly, 68 infected children (63.0%) were habitually barefoot at school, in contrast to 44 uninfected peers (17.8%). The tendency to share personal items, such as towels or hairbrushes, was noted in 78 infected children (72.2%) compared to 38 of the uninfected group (15.4%).

Statistical analysis using chi-square tests showed strong associations between infection status and hygiene practices, with all three variables—irregular bathing, barefoot walking, and sharing personal items—yielding statistically significant results ($p<0.001$). Independent samples t-tests confirmed that infected and non-infected groups did not differ significantly in age. Logistic regression analysis further supported these findings. Children who bathed less than five times per week had an adjusted odds ratio (OR) of 3.4

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(95% CI: 2.1–5.6, p<0.001), indicating they were over three times more likely to contract a dermatophyte infection. Similarly, walking barefoot at school increased the odds by 2.7 times (95% CI: 1.5–4.8, p<0.01), while sharing personal items had the strongest association with an OR of 4.1 (95% CI: 2.3–7.4, p<0.001). These results suggest that certain modifiable hygiene behaviors are significantly associated with an increased risk of dermatophyte infection in children. The most prominent of these were irregular bathing and sharing personal items, which were both highly prevalent among infected participants.

Table 1: Demographic Characteristics of Participants (N = 355)

Variable	n (%)
Age (mean ± SD)	9.1 ± 1.8
Gender	
Male	182 (51.3%)
Female	173 (48.7%)
School Sector	
Public School	190 (53.5%)
Private School	165 (46.5%)

Table 2: Prevalence of Dermatophyte Infections

Infection Status	n (%)
Infected	108 (30.4%)
Not Infected	247 (69.6%)

Table 3: Hygiene Practices and Infection Correlation

Hygiene Practice	Infected (n=108)	Not Infected (n=247)
Regular Bathing (≥5 days/week)	22	188
Irregular Bathing (<5 days/week)	86	59
Shoe Wearing in School	40	203
Barefoot at School	68	44
Not Sharing Personal Items	30	209
Sharing Personal Items	78	38

Table 4: Logistic Regression Summary for Infection Predictors

Variable	Adjusted OR (95% CI)	p-value
Irregular Bathing	3.4 (2.1–5.6)	<0.001
Barefoot at School	2.7 (1.5–4.8)	<0.01
Sharing Personal Items	4.1 (2.3–7.4)	<0.001

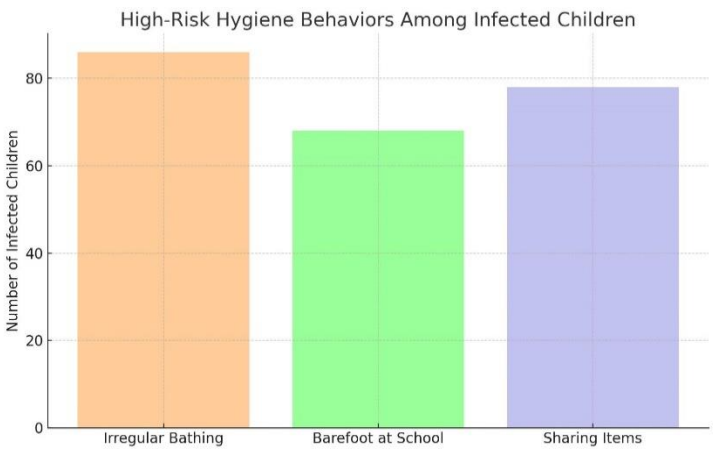

Figure 1 High-Risk hygiene Behaviors Among Infected Children

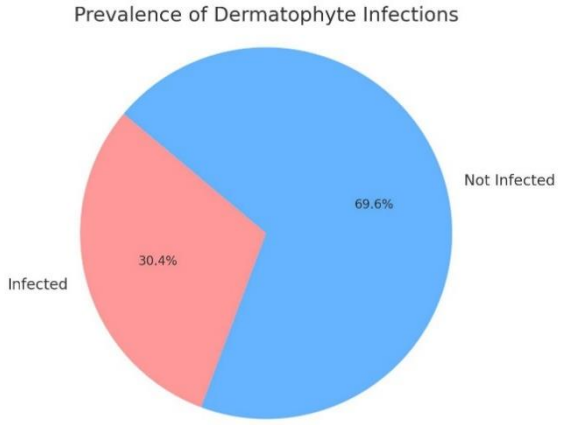

Figure 2 Prevalence of Dermatophyte Infections

DISCUSSION

The findings of this study provide compelling evidence of the burden of dermatophyte infections among school-aged children and reinforce the critical role of personal hygiene in disease prevention. The observed prevalence of 30.4% aligns with several recent studies in similar climatic and socio-economic settings. For instance, a study reported a 25.9% prevalence in Nigerian schoolchildren, highlighting the endemic nature of these infections in tropical environments where heat, humidity, and dense population conditions promote fungal growth (14). The study established a strong association between hygiene-related behaviors and dermatophyte infection. Irregular bathing, walking barefoot in school, and sharing personal items were all significantly linked to higher infection rates. These findings mirror those of a study which emphasized that, low awareness and poor hygiene practices significantly contribute to dermatophyte spread in school settings (15,16). Similarly, a study found poor hygiene to be the predominant risk factor among dermatophytosis cases in Kashmir, particularly among children from low socioeconomic backgrounds (17).

From a microbiological standpoint, consistent findings of Trichophyton species as the dominant etiological agent across studies from India, Africa, and the Middle East underscore the need for targeted antifungal strategies and improved diagnostic capacities (18). With growing global concern about antifungal resistance, as recently highlighted by a study, prevention through hygiene promotion becomes even more essential in settings where treatment failures are becoming more frequent (19). One of the strengths of this study lies in its comprehensive methodology, which included both clinical and mycological diagnosis, thereby enhancing diagnostic precision. The sample was geographically and socioeconomically diverse, which improves the generalizability of the findings to urban and peri-urban school environments in similar regions. Furthermore, the use of logistic regression to adjust for confounders ensured robust assessment of independent risk factors. Nonetheless, some limitations warrant consideration. The cross-sectional design restricts causal inference, and although hygiene behaviors were self-reported, which introduces the potential for recall or social desirability bias, the use of trained interviewers and validated tools mitigated this to some extent. Moreover, environmental factors such as classroom overcrowding, ventilation, or access to clean water—although likely influential—were not formally measured and could be addressed in future research.

There is also an opportunity to enhance surveillance and public health response. The lack of regular screening programs in schools contributes to undiagnosed cases that may serve as reservoirs for continued transmission. Integrating dermatological checks into school health programs, particularly in high-prevalence areas, could have substantial preventive value. As noted by a study, health education and awareness about hygiene are critical but often inadequately translated into behavior change without sustained community engagement (20,21). Further longitudinal studies could assess the impact of school-based hygiene interventions on dermatophyte prevalence over time. There is also a need for research into behavioral change strategies tailored for children, teachers, and caregivers, to bridge the gap between knowledge and practice. As emphasized by a recent study, improving economic and educational conditions remains a cornerstone for sustainable reductions in dermatophytosis and other communicable diseases in children (22). In conclusion, the study contributes to the growing evidence that dermatophyte infections remain a significant health concern among school-aged

children in humid, low-resource environments. The strong correlation between hygiene behaviors and infection emphasizes the potential for prevention through targeted, school-based hygiene education and infrastructure improvements.

CONCLUSION

This study revealed a high prevalence of dermatophyte infections among school-aged children and identified poor hygiene practices—especially irregular bathing, barefoot walking, and sharing personal items—as key risk factors. These findings underscore the urgent need for school-based hygiene education and public health interventions to reduce infection rates and improve child health outcomes in resource-limited settings.

AUTHOR CONTRIBUTION

Author	Contribution
Muhammad Faizan*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Ayesha Khalid	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Muhammad Ibrahim	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Mohammad Moosa	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Izza Rafi	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Hasnain Asad	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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