



Prevalence and Risk Factors for Cutaneous Mycoses among Boarding Secondary Schools Students in Coast Region, Tanzania

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Authors' contributions

This work was carried out in collaboration between both authors. Author KM designed the study, performed the statistical analysis, wrote the protocol, wrote the first draft of the manuscript and managed the analyses of the study. Author ED collected the data, managed the literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

Aims: To determine the prevalence and risk factors for cutaneous mycoses (CMs) among boarding secondary schools' students in Coast Region, Tanzania

Study Design: It was a cross-sectional survey-based study involving boarding secondary schools' students. Cluster sampling technique was employed for data collection using semi-structured questionnaire.

Place and Duration of Study: It involved students from both government and private boarding secondary schools in a period between January and June 2020.

Methodology: The study involved 320 students (equal number of females and males). The questionnaire inquired on these key issues: contraction of CMs and/or other skin related infections, and risk factors associated with CMs, previous exposure to antifungal agents, reasons for the use, duration of use and its outcome. Obtained information was analyzed using the SPSS version 20. Multivariate and logistic regression were employed to determine association among investigated variables. Differences among the variables were considered statistically significant when $p < 0.05$.

Results: Prevalence of CMs among the students was 61.5% (n = 197/320). Higher proportion of students in government schools had CMs as compared to private ones (35.9% vs. 25.6%; p <0.01). The former schools were twice more likely to contract CMs (OR = 2.43, 95%CI: 1.53-3.86, p <0.01) than those in private schools. Correlations existed between students' ages and recurrence of CMs (Pearson's R = 0.044; p <0.01); and between students' bodyweights and prevalence of CMs (R = 0.139; p = 0.02). Association existed between non-adherence to antifungal treatment and prevalence of CMs (p = 0.001).

Conclusion: High prevalence of CMs was revealed among students, which was relatively higher among males than females. Risk factors for CMs included poor personal hygiene and sanitary conditions, students' ages and bodyweights. Education on risk factors for CMs among the respondents is required for earlier, prevention and control. Further studies involving larger samples size are highly recommended.

Keywords: Prevalence; recurrence; cutaneous mycoses secondary schools' students.

1. INTRODUCTION

Cutaneous mycoses (CMs) are fungal infections that affect the keratinized layers of the human skin, nails and hair without involvement of the living tissues. These are increasingly becoming major health concerns worldwide particularly in low-income countries because of their association with socio-economic factors such as poor hygiene and overcrowded residences [1-3]. Some previous reports have shown that CMs affected 20-25% of the global habitants ranking it as among the wide spread microbial infectious condition [4-6]. Fungal infections in resource-limited countries call for special consideration as several of them are often ignored [7]. Fungal infections are estimated to cause over 1.7 million deaths annually and over one billion people suffer from severe fungal diseases [8]. The fact that most of these countries lack adequate diagnostic laboratory facilities, the magnitude of CMs might be underestimated [9]. Most of the available data on prevalence of CMs are hospital-based; and due to difference in predisposing factors and settings, most cases are unnoticed and/or neglected [10].

Fungal pathogens of human particularly those causing CMs such as dermatophytes and others evolve along with the geographic and socioeconomic conditions [5]. Such infections are more prevalent in tropical countries because of humid and warm climate, poor sanitary conditions and overcrowding [4,9,11]. In such countries, institutionalized persons such as students are more prone to the infections [12,13]. Changes of disease patterns as results of high prevalence of immunosuppressant diseases such as human immunodeficiency virus (HIV) infection; fungi causing CMs and other

opportunistic infections exacerbate conditions of the patients [3,6,13].

Some common CMs inflicting health of institutionalized persons are caused by dermatophytes such as tinea capitis (infection of the scalp), tinea corporis (ring worm affecting the skin), tinea unguium (onychomycosis) affecting nails and tinea pedis (athlete's foot) are depicted in Fig. 1. Others are caused by non-dermatophytes like pityriasis versicolor (jock itch) affecting warm and moist body parts and cutaneous candidiasis as well as black and white piedra [5,12,14].

Images adopted from Parents Africa and Dreamstime.

Although CMs are generally not implicated in their victims' deaths; they are associated with several perilous clinical complications, and their chronicity has socio-economic implications. Hence, our study aimed to determine the prevalence of CMs among boarding schools' students and their risk factors, and recommend appropriate preventive measures.

2. METHODOLOGY

2.1 Study Design, Areas and Population

It was a cross-sectional survey-based study conducted between January and June 2020, involving boarding secondary schools' students in Coast Region. The cluster sampling technique was employed for data collection by randomly selecting each participating secondary school. Ten boarding secondary schools with equal number of males and female students were selected.

2.2 Sample Size Determination and Data Collection

A pilot study was conducted to attest data collection tool. Sample size was determined based on two previous studies conducted in Africa[15,16]. A pre-tested semi-structured questionnaire was used for data collection. The questionnaire inquired on the following key issues: prevalence rate of CMs and/or other skin infections, and risk factors associated with CMs among boarding secondary schools' students. Further investigated issues were water sources, and if the respondent had previously used any antifungal agent, and duration of use and its outcome. To ascertain the possible sources of infections, respondents were asked about their personal hygiene such as sharing of private items (towels, sports wears, combs, bedsheets or beds). The study also inquired on whether respondents had experienced recurrences of CMs and kind of antimicrobial and/or antifungal agents that were used for treatment. Other information such as sex, age, education level/year of study and weight were also recorded.

2.3 Statistical Data Analysis

The collected information was entered into a data base and analyzed using the Statistical Package for the Social Sciences (SPSS version 20). Multivariate and logistic regression were employed to determine interactive effects among investigated variables. Differences, correlations and associations among the variables were considered statistically significant when $p < 0.05$.

2.4 Ethical Consideration, Inclusion and Exclusion Criteria

Ethical issues were addressed in accordance to the MUHAS Ethical Committee policy and guidelines. Permission to conduct the study was obtained from Regional Medical Officer and other relevant district and secondary schools' authorities. Adequate explanations on the study's objectives were given. All students who agreed to participate in the study, had to sign the consent forms prior to administration of the questionnaires and they were clearly explained the objectives of the studies. Confidentiality was assured by not revealing any personal details or name. Only students aged 18 years old and above were included. For students under 18 years old, permission was sought from teachers

or/and guardians. All sick and visitors were excluded from the study.

3. RESULTS AND DISCUSSION

The present study presents current epidemiological data on the prevalence of CMs in one of the risk groups, in this case students in boarding schools who are subjected to several predisposing factors [11,12,17]. Generally, skin problems affect both male and female students in institutionalized centers such as boarding schools, but few researchers have investigated into the issue so far[9,10]. A total of 320 boarding secondary schools' students with equal number females and males were recruited in this study. Participants' ages ranged from 14 to 22 years old with median age of 18 years; and weights ranging from 45 to 72 kg and median of 58kg. A percentile of 75% indicated the respondents' age of 20 years with 58 kg of body weight. Equal number of respondents were recruited from government and privately owned secondary schools ($n = 160$; 50%). Inter-variation of the prevalence of CMs among different groups of people is not uncommon, which depends on the socio-economic status [11].

Moreover, Majority ($n = 270$; 84.4%) had experienced some kind of skin infections while only 40(12.5%) and 10 (3.1%) said never had and did not remember respectively. About 61.6% ($n = 197$) respondents had have contracted CMs during their schooling. Relatively more male students (32.8% vs. 28.7%) had been infected as compared to their female counterparts. The reported prevalence of CMs was influenced by respondents' sex ($p = .001$) and bodyweight ($p < .001$). This is contrary to previous studies that showed that sex was not an independent factor for the vulnerability to CMs[18]. However, there was no statistically significant interaction between weight and sex ($p = .507$). Some previous studies had attributed sex differences in outcome to infections, suggesting that the discrepancies between females and males are likely to be associated with distinct immune compartments, where the mode of infection and involved tissues involved determine the susceptibility[19,20]. Considering the respondents' adolescent ages, who are sexually active and experiencing several sex hormonal-based regulations of immune responses that in turn may contributes to age-related diseases[20].

Regression analysis showed that students who had stayed at schools for longer period of time

were 11 times more likely to contract CMs (OR=11, 95%CI: 1.18-103.17, p = .04). Boarding schools' students are at high risk of contracting the fungal infections, because of predisposing conditions such as poor hygiene, overcrowding, and inadequate health care. The CMs were relatively more prevalent among government owned secondary schools (35.45%) as compared to 25.6% in private ones as indicated in (Table 1) below.

The odd ratio (OR) for students in government to contract CMs was about twice as much (OR=2.43, 95% CI:1.53-3.86; p < 0.01) as compared to those in privately owned schools.

The fact that CMs were more prevalent among students in in government owned schools than in privately owned ones, could be due to socio-economic factors such as the former customary afford to attend better schools[11,15].

Also, a positive correlation between bodyweights and recurrence frequency of CMs (R= 0.139; p = .02). ANOVA showed that diagnosis of other types of skin infections was an indicative of CMs (p < .01). Seasonal weather changes were attributed to the recurrence of CM (x² = 7.023, p = 0.03). Most respondents (85.3%; n = 168) reported to had contracted CMs during the hot-summer season than the rest of the year (Fig. 2).



Fig. 1. A: Body ringworm on the upper arm (tinea corporis); B: Ring worm of the scalp (tinea capitis) on human head, and C: Tinea versicolor due to invasion of cornified skin on upper back by Malassezia species

Table 1. Demographics of the study population and prevalence of MCs

Investigated Variables		Contracted Fungal Infections (%)		Fisher's test (p-value)
		Never	Yes	
Types of Schools	Government	45(14.1)	115 (35.9)	0.001
	Private	78(24.4)	82(25.6)	
Sex	Female	68(21.3)	92(28.7)	0.084
	Male	55(17.2)	105(32.8)	
Age group (yrs.)	13-17	58(18.1)	79(24.7)	0.131
	18-22	65(20.3)	118(36.8)	
Weight (kg)	45-55	30(9.4)	39(12.2)	0.152
	56-66	91(28.4)	152(47.5)	
	67-77	2(0.6)	6(1.8)	
Education level	O' level	64(20)	96(30)	0.133
	A' level	59(18.4)	101(31.5)	

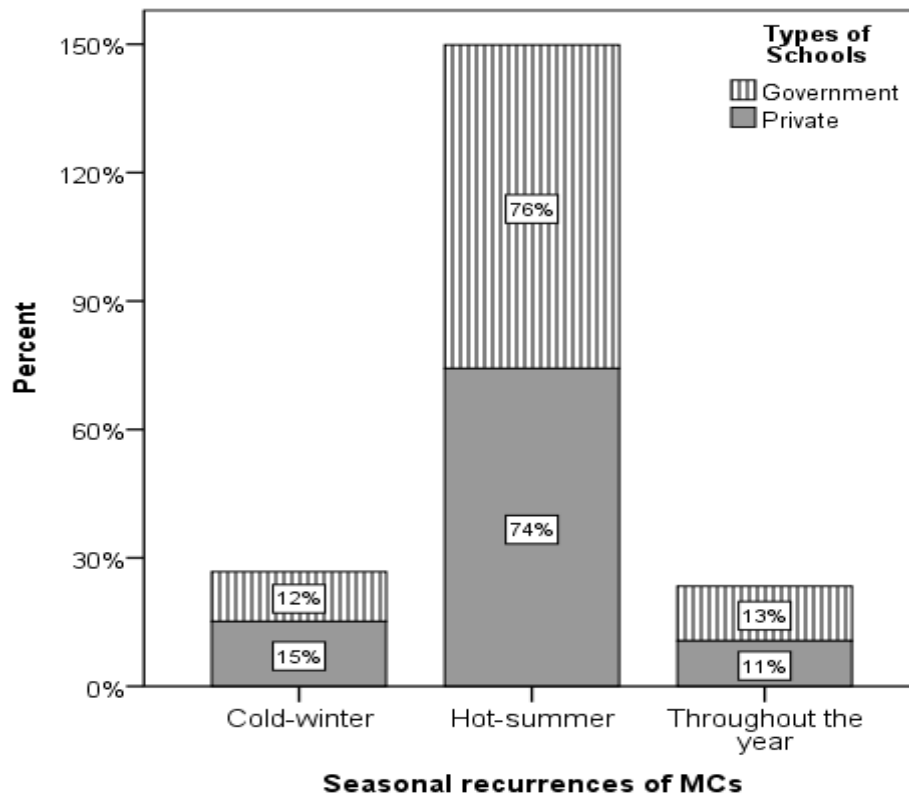


Fig. 2. Seasonal variations recurrence of MCs among students in government and private schools

Effect of seasonal variation on the prevalence of CMs was also evident. Higher prevalence of CMs was reported in the hot-humid season compared to other seasons, and this is in line with other previous findings[11]. Such variations have been attributed to changes in virulence of the pathogens and/or host susceptibility[11,21].

Controlling for respondents' bodyweights, association between sharing personal items and the prevalence of CMs was revealed ($\chi^2 = 18.931$; $p < .01$). Personal hygiene significantly influenced the prevalence of CMs among the respondents. Respondents who showered more frequently were less likely to contract CMs than those who barely did (OR=3, 95% CI: 0.42-0.626, $p < .01$). Simple main effects analysis showed that sharing of personal items such as bedsheets and sport wears has effect on prevalence of CMs ($\chi^2 = 16.367$; $p < .01$). Our findings also showed that body weight has been also associated with incidences of CMs, which coincides with previous study indicating that body mass index (BMI) greater than 26 kg/square meters is linked with high risk of contracting fungal infections[22,23,24]. An association was

also revealed between adherence to treatment regimens and the prevalence of CMs ($p < .01$). About 38% ($n=123$) of the respondents claimed to had never contracted CMs; of those 78(63.4%) had have used antifungal agents. Of 197(61.6%) students who had contracted CMs, only 177(89.9%) respondents had received treatment. It is well recognized that fungal infections greatly affect persons with underlying health conditions such as diabetic and immunocompromised individuals[4,22,25,26]. But also misuse of antifungal agents could exacerbate spread of resistant pathogens.

Our study showed that respondents who frequently used systemic topical antifungal preparations such as tablets experienced more recurrence of CM ($p = 0.02$) as shown in (Fig. 3).

About 22% ($n=112$) of the students did not comply to the prescribed medication (antifungal agents) as depicted in (Table 2).

Among reasons for non-compliance include the antifungals being finished prematurely, recovery even before the indicated period of time and non-

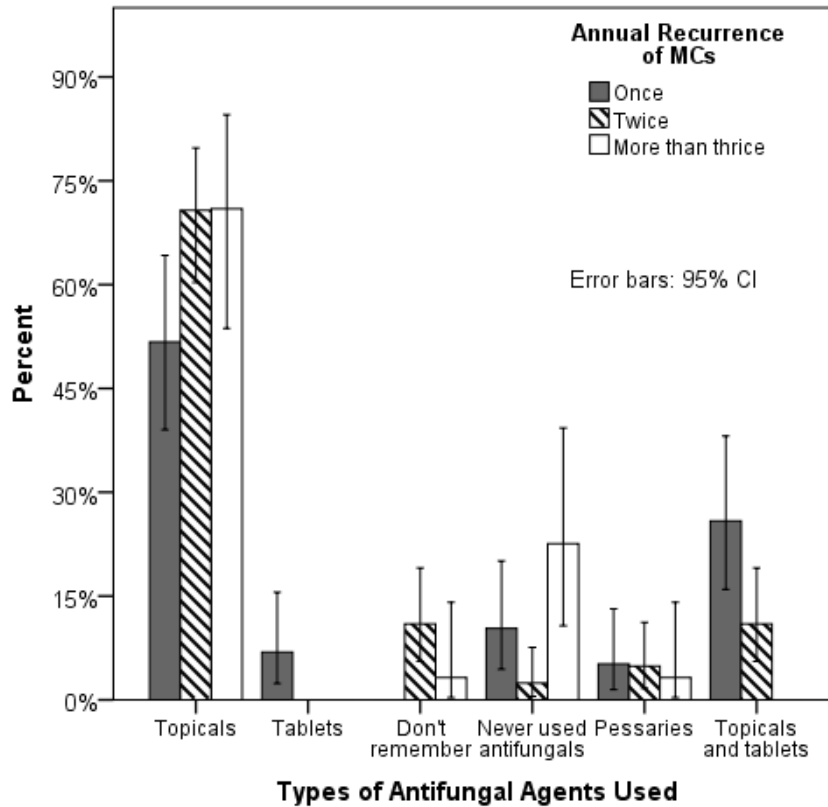


Fig. 3. Recurrence of MCs of in relation to previously used antifungals

Table 2. Recurrence of MCs in relation to sex, antifungal dosage forms and compliance with the prescribed regimens

Variables		Recurrence of MCs (n= 279)		p-values
		No	Yes	
Sex	Female	69 (24.7)	71(25.4)	0.06
	Male	68(24.4)	71(25.4)	
Treated	No	26(9.3)	9(3.2)	0.01
	Yes	111(39.8)	133(47.7)	
Treatment compliance*	Yes	89(31.9)	73(26.2)	0.2
	No	56(20.1)	61(21.9)	
Antifungal dosage forms	Tablets	1(0.4)	4(1.4)	0.48
	Topicals	22(7.9)	103(36.9)	
	Pessaries	8(2.9)	6(2.2)	
	Never used	47(16.8)	9(3.2)	
	Tablets/topicals	49(17.6)	10(3.6)	
	Didn't remember	10(3.6)	10(3.6)	

Key: (*) A total of 46 respondents did not answer this question

responsiveness to the treatment. This fact is interpreted as irrational use of the agents. Constant exposure of students to antifungal agents could have attributed to spread of resistant CM-causing microorganisms, which is reflected on the frequent recurrence of CMs[6,15,27].

Failure to collect specimens from respondents with obvious CMs and perform susceptibility tests are some of the drawbacks of our study. Reason for this was that the study was conducted during the peak of covid-19 pandemic in Tanzania. Henceforth, direct contacts with respondents were hardly possible.

4. CONCLUSION

In conclusion, the study has revealed high prevalence rate of CMs among the students, which was relatively higher among males compared to females. The potential risk factors for prevalence of CMs include poor personal hygiene and sanitary conditions especially in government owned schools. Indiscriminately use of antimicrobials and sharing of personal items was among the risk factors for the prevalence of CMs. Education on risk factors for CMs should be provided to students in order to improve their well-being. Regular screening for skin infectious diseases is recommended for early detection, prevention and control. Further studies involving larger samples size are highly recommended.

CONSENT

Both authors declare that written informed consent was obtained from the patient (or other approved parties) to conduct this study and subsequent publication of the findings without disclosing personal details. A copy of the sought consent is available for review by the Editorial office/Chief Editor/Editorial Board members of this journal."

ETHICAL APPROVAL

This study was conducted in accordance to Muhimbili University of Health and Allied Sciences (MUHAS) Research Policy and Ethical Conducts. Therefore, the study obtained Ethical Clearance prior to commencement of the same, and the study was through reviewed to attest that it complied with the Research Ethics (Attached). The MUHAS Ethical Committee, granted permission to carry out this study, as one of the requirements for partial fulfillment of the Bachelor of Pharmacy program.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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