Risk factors associated with acquiring superficial fungal infections in school children in South Western Nigeria: a comparative study.

Olaide Oke Olutoyin¹, Olaniyi Onayemi², Akinlolu Omisore Gabriel³

1. Federal Medical Centre, Abeokuta, Nigeria, Dermatology unit, Department of Internal Medicine
2. Obafemi Awolowo University, Ile-Ife, Nigeria, Department of Dermatology and Venereology
3. Osun State University, Osogbo, Nigeria, Department of Community Medicine

Abstract

Introduction: Superficial fungal infections (SFI) are caused mainly by dermatophytes and yeasts. SFI is of major public health concern and is a common cause of skin disease among school children.

Objectives: The aim of this study was to identify the risk factors associated with acquiring superficial fungal infections in school children in Ile-Ife, South West Nigeria as this will assist in instituting appropriate interventions.

Methods: A total of 560 children; 280 with superficial fungal infections as subjects and 280 age and sex matched school children as controls were recruited through multistage sampling method from 10 primary schools (private and public owned) in Ile-Ife, Nigeria.

Discussion: Pupils were aged 5-16 years with a mean age of 9.42±2.00. Risk factors documented in this study included poor living conditions, use of barbers’ clippers, low socio-economic status, poor hygiene, attendance of public schools and not living with both parents. The last four factors remained significant on binary logistic regression.

Conclusion: The study shows that the risk for acquiring superficial fungal infections remains high in school children and in communities with low socio-economic positions.

Keywords: Risk factors, school children, skin, superficial fungal infections.

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Introduction

Superficial fungal infections (SFI) of the skin describe fungal infections that affect the outer layers of the skin, the nails and the hair and these are caused mostly by dermatophytes or yeasts and rarely by non-dermatophyte moulds.¹ Though they rarely cause illness, they are often chronic or recurrent in their course.² SFI is a common cause of skin disease worldwide and poses a major public health concern especially among school children. There are regional characteristics and predispositions to development of SFI and this has been documented by some studies.²³ Though some studies have documented high prevalence of SFI among Nigerians, there is no recent data among the population studied to know current trends. Also, only few of the previous studies did a comparative study that involved pupils with SFI and controls while also comparing risk factors for acquiring SFI between public schools and privately owned schools. Furthermore, risk factors for acquiring SFI among school children have not been extensively documented. It is therefore imperative to identify the factors that predispose to the development of SFI so as to provide evidence-based and effective preventive measures, thus reducing the prevalence and the attendant morbidity associated with superficial fungal infections and this was our aim in this present work.

Methods

A cross sectional study was conducted that involved 280 pupils (subjects) with SFI and another 280 pupils who
served as age and sex matched controls. They were select-
- ed through multistage random sampling from 10 schools
(6 publicly owned and 4 privately owned) in Ile-Ife,
South-Western Nigeria between January and March 2011.
Selection of study participants was done via a multistage
sampling technique that involved selection along local
governments, schools (both public and private), classes
and proportionate pupils from selected class strata. After
clinical diagnosis of cases of SFI by the principal inves-
tigator, skin scrapings (or nail clippings where indicated)
for fungal microscopy and culture were done for the pu-
pils with tinea infections and those who were culture pos-
itive were then included in the study. Subsequently, one
control (a respondent without SFI) who was of the same
age and sex as the identified respondent (subject) with
SFI in the same class was chosen via balloting from the
pool of respondents who were of the same age and sex,
thus for each case of SFI seen, one age and sex matched
control was chosen, making equal number of subjects
and controls.

Informed consent from parents/guardians of all pupils
involved in the study was obtained, pupils whose parents
did not give consent and pupils who did not assent were
not included in the study. Permission was taken from
Osun State Ministry of Education, local inspectorates of
education at the local government levels and school au-
thorities. Ethical clearance was obtained from Obafemi
Awolowo University Teaching Hospital, Ile-Ife before
commencement of study.

All pupils recruited were interviewed and socio-demo-
graphic characteristics were obtained. History to identify
predisposing factors was also obtained. Socio-economic
status of their parents was determined using the modi-
fied wealth index. Household living conditions were
determined using the Canadian crowding index that de-
fines crowded housing as requiring one or more addition-
al bedrooms. The study participants were examined by
same dermatologist using natural light in a private room
within the school premises for the presence of any SFI.
Their level of hygiene was assessed using the hygiene
assessment tool. Skin scrapings and nail clippings were
done for clinically suspected SFI and sent for microscopy
and culture.

Data entry and processing was carried out using SPSS
version 16 software (SPSS Inc Chicago, Illinois, USA). Chi
square test was used as a test of association. A p value
of ≤ 0.05 was taken as significant. We also carried out a
multivariate analysis (logistic regression) to identify inde-
dependent factors associated with SFI. Only variables that
were significant on bivariate analysis (chi square) were put
in the logistic regression models and this was done at two
different levels, socio-demographic variables on one hand
and behavioral variables on the other hand.

Results
A total of 560 pupils were included in the study. 280 pu-
pils who had clinical evidence of SFI and 280 pupils who
were age and sex matched controls. Tables 1a & 1b show
the socio-demographic characteristics of the pupils and
the presence of superficial fungal infections. The vari-
ables; socio-economic status, ethnicity, school type, class
and living arrangement were all found to be statistically
significant.

Table 1a: Socio-demographic (age and sex) characteristics
of the pupils with SFI (Subjects and controls)

| Variable | Pupils with Superficial fungal infections (Subjects) n = 280 | Pupils without Superficial fungal infections (Controls) n = 280 |
|----------|-------------------------------------------------------------|---------------------------------------------------------------|
|          | Frequency (n) | Percentage (%) | Frequency (n) | Percentage (%) |
| Age in years |                 |                 |                 |                 |
| 5-8      | 94             | 33.6            | 94             | 33.6            |
| 9-12     | 164            | 58.6            | 164            | 58.6            |
| 13-16    | 22             | 7.8             | 22             | 7.8             |
| Total    | 280            | 100.0           | 280            | 100.0           |
| Sex      |                 |                 |                 |                 |
| Male     | 166            | 59.3            | 166            | 59.3            |
| Female   | 114            | 40.7            | 114            | 40.7            |
| Total    | 280            | 100.0           | 280            | 100.0           |
Table 1b: Other socio-demographic characteristics of the pupils and the presence/absence of superficial fungal infections

| Variable                      | SFI Subjects (%) n=280 | Controls (%) n=280 | Total. n=560 | Remark        |
|-------------------------------|------------------------|--------------------|--------------|---------------|
| Socio-Economic Status (SES)   |                        |                    |              |               |
| Low SES                       | 186 (60.8)             | 120 (39.2)         | 306          | $\chi^2=31.385$, p < 0.001 |
| High SES                      | 94 (37.0)              | 160 (63.0)         | 254          |               |
| Ethnicity                     |                        |                    |              |               |
| Yoruba                        | 265 (51.1)             | 254 (48.9)         | 519          | $\chi^2=8.300$, p = 0.040 |
| Hausa                         | 7 (50)                 | 7 (50)             | 14           |               |
| Igbo                          | 2 (13.3)               | 13 (86.7)          | 15           |               |
| School Type                   |                        |                    |              |               |
| Public                        | 205 (60.5)             | 134 (39.5)         | 339          | $\chi^2=38.81$, p < 0.001 |
| Private                       | 75 (33.9)              | 146 (66.0)         | 221          |               |
| Class*                        |                        |                    |              |               |
| Lower primary school          | 139 (45.7)             | 165 (54.3)         | 304          | $\chi^2=4.864$, p = 0.027 |
| Higher primary school         | 141 (55.1)             | 115 (44.9)         | 256          |               |
| Religion                      |                        |                    |              |               |
| Christianity                  | 213 (49.3)             | 219 (50.7)         | 432          | $\chi^2=0.365$, p = 0.546 |
| Islam                         | 67 (52.3)              | 61 (47.7)          | 128          |               |
| Living arrangement            |                        |                    |              |               |
| Living with both parents      | 148 (41.0)             | 213 (59.0)         | 361          | $\chi^2=32.935$, p < 0.001 |
| Not living with both parents  | 132 (66.3)             | 67 (33.7)          | 199          |               |
| Household living condition    |                        |                    |              |               |
| Uncrowded                     | 130 (47.8)             | 142 (52.2)         | 272          | $\chi^2=1.040$, p = 0.594 |
| Crowded                       | 150 (52.1)             | 138 (47.9)         | 288          |               |

*Lower primary school (Years 1 to 3), Upper primary school (Years 4 to 6).

Table 2 shows the behavioral characteristics of the pupils that were statistically significant in acquiring superficial fungal infections. These were poor hygiene, involvement in gardening and use of barbers’ clippers.
In Table 3, the variables; ethnicity and class were not statistically significant, however, attendance of private schools, high socio-economic status and living with both parents were protective socio-demographic factors against the development of SFI. Similarly, the variables involvement in gardening and ownership of clippers were not statistically significant, while good hygiene was a behavioral protective factor against the development of SFI.

| VARIABLE                        | SFI          | Total | Remark                      |
|---------------------------------|--------------|-------|-----------------------------|
|                                 | Subjects (%) | Controls (%) | n=560 |                          |
| Poor hygiene                    | 190 (76.9)   | 57 (23.1)     | 247   | \( \chi^2 = 127.6, p < 0.001 \) |
| Good hygiene                    | 90 (29.3)    | 223 (70.7)    | 313   |                           |
| Yes                             | 102 (56.7)   | 78 (43.3)     | 180   | \( \chi^2 = 4.716, p = 0.030 \) |
| No                              | 178 (46.8)   | 202 (53.2)    | 380   |                           |
| Personal or Father’s            | 13 (36.1)    | 23 (63.9)     | 36    | \( \chi^2 = 6.218, p = 0.013 \) |
| Barber’s clippers or blade      | 238 (57.6)   | 175 (42.4)    | 413   |                           |

N.B: Other behavioral characteristics (variables) which were not statistically significant were not included in this table. They include frequency of bath, allergy, use and frequency of use of occlusive clothes and shoes.

Table 2: Behavioural characteristics of the pupils and the presence of superficial fungal infections

***n=449 because this is not applicable to those excluded.

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Discussion
Our study identified certain factors as being significant for the development of superficial fungal infections. Superficial fungal infections that were studied included *tinea capitis*, *tinea faciei*, *tinea corporis*, *tinea unguium*, *tinea manuum*, *tinea pedis* and *pityriasis versicolor*. The factors associated with development of SFI included socio-demographic characteristics such as living with either parent rather than living with both parents, low socio-economic status, attendance of public school rather than privately funded school, and behavioral characteristics such as poor hygienic habits and use of barbers’ clippers instead of personal clippers. These findings are comparable to previous studies done on possible risk factors for acquiring superficial fungal infections. In the study carried out by Akinboro et al in a community in Osogbo, Nigeria, they found risk factors for fungal infections to include crowded living conditions, poor sanitary conditions, visits to barbers’ salon and use of their clippers and lastly, close contact with soil and animals. Similarly, Metintas et al in another study among pupils living in rural areas in Turkey, documented male gender, poor hygiene and history of contact as the main risk factors associated with acquiring SFI. Figueroa et al in their study on the risk factors for infection and carriage of *tinea capitis* in South Western Ethiopia found overcrowding not to be significantly associated with infection, just as it was in this study and also noted increased prevalence among the urban community rather than the rural community. Although it was not statistically significant, more people who live in crowded conditions had SFI than those who did not live in overcrowded homes in this study. The slightly higher prevalence of superficial fungal infections among pupils living in crowded populations compared to controls observed in this study was not as significant as in previously documented studies that showed that overcrowding promotes the spread of fungal infections.

Considering the living arrangement, there were more pupils living with their parents among the controls (59.0%) than among those with superficial fungal infections, this probably may be due to the fact that there may be better supervision of their health and effective care such as good personal hygiene, having regular baths, good personal grooming and good nutrition than if the child was living with just one of the parents, grandparents or any other family member. Socio-economic status of parents has been one of the factors associated with presence of superficial fungal infections. Pupils with parents of low socio-economic status had been found to have increased prevalence of superficial fungal infections and vice versa. This was corroborated in this study as up to two thirds of the pupils with superficial fungal infection were of low socio-economic status while up to two thirds of the pupils in the control group had parents of high socio-economic status.

### Table 3: Binary logistic regression of the outcome variable presence of superficial fungal infections and its possible socio-demographic predictors.

| Variable                  | Categories of variable.       | Stat. significance | Odd’s ratio | 95% Confidence interval Lower | 95% Confidence interval Upper |
|---------------------------|-------------------------------|--------------------|-------------|-------------------------------|-------------------------------|
| Ethnicity                 | Yoruba (Reference)            | 0.016              |             |                               |                               |
|                           | Hausa                         | 0.818              | 0.867       | 0.257                         | 2.924                         |
|                           | Igbo                          | 0.073              | 6.088       | 0.845                         | 43.866                        |
|                           | Others                        | 0.983              | 0.983       | 0.195                         | 4.945                         |
| Type of School            | Public (Reference)            | <0.001*            | 0.467       | 0.317                         | 0.687                         |
| Class                     | Lower primary school (Reference) | 0.081             | 1.384       | 0.961                         | 1.995                         |
| Socio-economic Status     | Low (Reference)               | <0.001*            | 0.496       | 0.340                         | 0.723                         |
| Living arrangement        | Living with both parents (Reference) | <0.001*         | 2.311       | 1.576                         | 3.390                         |

Variables in this model: Ethnicity; Type of school; Class; Socio-economic status; and Living arrangement.
status. Poverty is one of the reasons why SFI remain a prevalent condition in our environment. Poorer people are likely to be less hygienic compared to people who are well to do.

Likewise, more pupils visiting the barbers’ for their haircut had superficial fungal infection particularly tinea capitis than control cases, such was found in other studies including that by Soyinka in Ife, SouthWest Nigeria and Ogbonna in Jos, North central Nigeria.\(^\text{10,12,13}\) As was rightly noted by these studies, most of the salons used by the children have poor sanitary conditions. Moreover, the clippers are not adequately disinfected before use for another child; these promote the spread of the infection. Use of personal clippers reduced the chances of acquiring the infection in this study.

Pupils in public schools (government funded) had superficial fungal infection more significantly than the privately funded schools. This is corroborated by previously documented studies.\(^\text{10,14-16}\) Part of the explanation for this is that majority of the pupils in the public schools are of low socio-economic status as was also observed in this study with poor hygiene, malnutrition, overcrowding and poor general social conditions. These are significant risk factors for acquiring superficial fungal infections.\(^\text{16}\) Factors such as living conditions, socio-economic status, poverty, sanitary conditions at the barbers’ shops are social determinants of health that influence the presence of superficial fungal infections observed in this study.\(^\text{17,18}\) These findings thus suggest that control of superficial fungal infections among school children can be achieved by improvement in personal hygiene. There is also the need for empowerment of the communities by the government through provision of social amenities and job creation so that the socio-economic status of the parents can improve with resultant better nutrition for the children and improved housing devoid of overcrowding.

**Conclusion**

Identified risk factors that predispose to acquiring superficial fungal infections in children were; Attendance of public schools, low socio-economic status of parents, living with either parent rather than with both and poor hygiene and these remained significant factors after binary logistic regression, with low socio-economic status being more or less central to other factors. In order to curtail the spread of SFI among school children, each local government authority may provide dermatological services to the schools by ensuring a dermatologist visit to schools at least once every term to identify and treat pupils with SFI, thus reducing the spread of SFI. In the absence of qualified personnel, community health extension workers may be trained on how to identify SFI in pupils for appropriate referrals. Likewise, the school authority should inspect the school children for good personal hygiene at least once a week and identify any obvious rash on them. They can also promote health seeking behavior among the pupils and their parents/guardians through proper counselling, for instance encouraging hospital visits as needed and lastly, they can give the pupils regular health education on prevention of infection and encourage use of personal clippers and proper grooming of hair.

We hope these findings will assist in reducing the prevalence of SFI among school children in Nigeria as an effort towards promoting holistic health in them.

**Study limitation**

In consonance with international research best practices, the use of age and sex matched controls did not allow the researchers to examine the effect of age and sex as independent variables in both the bivariate and multivariate analyses. Thus, the effect of age and sex on development of superficial fungal infections could not be determined from this study.

**Conflicts of interest:**

We hereby declare no conflicts of interests as regards this study.

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