

## Survey of *Tinea* Infections Distribution Among Tsangaya System Children in Sokoto Metropolis, Sokoto State of North-Western Nigeria

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### ABSTRACT

*Tinea* infections is one of the most prevalence disease of nails, hairs and skin, classified as one of the most common dermatophytes problem across the globe. This study investigates the incidence of tinea infections among Tsangaya system children in Sokoto Metropolis. A multi-stage sampling approach was used and 300 individuals were screened followed by isolation and identification of causative agents. The study found an overall tinea infection prevalence of 45%, consistent across Sokoto metropolis. Sokoto South local government had the highest prevalence (35.2%), while Sokoto North local government had the lowest (30.7%). The most common infections were *Tinea capitis* (30.7%) and the least was *Tinea barbae* (3.4%). The study highlights the high burden of tinea infections, particularly among vulnerable populations, and emphasizes the need for improved healthcare access, hygiene education, and fungal surveillance programs. The research suggested the potential for further researches into prevalence, distribution and control of tinea infections.

**Keywords:** fungi, tinea, infection, tsangaya, Sokoto.

### 1.0 INTRODUCTION

Children are more prone to *Tinea* dermatophyte infection of scalp. Fungi are the causative agent of dermatophytosis in the genera of *Microsporum*, *Trichophyton* and *Epidermophyton*. Dermatophytes are pathogenic organism members of the keratinophilic (keratin digesting) soil fungi. Human and animal pathogens are the *Microsporum* and *Trichophyton* but *Epidermophyton* is strictly a human pathogen (Chinyere *et al.*, 2022). In the Sub-Saharan Africa, *Tinea* was estimated to have over 138.1 million cases in the year 2021, and Nigeria had the highest population of children with 98.7 million (Bongomin, 2022).

Dermatophytes that caused *Tinea* infections are a unique parasitic group of molds capacitated to invade keratinized tissues in man and animals, causing cutaneous infections commonly referred to as *Tinea* or 'ringworm' (Mengistu *et al.*, 2023). They are dependent on keratin as main nutrient source as they can cause its hydrolysis. *Tinea capitis* is common in children while *Tinea cruris* and *Tinea pedis* are common in adults (Adelodun, 2021). Moreover, *Tinea capitis* is classified as one of the most prevalent in African children (Bongomin, 2022). Infections caused by these fungi are also known as "ringworm" or "*Tinea*" and causes skin, hair and nail infections.

Previous Studies reveals that, children of 1 to 10 years are most susceptible to dermatophyte infection (Abd

Elmegeed *et al.*, 2023; Bitew, 2019). According to World Health Organization (2019) and Chinyere *et al.* (2022), in Nigeria, *Tinea* infections are common among pediatric age groups which are endemic in many parts of the country. The morbidity associated with these diseases is enormous that the WHO has to pay special attention to their control under auspices of its special programme and research. The less privileged which include the beggars (almajiri), children from poor or rural families, nomadic communities and the farmers are more exposed to these skin, hair and nails infections than the elite and urban families because of the poor health, environmental hygiene and socioeconomic status of the less privileged and rural families (Bright *et al.*, 2019).

In Sokoto State, the study on various *Tinea* infections in human, cohort groups and epidemiological data on etiological agents of *Tinea* infections is unavailable. That is why the study became imperative to assess the prevalence on dermatophytes isolated from *Tinea* infections in the selected nomads and beggar's population in the State. The essence of this study was to establish evidences on the occurrences and distribution of tinea infections among the Tsangaya system students in Sokoto Metropolis.

### 1.1 Objectives of the Study

Objectives of this study were: to

- (i) determine the prevalence of *Tinea* infections among the Tsangaya children in the study areas, and

(ii) isolate and identify the etiological agents of *Tinea* infections in samples obtained from the infected children in the study area.

### 1.2 Transmission of *Tinea* Infections

The transmission of *Tinea* infections is by direct contact with the infected host. Sharing of house utensils is an important means of transmitting the disease (Emily and Karen, 2022). The transmission of the infection can be direct or indirect contact with the skin or scalp lesions of the infected people (Ezihe *et al.*, 2022) animals or fomites (floors, shower stalls, clothing, hairbrushes, and so on) contaminated with desquamated epithelium (Richa and Choudhary, 2019). The infection is also susceptible through the broken skin of individuals that their immunity is suppressed (Zafar *et al.*, 2021).

### 1.3 Pathogenicity of *Tinea* infections

All the body keratinized areas can be affected by dermatophytosis. Symptoms of the infection differ depending on the region affected. There is hair loss (ectotrix) or breakage (endotrix) when the hair is infected. Zoophilic dermatophyte infections are inflammatory than those caused by anthropophilic dermatophytes. Infection of human nails present as discoloration, dystrophy, hyperkeratosis and occasionally onycholysis. Effects of the infections are aesthetic and can if not treated with the appropriate medication (Alexopoulos *et al.*, 2019).

### 1.4 Diagnosis of *Tinea* Infections in Human

An ultra violet Wood's lamp examination is used to detect dermatophytes; such as zoophilic organisms *M. canis* and *M. equinum* and some anthropophilic dermatophytes such as *M. audouinii* Potassium hydroxide (KOH). Microscopy can detect hyphae and conidia in skin scrapings or hair. Fungal cultures are necessary for the identification of the organism. Skin or nail biopsies are also used in humans (Zafar *et al.*, 2021).

A dermatophyte infection prevalent is common but remains unknown as is not noticeable (Degreef, 2019). Healthy people are not prone to the infections of dermatophyte; however, opportunistic bacteria causes cellulitis in skin damaged by inter digital fungal infections. These infections are a particular concern in diabetics (Degreef, 2019). Unhealthy people are more prone to dermatophytosis and having immunosuppression. These individuals may have typical and locally aggressive dermatophyte infections, including extensive skin disease, subcutaneous abscesses, and disseminated disease (Felix *et al.*, 2021).

### 1.5 Sources of Dermatophytes

Dermatophytes are found in contaminated soil and laboratory instruments. They are also found in keratinized tissues of the infected organism hosts (Weitzman and Summerbell, 2022). Sunil *et al.* (2019) reported that body contact with the infected organisms and their beddings is a hazard, and also sever as institutions where communal hygiene activities occur.

### 1.6 Precautions and Prevention of *Tinea* infections

Protective clothing e.g. Laboratory coat and gloves are used to prevent direct contact with the hosts. Where there is potential exposure to the infection, eye protective material must be used. All the diagnostic procedures must be conducted in a biological safety cabinet (BSC). There should be limited use of needles, syringes, and other sharp objects (Sunil *et al.*, 2019).

## 2.0 MATERIALS AND METHODS

### 2.1 Study Area

Sokoto State is located in the Northwestern part of Nigeria lies on Longitude 4° 8'E to 6° 54'E and latitude 12° 30'N to 13° 58'N with an attitude of 351m above sea level. As at 2006, the population of Sokoto State is 3,702,676 people (Bello *et al.*, 2022). Sokoto State has average and minimum temperature as 20-46°C respectively and relative humidity of 12-17% (Muhammad *et al.*, 2023).

### 2.2 Sampling Techniques

A multi-stage sampling method was choosing cluster samples. 30 Tsangaya schools were chosen random form the three local government (Sokoto North, Sokoto South and Wamakko) domicile in the metropolis. 10 Children were selected from 30 Almajiri Islamic schools totaling to 300 children and the groups were screened from September 2024 to April 2025, for *Tinea* infections (Felix *et al.*, 2021).

### 2.3 Sample Collection and Processing

A total of 300 samples of skin, hair and nails were collected from beggars with a solicited service of professional nurses, technologists and registered rural community health volunteers were used in the research. The cohort group's location sites; age and types of *Tinea* infections were recorded (Chinyere *et al.*, 2022).

**2.4 Ringworm lesions:** Dermatophytes typically cause *Tinea* infections with ringworm lesions of the skin with vesicular, erythematous margin. Briskly the lesion was cleaned including the entire periphery using 70% ethanol. With a sterile scalpel blade and tooth brush, skin scrape materials from the periphery of the lesion were taken and transported to the laboratory after labelling in small white paper envelopes or Petri dishes while Cotton gow was

used to collect pus from incendiary lesion as outlined by Zafar *et al.* (2021).

**2.5 Skin scrapping:** After seeking permission from the authorities concerned, fungal infections areas were scraped using disposable scalpel knife after first. The scrapings were collected on a sterile brown paper and taken to laboratory for further analysis (Kaniska *et al.*, 2019).

**2.6 Nail clippings:** were also done as required with the aid of clipping materials and with scissors (Chinyere *et al.*, 2022).

**2.7 Hair pieces:** A sterilized clipper was used to shave the heads of the infected children a portion was taken to laboratory for diagnosis (Kaniska *et al.*, 2019).

### 2.8 Data Analysis

The data generated on prevalence and occurrence was presented in percentage and analyzed using Chi-square. Other data generated were processed and expressed as mean values and standard deviation (SD), analyzed using one-way analysis of variance (ANOVA) performed with SPSS version 20.0.

## 3.0 RESULTS AND DISCUSSIONS

**Table 1: Prevalence of Tinea Infections Across the Three Local Government**

Local Government	No. Examined	Positive	Prevalence (%)
Sokoto North	100	82	30.7
Sokoto South	100	91	34.1
Wamakko	100	94	35.2
<b>Total</b>	<b>300</b>	<b>267</b>	<b>45</b>
<b>Chi square</b>			<b>0.58</b>
<b>P value</b>			<b>0.971</b>

The results presented in Table 1 show the prevalence of tinea infections across the three local governments in Sokoto metropolis. A total of 300 individuals were examined, with 267 testing positive for tinea. From the total of 100 individuals examined in Sokoto North, out of which 82 were positive, giving a prevalence rate of 30.7%. In Sokoto South, 91 individuals were reported positive, giving a prevalence of 34.1%. Similarly, Wamakko had 94 examined with positive cases, giving 35.2% prevalence rate.

The Chi-square values in all the three local governments were reported to be 0.58; the p-value for is 0.971. This means there is no statistical difference ( $P > 0.05$ ) in the rate of tinea infection from one local government to another. This shows that all differences in the rates, as seen throughout the local governments in this study, may likely be due to chance.

**Table 2: Cultural and Morphological Characteristic of Fungi Isolated from Tinea Infected children**

Cultural and Morphology Characteristics	Fungal Isolates
Colonies were grainy, cottony and yellow; the reverse was auspicious to red-brown in color. Conidiophores were long. Conidia were round, smooth or slight rough and form long chain.	<i>Aspergillus flavus</i>
Colonies were white to pale yellow. But quickly form jet black conidia. The reverse was buff yellow grey in color. Conidiophores were smooth-walled. Conidial heads were biserial with the phialide borne on brown, often septate metulae. Conidia were globose sub-globes, dark-brown to black and rough-walled	<i>Aspergillus niger</i>
colonies appeared cottony and pale pink color, with a slightly raised, The conidia were curved macroconidia (large conidia)	<i>Fusarium solani</i>
Aerial mycelium becomes exiguous, feebly, whitish with a purple tinge, more acute about the medium surface.	<i>Fusarium oxysporum</i>
Cream-colored colony with a cottony surface	<i>Candida albicans</i>

Colonies were flat; accelerate white to cream colour, dense cottony surface. Beaming golden yellow to brownish yellow antipode pigment. Microconidia were spindle-shaped. Verrucose, thick-walled with terminal knob. A few pyriform to clavate microconidia were also present.

*Microsporium canis*

Colonies were slow growing, small, disk shaped, white to cream Color, a raised center, and flat periphery with submerged growth. Macroconidia are mostly borne laterally directly on the hyphae or on short pedicels, and are thin- or thick-walled, clavate to fusiform. Macroconidia are few or absent in many species. Microconidia are spherical, pyriform to clavate or of irregular shape. The presence of microconidia

*Trychophyton interdigitate*

Colonies were slow growing, small, disk shaped, white to cream Color, a raised center, and flat periphery with submerged growth. Reverse pigment colorless. *Chlamydoconidia* in chain were present.

*Trychophyton rubrum*

### 3.1 Occurrence of Etiological Agents Responsible for Tinea Infections

Table 2 presents the occurrence of various etiological agents responsible for tinea infections among the study participants in Sokoto State, Nigeria. The results reveal that *Tinea capitis* is the most prevalent form of tinea infection, accounting for 30.7% (82 occurrences) of all infections. This is followed by *Tinea corporis* at 18.0% (48 occurrences), and *Tinea faciei* 10.9% (29 occurrences). Other types of tinea infections, such as *Tinea manuum*, *Tinea pedis*, *Tinea cruris*, *Tinea nigra*, *Tinea unguium*, *Tinea barbae*, and *Tinea versicolor*, have significantly lower occurrence rates. The most common tinea infection, *Tinea capitis*, primarily affects the scalp and is highly prevalent among children and young adults. In contrast, *Tinea corporis*, affecting the body, and *Tinea faciei*, affecting the face, also show significant occurrences, suggesting that a wide range of tinea species is responsible for skin infections in the study population.

**Table 3: Occurrence of Etiological Agents Responsible for Tinea Infections**

Species	No. of Occurrence	Percentage
<i>Tinea capitis</i>	82	30.7%
<i>Tinea corporis</i>	48	18.0%
<i>Tinea faciei</i>	29	10.9%
<i>Tinea manuum</i>	24	8.9%
<i>Tinea pedis</i>	19	7.1%
<i>Tinea cruris</i>	15	5.6%
<i>Tinea nigra</i>	17	6.4%
<i>Tinea unguium</i>	13	4.9%
<i>Tinea barbae</i>	9	3.4%
<i>Tinea versicolor</i>	11	4.1%
Total	267	100%

The results of this study highlighted substantial differences in the prevalence of tinea infections among the selected LGAs. The highest prevalence rates were observed in Wamakko followed by Sokoto South then Sokoto North.

This study clearly indicated a dominance of *Tinea capitis* among tinea infections in the study area, and it tallies with the work of Fadaei *et al.* (2021). The work also reported that this form of infection is often transmitted in environments such as schools or crowded living conditions, which are common in many parts of Nigeria (Gianni *et al.*, 2020). The high occurrence of *Tinea corporis* also indicates that skin-to-skin contact or shared environments are significant risk factors for dermatophyte transmission. This finding tally with the work of Adebayo-Tayo *et al.* (2019) that says spreading of *Tinea corporis* is link to lifestyle factors, such as direct body contact or sharing of clothes.

The work of Santos *et al.* (2022) is inline the findings of this work showing varying rates of dermatophyte infections depending on local environmental factors, hygiene practices, and population density. The findings also align with the studies on tinea infections, which have indicated that certain areas, especially those with higher levels of poverty, inadequate sanitation, and limited healthcare access, are more vulnerable to fungal outbreaks (Santos *et al.*, 2022). The higher prevalence rates in the LGAs are linked to factors such as climatic, cultural and traditional practices that affect the spread of fungal infections. Higher infection rates in more densely populated or poorly sanitized areas increases the likelihood of transmission, a pattern previously observed in urban settings by Gianni *et al.* (2020).

The study further finds that, the diversity of fungal isolates from tinea-infected beggars in the study areas had a possible link between poor hygiene, exposure to

environmental pathogens, and the prevalence of dermatophyte infections in this vulnerable population. Previous research has shown that skin conditions, including tinea, are more prevalent in individuals with limited access to healthcare and sanitation (Santos *et al.*, 2022). This reinforces the need for targeted health interventions in high-risk populations.

#### 4.0 CONCLUSIONS AND RECOMMENDATIONS

This study finds that, the distinct cultural and morphological characteristics of *Aspergillus*, *Fusarium*, *Candida*, and dermatophytes such as *Microsporum* and *Trichophyton* species underscore the complexity of fungal infections in the study areas. It also finds that, the contribution to a better understanding of the etiological agents of tinea infections, the results indicate that proper fungal identification is crucial for effective diagnosis and treatment. The findings from this study shows that, Tinea infections are widespread, with varying prevalence across different body parts, and are particularly significant in children and young adults.

These findings recommend further investigation into the underlying factors driving these comprehensive public health approaches to reduce the burden of tinea infections in the state. The work also recommended health campaigns to emphasize on the importance of proper personal hygiene, skin care, and early medical intervention to prevent the spread of fungal infections. Local health authorities should establish fungal surveillance programs to monitor the prevalence of dermatophytes and other fungal pathogens. Efforts should be made to improve sanitation and hygiene practices, particularly in crowded communities.

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