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DERMATOPHYTIC CONTAMINATION OF SOME HAIR SALON TOOLS WITHIN KANO METROPOLIS

[1]*Yusha'u M., [2]Muhammad J.G. and [3]Hamza M.M.

[1]Department of Microbiology, Bayero University, Kano – Nigeria
[2]Department of Biological Sciences, Northwest University, Kano - Nigeria
[3]Department of Microbiology, Kaduna State University, Kaduna – Nigeria

*Corresponding Author Email Address: mryushau@gmail.com Phone: +2348034589499

ABSTRACT
Dermatophytes are infectious fungi that colonize keratinized tissues, causing superficial mycoses in humans and animals. This study investigated the prevalence and distribution of dermatophytic contamination on hair salon tools within the Kano metropolis, Nigeria. A total of 60 swab samples were collected from combs, clippers, and brushes across 20 randomly selected salons spanning four local government areas. Samples were cultured on Sabouraud Dextrose Agar and incubated at 25°C for 7–14 days, followed by identification using morphological features. The overall prevalence of dermatophyte contamination was 83.3% (50/60), with the highest contamination rates recorded in Local Governments 3 and 4 (100% each). Among the tools, combs showed the highest contamination (40.0%), followed by clippers (25.0%) and brushes (18.3%). Seven dermatophyte species were identified, with *Microsporum gypseum* (20.0%), *Trichophyton violaceum* (16.7%), and *T. tonsurans* (15.0%) being the most common. The findings underscore a significant risk of fungal transmission in hair salons due to poor hygiene and disinfection practices. This study highlights the urgent need for improved sanitation protocols and awareness among salon operators to reduce the spread of dermatophytic infections in the community.

Keywords: Dermatophytes, Hair salons, Contamination, Public health, Kano, Mycoses.

INTRODUCTION

Dermatophytes are a specialized group of keratinophilic fungi that infect keratinized tissues such as the skin, hair, and nails, leading to superficial fungal infections collectively known as dermatophytoses. These infections are among the most common mycotic diseases globally and are caused primarily by three genera of fungi: *Trichophyton*, *Microsporum*, and *Epidermophyton* (Weitzman & Summerbell, 1995). Dermatophytoses are typically chronic, recurrent, and easily transmissible, often resulting in substantial discomfort, stigma, and economic burden. Globally, it is estimated that more than 20–25% of the world's population is affected by superficial mycoses at any given time (Gnat *et al.,* 2020).

The burden of dermatophytic infections is exceptionally high in tropical and subtropical regions, where hot and humid climates promote the survival and dissemination of fungal spores. In such environments, dermatophyte infections are frequently encountered among individuals living in densely populated urban areas, often exacerbated by poor hygiene, overcrowding, and limited access to healthcare services (Kumar *et al*., 2017). In many developing countries, including Nigeria, dermatophytoses are considered neglected infections, despite their widespread prevalence and significant public health impact (Ogbonna *et al*., 2015).
Several studies conducted across Nigeria have documented high prevalence rates of dermatophyte infections in different populations. For instance, Adeyemi *et al.* (2015) reported a 34.6% prevalence among school children in Lagos, while Oninla *et al*. (2016) found that 27.8% of patients attending a dermatology clinic in Abuja had dermatophytic infections. In Enugu State, Ogbonna *et al*. (2015) also reported a high prevalence among children, attributing the trend to poor hygiene, frequent contact, and environmental exposure. However, there remains a critical knowledge gap regarding the environmental reservoirs of dermatophytes, particularly in northern Nigeria where such data are scarce. One overlooked but potentially significant route of transmission is through contaminated grooming tools in hair salons and barbershops. These tools—combs, clippers, brushes, and razors—are often reused on multiple clients with minimal or inadequate disinfection, thereby facilitating the indirect spread of dermatophytes (Havlickova *et al*., 2008).

Despite the known risks, few studies have assessed the presence of dermatophytes on salon tools in northern Nigeria. The Kano metropolis, one of the most densely populated and culturally active cities in the region, hosts a large number of informal and formal grooming establishments. Given the popularity of communal grooming practices and the frequent reuse of tools, it is crucial to investigate the microbial safety of salon equipment and its potential role in the transmission of dermatophyte infections (Elewski, 2013). This study, therefore, investigates the occurrence and distribution of dermatophyte contamination on hair salon tools within the Kano metropolis, Nigeria. By identifying the types of dermatophytes present and highlighting the tools most prone to contamination, this research aims to provide evidence-based insights to inform public health strategies and improve hygiene practices in salons.

MATERIALS AND METHODS

Study Area

The study was conducted in Kano State, Nigeria. Kano State is located in the northwestern region of Nigeria and lies between latitudes 10°33'N and 12°37'N and longitudes 7°34'E and 9°29'E. It is bordered by Jigawa State to the northeast, Bauchi State to the southeast, Kaduna State to the southwest, and Katsina State to the northwest. Kano is one of Nigeria's most populous states and serves as a major commercial and cultural hub in the region. The state experiences a tropical savanna climate, characterized by a distinct wet season (May to September) and dry season (October to April), with average annual temperatures ranging from 21°C to

39°C. The state capital, Kano metropolis, is a densely populated urban center comprising multiple local government areas and is well known for its vibrant markets, healthcare services, and diverse socio-economic activities (Aliyu *et al.,* 2021).

Sample Size

A total of 60 samples were randomly collected from 20 hair salons from different parts of the Kano metropolis. Samples from three hair salon tools (combs, clippers, and brushes) were collected from 5 salons in each of the 4 local governments selected.

Collection of Samples

Swab samples were collected from three types of hairdressing tools—combs, clippers, and brushes—in 20 hair salons located across four selected local government areas in Kano metropolis. From each salon, one tool of each type was sampled, totaling three samples per salon and 60 samples overall. For each tool, a sterile cotton swab was moistened by dipping it into sterile distilled water. Then, the entire surface of each tool (including teeth, blades, and handles where applicable) was thoroughly swabbed. For combs and brushes, both sides were swabbed. For clippers, the blade and outer casing were swabbed. Each swab was then immediately inserted into a labeled sterile universal bottle containing 5 mL of sterile normal saline to preserve any microorganisms present.

After collection, the samples were stored in a cooler with ice at approximately 4°C and transported to the laboratory within 2 hours of collection. The samples were processed immediately or stored at 4°C and analyzed within 24 hours (Adebiyi *et al*., 2020).

Isolation and Identification of Fungi

Each swab sample was streaked directly onto Sabouraud Dextrose Agar (SDA) plates containing chloramphenicol (50 mg/L) to suppress bacterial growth. The plates were incubated at 25°C for 7 to 14 days. After incubation, plates were examined for fungal growth. Colony morphology (color, texture, and surface appearance) was recorded. A portion of each colony was picked with a sterile needle, placed on a glass slide, and stained with Lactophenol Cotton Blue (LPCB). Microscopic structures (e.g., hyphae, conidia, and spore arrangements) were observed under a light microscope at ×400 magnification. Identification was done based on morphological and microscopic features using standard mycological keys (Enitan *et al.,* 2020)

RESULTS

The dermatophyte species isolated from hairdressing tools across the four Local Government Areas were identified based on distinct cultural (macroscopic) and microscopic characteristics observed on Sabouraud Dextrose Agar (SDA) and under Lactophenol Cotton Blue (LPCB) staining (Table 1). These features were compared with standard descriptions from mycological keys (Barnett & Hunter, 1998; Ellis *et al*., 2007). The fungal species identified were *Trichophyton schoenleinii, Trichophyton violaceum, Trichophyton tonsurans, Trichophyton rubrum, Microsporum gypseum, Microsporum canis*, and *Microsporum audouinii*.

Table 2 highlights the frequency and distribution of dermatophyte-positive samples across the four local government areas (LGAs) within the Kano metropolis. Out of the 60 salon tool samples analyzed, 50 were contaminated with dermatophytes, resulting in an overall contamination rate of 83.3%.

Among the tool types sampled, combs showed the highest frequency of contamination, with 24 out of 60 samples (40.0%) testing positive for dermatophytes (Table 3). Clippers accounted for 15 positive samples (25.0%), ranking second in contamination frequency, while brushes had the lowest contamination rate, with 11 positive samples (18.3%).

The distribution of dermatophyte species isolated from contaminated hair salon tools across the four local government areas (LGAs) surveyed in the Kano metropolis is highlighted in Table 4. A total of seven dermatophyte species were identified from the positive samples, with varying frequencies and distribution patterns across the LGAs. The most frequently isolated species was *Microsporum gypseum*, accounting for 12 isolates (20.0%), and was particularly prevalent in LGA 3 with 6 isolates (50%) and LGA 2 with 4 isolates (33.3%). The second most common isolate was *Trichophyton violaceum*, with 10 isolates (16.7%), predominantly found in LGA 4 with 7 isolates (70%) and LGA 3 with 3 isolates (30%). Other frequently isolated species included *Trichophyton tonsurans* (8 isolates, 13.3%) and *Microsporum canis* (7 isolates, 11.7%). *Trichophyton schoenleinii* and *Microsporum audouinii* were less frequently encountered, with 6 (10.0%) and 4 (6.7%) isolates respectively. *T. schoenleinii* was isolated exclusively from LGAs 2, 3, and 4, while *M. audouinii* was absent in LGA 4. Interestingly, *Trichophyton rubrum*, a globally dominant dermatophyte and a primary cause of tinea corporis and tinea pedis, was isolated only in LGA 1 (3 isolates, 5.0%) and was absent in the other LGAs.

Table 1: Cultural (Macroscopic) and Microscopic Identification Features of Dermatophyte Species Isolated

Fungal Species	Macroscopic Features	Microscopic Features
Trichophyton schoenleinii	Colonies are waxy with a pale to yellow color.	Presence of characteristic knob-like hyphal ends with very few or no macroconidia or microconidia.
Trichophyton violaceum	Colonies are suede-like to waxy, and purplish in color.	Presence of chlamydoconidia, some intercalary and terminal thick-walled cells.
Trichophyton tonsurans	Colonies vary from powdery to suede-like, yellow to reddish-brown in color	Numerous microconidia of varying shapes (teardrop, club-shaped) along hyphae, few macroconidia.
Trichophyton rubrum	Colonies are white to pale on the surface	Numerous teardrop-shaped microconidia along hyphae; macroconidia are rare, pencil-shaped
Microsporum canis	Colonies are fluffy to powdery, white on surface with yellow colored center.	Numerous spindle-shaped, rough-walled macroconidia (6–15 cells), few microconidia.
Microsporum audouinii	Colonies are flat, greyish with a cottony surface	Rare macroconidia, terminal chlamydoconidia in chains with some pectinate hyphae (comb-like).
Microsporum gypseum	Colonies are powdery to granular, cinnamon or buff-colored	Abundant thin-walled, rough macroconidia (4–6 cells) that are ellipsoidal to fusiform.

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Table 2: Frequency of Dermatophyte Contamination by Local Government Area (LGA)

Local Government Area (LGA)	Total No of Samples	No of Positive Samples	Percentage (%)
LGA 1	15	8	53.3
LGA 2	15	12	80.0
LGA 3	15	15	100.0
LGA 4	15	15	100.0
Total	**60**	**50**	**83.3**

Table 3: Frequency of Dermatophyte Contamination by Tool Type

Tool Type	Total No of Samples	No of Positive Samples	Percentage (%)
Comb	60	24	40.0
Clipper	60	15	25.0
Brush	60	11	18.3
Total	**60**	**50**	**83.3**

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Table 4: Distribution of Dermatophyte Species across the four Local Government Areas (LGAs)

Local Government Area (LGA)	*Trichophyton schoenleinii*	*Trichophyton violaceum*	*Microsporum canis*	*Microsporum Audouinii*	*Trichophyton tonsurans*	*Microsporum gypseum*	*Trichophyton rubrum*
LGA 1	0	0	2	1	2	0	3
LGA 2	2	0	2	2	3	4	0
LGA 3	2	3	1	1	1	6	0
LGA 4	2	7	2	0	2	2	0
Total	6	10	7	4	8	12	3

DISCUSSION

The findings of this study underscore the high prevalence and diversity of dermatophyte contamination in hair salon tools across the Kano metropolis, Nigeria. The overall contamination rate of 83.3% is alarmingly high and indicates that salon equipment—particularly combs, clippers, and brushes—can serve as significant reservoirs for the transmission of dermatophytic infections. These results not only reflect poor hygiene and inadequate sterilization practices in many salons but also raise important public health concerns regarding the role of communal grooming facilities in the spread of superficial fungal infections. When compared with similar studies conducted in other parts of Nigeria and internationally, the data from this study reinforce existing evidence that salon tools are critical fomites in the transmission of dermatophytoses, necessitating urgent intervention through education, policy, and improved sanitation protocols.

The prevalence of dermatophyte contamination varied significantly across the four surveyed local government areas (LGAs), with LGAs 3 and 4 exhibiting a contamination rate of 100%, followed by LGA 2 (80%) and LGA 1 (53.3%) (Table 2). These differences in dermatophyte distribution may be attributable to variations in the number and concentration of hair salons within each Local Government Area, which can influence the frequency of tool usage and potential for fungal contamination, awareness of hygiene practices, disinfectant usage, and enforcement of local sanitation regulations. Similar findings were reported by Traoré *et al.* (2014) in Mali, where over 70% of salon tools were contaminated with dermatophytes, particularly in densely populated areas with high customer turnover. In Nigeria, a study conducted by Adeyanju *et al.* (2017) in Lagos revealed fungal contamination in 78% of hairdressing tools, with poor sterilization practices linked to the presence of *Trichophyton* and *Microsporum* species. The higher rates observed in this current study suggest a potential lowering of hygiene standards or increased fungal burden in Kano metropolis salons, particularly in LGAs 3 and 4.

Among the different tool types analyzed, combs had the highest dermatophyte contamination rate (40%), followed by clippers (25%) and brushes (18.3%) (Table 3). The high contamination of combs may be due to their frequent and direct contact with clients' hair and scalp, where dermatophyte spores are often present. Moreover, combs are typically reused without adequate disinfection between clients, thereby facilitating the mechanical transfer of fungal elements. These findings align with those of Uslu *et al*. (2008), who reported that combs and hairbrushes used in Turkish barbershops harbored viable dermatophyte spores due to inconsistent cleaning routines. Similarly, Santos *et al*. (2017) documented fungal contamination in 60% of combs and brushes sampled in Brazilian salons, with *Microsporum gypseum* and *Trichophyton tonsurans* being the most prevalent isolates. Clippers, though often considered lower risk due to their metal surfaces, are not immune to contamination, especially when used without disposable guards or sufficient sterilization. Brushes showed the lowest contamination levels, possibly due to their less frequent use or lower likelihood of retaining fungal spores.

A total of seven dermatophyte species were isolated across the four LGAs, with *Microsporum gypseum* (20.0%), *Trichophyton violaceum* (16.7%), and *Trichophyton tonsurans* (13.3%) being the most frequently isolated (Table 4). The predominance of *Microsporum gypseum*, a geophilic species, suggests environmental contamination, while *T. violaceum* and *T. tonsurans*, both anthropophilic, highlight the role of human carriers and interpersonal transmission via shared grooming tools. The detection of *Trichophyton schoenleinii*, *Microsporum canis*, and *Trichophyton rubrum*, though less frequent, is noteworthy. *T. schoenleinii* is classically associated with tinea favosa, while *M. canis* is a zoophilic species often linked to contact with animals. The presence of *T. rubrum* though limited to a single LGA surveyed, indicates broader fungal diversity than previously anticipated in salon environments. Its restricted distribution in the present study may reflect regional differences in lifestyle, hygiene, or tool-sharing practices, or a lower environmental burden in northern Nigeria. According to Nenoff *et al.* (2014), *T. rubrum* is increasingly being detected in urban grooming settings, reflecting

changes in fungal ecology and human behavior.

Overall, these findings indicate that multiple pathogenic dermatophyte species are circulating within salon environments in Kano metropolis, with significant variation across locations. This underscores the urgent need for public health interventions, including routine monitoring, salon hygiene education, and strict disinfection practices to curb the spread of dermatophytic infections in urban communities.

Conclusion

This study revealed a high prevalence (83.3%) of dermatophyte contamination in hair salon tools across four local government areas in Kano metropolis, Nigeria. Combs were the most frequently contaminated tools, followed by clippers and brushes. Among the isolated dermatophyte species, *Microsporum gypseum*, *Trichophyton violaceum*, and *Trichophyton tonsurans* were the most common, highlighting both environmental and anthropophilic sources of contamination. The presence of multiple species across different LGAs, with particularly high contamination in LGAs 3 and 4, underscores the widespread risk of fungal transmission in communal grooming environments. These findings indicate that hair salon tools can act as significant fomites in the transmission of dermatophyte infections, especially in urban areas with limited hygiene regulation and public awareness. The study provides strong evidence for the need to address salon hygiene as a public health priority to prevent outbreaks of superficial fungal infections.

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