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Barbing Equipments: Tools for Transmission of Tinea Capitis

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Authors' contributions

This work was carried out in collaboration between all authors. Author OMO designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author DEB managed the analyses of the study. Authors OAO and MM managed the literature search and statistical analysis. All authors read and approved the final manuscript.

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ABSTRACT

This efficacy of sterilization and cleaning methods used in the barbing salons and the possibility of those equipments acting as vehicles of transmission of fungal pathogens from one customer to another was assessed in this study. Thirty barbing saloons were randomly selected from the five wards in Calabar South. One hundred and fifty samples were aseptically collected using sterile swab sticks to brush out debris from combs, hair brushes and sterilized clippers into sterile paper envelopes. Samples were subjected to microscopy, culture and physiological tests. The recovery rate of fungal organisms from barbing equipments was 52(34.7%). Dermatophytes recovery rates was 40(26.7%) and non dermatophytes recovery rates was 12(8.0%). There was a statistically significant relationship between dermatophytes and barbing equipments recovered from (χ^2 = 25.0, p =0.01). *Trichophyton interdigitale* 12(30.0%). was the most common dermatophtye recovered

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from barbing equipments, followed by *Trichophyton rubrum* 9(22.5%). *Malassezia* species 5(41.6%) was the most common non dermatophytes recovered, followed by *Aspergillus flavus* 3(25.0%). Hair brushes were the most contaminated equipments (60.0%) by dermatophytes while the least contaminated were the hair clippers 17.5%. Dermatophytes and non dermatophytes were recovered from barbing equipments which depicts that they could serve as vehicles for transmission of fungal infections. Although the clippers were sterilized by all Barbers, dermatophytes and few non dermatophytes were still recovered from them. This points to incomplete sterilization either by disinfectant inefficacy or methods inefficiency.

Keywords: Barbing equipments; Tine capitis; sterilization; transmission.

1. INTRODUCTION

Barbers are important professionals in the community. Barber's shops are owned and managed by individuals in the community. Barbers use instruments such as knives, blades, clippers, brushes and combs which may serve as vehicles for transmission of fungal infections [1-2].

The establishment of barbing salons in our locality have been on the increase. Majority are owned and controlled by people with little or no training and knowledge on infection controlled practices. Researchers have shown the possibility of customers returning home with one infection or the other despite the aesthetics in the barbing industry [3].

Tinea capitis affects the scalp and hair. The infection is caused by *Trichophyton, Microsporum* and *Epidermophyton* species *of* dermatophytes [4]. The dermatophytes invade hair follicles and keratinized layer of hairy skin leading to scaling, kerion, hair loss, folliculitis, favus and black dot [4]. The infection could be anthropophilic, zoophilic or geophilic [4-5]. Prepubertal school age children between 6 to 10 years are usually more affected, it is rare in adults. The infection occurs in both sexes with high infection rates among males [4,6].

Tinea capitis is of public health importance but not a notifiable disease therefore little is known on its prevalence in many endemic areas [7-8]. Tinea capitis can be transmitted via infected persons, animal vectors and fallen infected hairs. Spread of tinea capitis by formites (contaminated barbershop instruments, hairbrushes, combs and shared hats) is common [9-10]. Factors affecting disease transmission are personal hygiene, overcrowding and low socioeconomic status. Shed hairs may harbour infectious fungal agents up to a year. Eradication is difficult due to common asymptomatic carriers [11]. Barbering operations are still under little or no scrutiny despite the possible risk of spreading infectious diseases [10].

Barbers use equipments which are always contaminated after some customer usage. Their sterilization methods include disinfecting and flaming. Some of the materials used are never sterilized, while some are sterilized but the sterilization efficacy is questionable since customers still get infected after saloon visits. This study was designed to assess the possibility of transmission of tinea infections from otherwise sterilized barbing equipments in Calabar, Nigeria.

2. MATERIALS AND METHODS

The study area for this research was Calabar South Local Government Area of Cross River State. It has an area of 264 km^2 and the population of 191,630 with the headquarters at Anantigha. Thirty barbing saloons were randomly selected from the five wards in Calabar South. Ethical approval was not sought since samples were obtained from inanimate objects. One hundred and fifty samples were aseptically collected using sterile swab sticks to brush out debris from combs, hair brushes and sterilized clippers into sterile paper envelopes. Samples were transported to the Department of Medical Microbiology/Parasitology, University of Calabar Teaching Hospital, Calabar for analysis.

Samples were subjected to microscopy using 10% KOH. The samples were cultured on dermatophyte test medium (DTM) with actidione (LabM Limited, Lancashire, UK) and Sabouraud dextrose agar with chloramphenicol [12]. Plates were incubated at room temperature and at 37℃, and examined for growth up to 2 weeks.

Hair fragments from the barbing equipments were placed on the microscope slide. A drop of

10% KOH was added and covered with cover slip. The slides were examined microscopically for arthroconidia in an ectothrix (outside the hair shaft) or endothrix (within the hair shaft) patterns [13].

Pure culture of the isolates were obtained by sub culturing individual isolates onto fresh Sabouraud dextrose agar (SDA) at room temperature (26℃-29℃) for up to 10-14 days. In cases of no or slow sporulation, slide culture was carried out [12]. Isolates were identified based on colonial morphology: (color, pigmentation, rate of growth and texture), microscopy and physiological tests. The Physiological tests carried out include: urease test, hair penetration test, growth on rice grains, tween assimilation and lipid test [1,14-17]. The isolates were compared to published descriptions of these organisms.

Pure cultures of isolates were inoculated on Christensen's urea slants. A change in colour from yellow to pink indicated a positive urease production.

Hair perforation test was performed in a Petri dish containing 20 ml of deionized water with 2-3 drops of 10% yeast extract. Sterilized hair fragments from a prepubescent child was placed in the dish and inoculated with the isolate to be tested. The petri dishes were incubated at room temperature for up to 4 weeks. Positive and negative controls were also set up with *Trichophyton interdigitale* and *Trichophyton rubrum* respectively. The hair fragments are examined weekly under the microscope as wet preparations in a drop of water. The observation of a cone shaped perforation on the hair shaft means positive. When viewed from the top they appear as round holes [13].

In vitro hair perforation test and urease test was used to differentiate *T. soudanense* and *T. Tonsurans. Trichophyton soudanense* is usually urease negative and hair perforation test negative while *T. Tonsurans* is urease positive and hair perforation test variable.

Growth on rice grains was used to distinguish *M. gypseum* from *M. audouinii.* Few grains of polish rice were placed in a small flask and covered with distilled water before autoclaving. The isolates were inoculated onto the surface of the grains and incubated for 7-14 days. *Microsporum gypseum* produces good growth, with no pigmentation but with variable conidia formation. *Microsporum audouinii* does not grow on rice grain. The identification scheme for the dermatophytes is shown in Table 1.

Catalase test, lipid test and tween assimilation test were used in the identification of *Malassezia* species [16-19]. *Aspergillus* species were identified based on their colonial and microscopic morphology.

2.1 Data Analysis

The data obtained in this study were analyzed with Epi-Info CDC, 2012 data analysis package. Descriptive statistics were carried out. Frequencies were calculated for categorical variables. Interactions between specific categorical variables were tested for significance using the χ^2 test. A p-value of 0.05 was considered statistically significant.

Table 1. Identification scheme for dermatophytes

Dermatophytes isolates	*In vitro* hair perforation test	Hair invasion	Growth on rice grains	Urease
Microsporum gypseum	+	Large spores ectothrix	Good growth no pigmentation. (+) or (-) conidia	+
Microsporum audouinii	-	Ectothrix	Poor with no conidia	(-) or (+)
Trichophyton interdigitale	- or (+) variable	Negative	-	+
Trichophyton rubrum	-	Negative	N/A	+
Trichophyton tonsurans	Variable	Endothrix	N/A	+
Trichophyton soudanense	Negative	Endothrix	N/A	Usually negative

3. RESULTS

Out of the 150 samples collected from hair barbing equipments 52(34.7%) were infected with fungal organisms. Fig. 1 shows the distribution of fungal isolates by barbing equipments. Hair brushes were the most contaminated barbing items 27(54.0%) followed by combs 15(30.0%). Only 10(20.0%) isolates were recovered from hair clippers.

Dermatophytes recovery rates was 40(26.7%). The most common dermatophyte was *Trichophyton interdigitale* 12(30.0%), followed by and *Trichophyton rubrum* 9(22.5%) and *T. tonsurans* 6(15.0%). *Trichophyton soudanense* 3(7.5%) was the least recovered isolate. Hair brushes were the most contaminated equipments 24(60.0%) by dermatophytes and the least contaminated were the hair clippers 7(17.5%). There was a statistically significant relationship between the barbing equipments and dermatophytes recovery rates (χ^2 = 25.0, p =0.01) (Table 2).

Non dermatophytes recovery rates was 12(8.0%). The most common non-dermatophyte recovered from barbing equipments was *Malassezia* species 5(41.6%) followed by *Aspergillus flavus* 3(25.0%). Combs were the the most contaminated barbing items 6(50.0%) by non-dermatophytes. There was no statistically significant relationship between non-dermatophytes recovery rate and barbing equipments (χ^2= 11.0, p= 0.16) (Table 3).

4. DISCUSSION

This present study assessed the efficacy of the sterilization and cleaning methods used in the barbing salons and the possibility of those equipments acting as vehicles of transmission of fungal pathogens from one customer to the other.

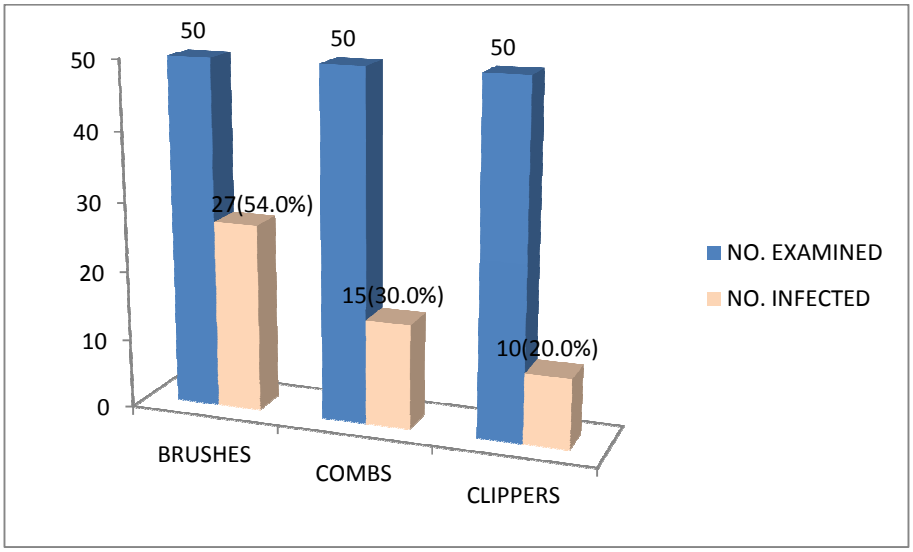

Fig. 1. Distribution of fungal isolates in barbing equipments

Table 2. Distribution of dermatophytes on barbing equipments

Dermatophytes isolates	Barbing equipments (n=150) No (%) of isolates			
	Clippers	**Brushes**	**Combs**	**Total**
Microsporum audouinii	0(0.0)	4(16.6)	1(11.1)	5(12.5)
Microsporum gypseum	0(0.0)	4(16.6)	1(11.1)	5(12.5)
Trichophyton interdigitale	2(28.5)	7(29.1)	3(33.3)	12(30.0)
Trichophyton rubrum	2(28.5)	5(20.8)	2(22.2)	9(22.5)
Trichophyton soudanense	0(0.0)	1(4.2)	2(22.2)	3(7.5)
Trichophyton tonsurans	3(42.8)	3(12.5)	0(0.0)	6(15.0)
Total	7(17.5)	24(60.0)	9(22.5)	40(26.7)

Table 3. Distribution of non-dermatophyte isolates on barbing equipments

Non-dermatophyte isolates	Clippers	Brush	Combs	Total
Aspergillus flavus	0(0.0)	2(66.7)	1(16.7)	3(25.0)
Aspergillus fumigatus	2(66.7)	0(0.0)	0(0.0)	2(16.7)
Aspergillus niger	0(0.0)	0(0.0)	2(33.3)	2(16.7)
Malassezia species	1(33.3)	1(33.3)	3(50.0)	5(41.6)
Total	3(25.0)	3(25.0)	6(50.0)	12(8.0)

The barbers in the salons recruited for the study were of wide range of barbing experience with mean years of practice 6.4 ± 3.5 yrs. They could reasonably be reflective of overall attitude of the barbers in the locality. Barbers in this part of the world are barely educated and often primary or secondary school leavers. Becoming a barber usually requires a few months of apprenticeship; the actual length of time varies, and is often dependent on the agreement between the apprentice and his master; no form of certification or license is involved. We found out that majority of the barbers were aware that their clippers could transmit ringworm infection, but were ignorant about other items doing same.

In this study, all the barbers decontaminated their clippers with the application of methylated spirit followed by flaming for 2-5 minutes after every customer usage. Other barbing equipments were rarely decontaminated while some barbers washed the combs and brushes with detergents and 10% hypochlorite once or twice a month at room temperature.

The recovery rate of fungal pathogens may depict the infectivity rate in the locality or the inefficiency of the sterilization processes in the barbing salons. In this study *Trichophyton interdigitale* 12(30.0%) was the most common dermatophytes recovered from barbing equipments, followed by *Trichophyton rubrum* 9(22.5%). This is in agreement with the study of Oyeka and Eze [20], Ayanbimpe et al. [10] and Mbata and Nwajagu [15] who reported *Trichophyton interdigitale* and *Trichophyton rubrum* as the most predominant species causing tinea capitis in the South Eastern and North Central zones of Nigeria. However, our findings differ from the study of Oke et al. [21] who reported *Microsporum audouinii* (28.0%) as the commonest dermatophyte species among their subjects in South western Nigeria. These differences may be due to variation in distribution of dermatophytes species in different geographical areas in the country.

In this study hair brushes were the most contaminated equipments 54.0% by fungal organisms while the least contaminated were the hair clippers 20.0%. This shows that the sterilization method of the clippers by the application of methylated spirit followed by flaming is more effective than washing with detergents and 10% hypochlorite which is applicable to the brushes and combs.

The 17.5% recovery rates of dermatophytes from clippers depict incomplete sterilization leading to mere reduction in microbial load. The location with the highest recovery rate was Malabor, University of Calabar male hostel. This may be due to high patronage caused by high population of students which leaves the barbers with little or no time for sterilization of equipments.

The presence of non dermatophyte moulds on the scalp is becoming increasingly common. Adefemi et al. [22] and Chepchirchir et al. [23] attributed this to the presence of spores in the environment which enables them to be carried transiently on healthy skin. The non-dermatophyte moulds identified in the study were *Aspergillus flavus* 25.0%*, Aspergillus fumigatus* 16.7% and *Aspergillus niger* 16.7%. Oke et al. [21] in their study among children in South Western Nigeria also isolated lower rates of *Aspergillus fumigatus* (8.4%), and *Aspergillus niger* (6.4%). This suggests the possibility of transmission of these moulds from improperly sterilized barbing equipment from one customer to the other.

The limitation of the study was the inability to obtain multiple samples from the barbing equipments after each customer usage for laboratory studies. This could have given an insight unto whether the non-Dermatophytic moulds were contaminants or pathogens. This limitation was because of the uncertainty of when each customer will return for another barbing.

5. CONCLUSION

Dermatophytes and non dermatophytes were recovered from barbing equipments which depicts that they could serve as vehicles for

transmission of fungal infections. Although the clippers were sterilized by all Barbers, dermatophytes and few non dermatophytes were still recovered from them. This point to incomplete sterilization. Customers that cannot afford hair clippers should insist on longer sterilization exposure time while combs and brushes should be personalized.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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