MAGNITUDE, ANTIMICROBIAL SUSCEPTIBILITY PATTERN AND FACTORS ASSOCIATED WITH MICROBIAL CONTAMINATION OF HAIR DRESSING TOOLS IN KINONDONI MUNICIPALITY, DAR ES SALAAM.

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MSc (Microbiology and Immunology) Dissertation
Muhimbili University of Health and Allied Sciences
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Muhimbili University of Health and Allied Sciences

Department of Microbiology and Immunology

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By

Michael Charles Mgimba

A Dissertation Submitted in (Partial) Fulfillment of Requirements for the Degree of Master of Science (Microbiology and Immunology) of

Muhimbili University of Health and Allied Sciences
October, 2021

CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled; **''Proportion, antimicrobial susceptibility pattern and factors associated with microbial contamination of hair dressing tools in Kinondoni Municipality, Dar es salaam'',** in (partial) fulfillment of the requirements for the degree of Master of Science (Microbiology and Immunology) of the Muhimbili University of Health and Allied Sciences.

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DECLARATIONANDCOPYRIGHT

I, Michael Charles Mgimba, declare that this **dissertation** is my own original work and that it has not been presented and will not be presented to any other University for similar or any other degree award.

Signature……. **Date**……

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All praises be to almighty God for the strength and blessings in completing this dissertation work. Obviously, this dissertation report would not have been possible without the effort of supervisors, friends and colleagues at MUHAS. I am deeply grateful for the support of my supervisors Prof Eligius Lyamuya and Dr. Frank Msafiri from MUHAS, Department of Microbiology and Immunology. In addition, several MUHAS academic staff including Dr. Agricola (Head of Department), Laboratory technicians, gave me constructive inputs from research proposal development to dissertation report writing.

I also wish to express gratitude to Kinondoni administrative and Municipal medical officer for allowing me to conduct this study, and I extend my acknowledgement to biostatisticians at MUHAS for helping with data analysis.

DEDICATION

I would like to dedicate this dissertation to my wife Clara and my daughter Michaella for their support all the time of my studies.

ABSTRACT

Background: Inadequate disinfection of contaminated hair cutting implements could be potential source for transmission of scalp and blood borne infections. There is paucity of information regarding the extent of microbial contamination of tools used in barbershops as well as antimicrobial susceptibility pattern of the responsible contaminants in Tanzania.

Objective: This study aimed at determining the prevalence, antimicrobial susceptibility pattern, and factors associated with bacterial and fungal contamination of hair dressing tools used by barbers in Kinondoni Municipality, Dar es Salaam.

Methodology: This was a cross-sectional study conducted in Kinondoni Municipality, Dar es Salaam. Combs, scissors, brushes and electric trimmers were examined for bacterila and fungal contamination. Multistage sampling technique was used to select barbershops and purposive sampling to select barbers to be interviewed. Samples were collected using sterile cotton swabs, and tested for contamination at the Microbiology and Immunology Laboratory at Muhimbili University of Health and Allied Sciences. In the laboratory, swabs were inoculated into blood agar, MacConkey agar, chocolate agar and Sabouraud's dextrose agar for bacterial and fungal isolation, respectively. Kirby Bauer disc diffusion method was used for antimicrobial susceptibility testing (AST). Practices, knowledge and hygiene were assessed using pre-designed questionnaire and checklists. Binary logistic regression was performed to examine the association between related findings. P-value of < 0.05 was considered as statistically significant.

Results: A total of 400 hair dressing tools were collected and examined. The prevalence of microbial contamination of hair dressing tools was 20.25%, with *Pseudomonas aeruginosa* being the most isolated pathogen (30.9%), followed by *C. albicans* (22.2%), *Staphylococcus aureus* (16%), *Escherichia coli* (16%), *Morganella morganii* (6.6%), *Proteus mirabilis* (4.9%), *Salmonella paratyphi A* (2.5%) and *Salmonella paratyphi B* (1.2%). *Pseudomonas aeruginosa* and *Escherichia coli* were highly resistant to all first line antibiotics whereas *Staphylococcus aureus* was sensitive to Ciprofloxacin only.

Poor hygiene and sanitation, age of barbers, use of methylated spirits, sterilization, barbershop status, and number of clients per day were independently associated with microbial contamination in hair dressing tools.

Conclusion: There is significant contamination of hair dressing tools in Kinondoni Municipality. This increases the risk of transmitting scalp infections and spreading antibiotic resistance. Further studies are needed in this area in order to generate significant data that can elucidate on the magnitude of this problem in Tanzania.

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LIST OF ABBREVIATIONS

AIDS	Acquired Immunodeficiency Syndrome
AMR	Antimicrobial Restistance
CLSI	Clinical Laboratory Standard Institute
CPL	Central Pathology Laboratory
GNB	Gram Negative Bacteria
HIV	Human Immunodefiency Virus
KIA	Kligler Iron Agar
Mini UV	Mini ultra violet sterilizers
MCA	MacConkey Agar
MDR	Multidrug Resistance
MHA	Mueller Hinton agar
MNH	Muhimbili National Hospital
MUHAS	Muhimbili University of Health and Allied Sciences
NA	Nutrient Agar
SPSS	Statistical Package for Social Sciences
TBS	Tanzania Bureau of Standards Tanzania Food and Drug Authority
TFDA	Tanzania Medicines & Medical Devices Authority
TMDA	Tanzania Medicines & Medical Devices Authority
WHO	World Health Organization

DEFINITION OF TERMS

Barbershops: Are facilities used by men as public places for dressing and trimming hair, beards, pedicure, manicure and facial cleanliness.

Hairdressing Salon: means any establishment engaged in the practice of hairdressing, cosmetology, or barbering for the public.

Hair dressing tool: Any tool or device used for barbering.

Microbial contamination: Is a non-intended or accidental introduction of microbes such as bacteria, yeasts moulds, fungi, virus, prions, protozoa or their toxins or by products to barbering equipment.

Antibiotic susceptibility Testing: Is the test done to detect sensitivity or resistance of pathogenic aerobic and facultative anaerobic bacteria to various antimicrobial compounds in order to assist a physician in selecting treatment options for his or her patients.

Barber: A person who cuts men's hair and shaves or trims beards as an occupation.

Safety- refers to the state of being safe; freedom from the occurrence or risk of injury, danger, or loss.

Occupational health: Include protection and promotion of health of the workers by preventing and controlling occupational diseases and accidents as well as eliminating factors hazardous to health and safety at work.

Regulatory compliance: Refers to obedience by a target population with regulations.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Hair is one of the structures with a protein filament that grows from follicles found in the dermis, or skin in a body of human being. Hair is one among the defining characteristics of mammals that they possess. Hair strand is anatomically made up of the medulla, cortex, and cuticle, which appear to be different from every organism by having its own specific characteristics that determine the length of the hair. The hair found on the head serves as primary sources of heat insulation and cooling as well as protection from ultra-violet radiation exposure from the atmosphere or any other heat source (1).

Barbershops are used by both men and women for dressing and trimming of hair in order to make them look neat and beautiful. For men almost each week they attend barbershops for hair and beard trimming as hygienic measure. There is no enough data for those who attend barbershops per week/month as clients because it depends on the areas and nature of those clients per time.

If proper and adequate hygiene is not maintained in these premises, contaminated equipment like combs, electric trimmers, scissors, towels and cotton wools in barbershops can be potential sources for transmission of many infections from one client to another due to sharing of these tools (2). There is no any regulatory body for overseeing the opening and closing of the barbershops/salon, also there is no infection prevention (IPC) policy for the municipal or country as most of heads of the shops operate according to their business areas and preferences (2). Skin infection and blood borne infections can be transmitted through the use of sharp equipment which are not well sterilized or disinfected by barbers (3). Clients with fungal and bacterial skin infections on the scalp, face and neck such as *Tinea capitis*, impetigo, and ringworm may be the source of hair and skin infections (4).Various studies on microbial contamination in hair dressing tools have been done in the world and in some

African countries with some reporting the prevalence of microbial contamination ranging from 21.2% to 28% (2,4–7).

Common pathogens have been reported to be isolated from hair cutting equipment whereby three potentially pathogenic bacteria species and three potential pathogenic fungal species were isolated from different barbershops. Streptococcus spp and *Staphylococcus aureus* were isolated from all the barbershops and these are among the most important bacteria that cause disease in humans. They have been reported to cause various pus-forming diseases in humans such as boils, impetigo contagiosa, carbuncles, folliculitis and scalded-skin syndrome (8).

Isolates were identified using Gram staining technique, biochemical tests and antimicrobial susceptibility testing (AST) to isolated bacteria using disc diffusion method. Results showed microbes present were *Staphylococcus aureus*, *Klebsiella pneumonia (K. pneumonia)*, *Escherichia coli* and *Pseudomonas aeruginosa (P. aeruginosa)*. Among all *S. aureus* was the most prevalent isolate while the least distributed bacterial isolate was *K. pneumoniae*. AST results showed that *E. coli* was the one with resistance to all test antibiotics. *K. pneumoniae* and *S. aureus* were both susceptible to streptomycin and gentamicin. *P. aeruginosa* was resistant to cephazolin, novobiocin, erythromycin and susceptible to ofloxacin and ciprofloxacin (9). According to Rideout et al the most preferred disinfection and sterilization methods in many barbershops worldwide are heat, chemicals, boiling, flaming, ultra violet (UV) light, glass beads and ultrasonic cleaners. Most of barbershops in Iran use methylated spirits (70% alcohol) as the main disinfectant while very few use autoclaves or ovens though in Tanzania there is limited data on this (5). In various studies done in some countries in the horn of Africa to evaluate the potential risk of HIV transmission in barbering practice it was observed that, practices like sterilization and disinfection techniques were commonly used (3,10).Factors that led to microbial contamination in various studies have been revealed to be source of microbial contamination of hair dressing tools like limited knowledge on using sterilizing machines as most of them do not know, time of using sterilizers before and after attending the client as many of them sterilize only when they attend a client.

Other factors include servicing of the sterilizing machine per time which is not done in almost all barbers, knowledge about using disinfectants and adherence to manufacturer's instructions are not clearly stated and practiced, washing hands by soap before and after attending the client is not done to all. The studied barbershops were found to have few towels and also the way they were cleaned was not appropriate. Storage of used tools after attending the client was not appropriate. Awareness during attending a client and number of clients per day per barbershop influenced the proportion of microbial contamination. Opening of caps of methylated spirits after buying to mix with water also was among the factors that could be the source of contamination of microbes in hair dressing tools. These predisposing factors of microbial contamination in hair dressing tools may lead to scalp infection, blood borne infection and other skin diseases.

Due to these problems and paucity of information in Tanzania, in this study we aimed to determine the extent of microbial contamination, antimicrobial susceptibility pattern and factors associated with contamination of hair dressing tools in barbershops in Kinondoni, Dar es Salam (4).

1.2 Statement of the problem

To achieve hygiene and sanitation is the pre-requisite for worker's safety in any occupational setting including barbershops. Personal and client hygiene practices should be taken as an important step in prevention of health and safety problems, which may be due to contamination in equipment used. However, ongoing unsafe or unhygienic practices as observed in daily attending barbershops in other studies may also be occurring in barbershops and hairdressing salons in Tanzania, which may affect the health of both the customers and the workers due to contamination (11). For instance, for a procedure involving skin puncture piercing in processes such as cutting, manicure, pedicure, and skin care if not well managed properly may transmit bacterial, fungal and viral infections including HIV, Hepatitis B and Hepatitis C to workers, but also to their customers (10).

There is little information regarding microbial contamination of barbershop implements as limited studies have been done in Tanzania and hence paucity of documented information on microbial contamination. There is a need to establish the microbial contamination, prevalence and AST in barbershop routinely used tools like combs, brushes, scissors and electric trimmers due to the fact that the findings obtained will help to improve public health. This study was therefore undertaken to shed light on the extent of the problem, on factors that perpetuate bacterial and fungal contamination of the implements, as well as antimicrobial sensitivity pattern of these isolates.

1.3 Conceptual frame work

Several factors have been associated with microbial contamination in barbering equipment. These includes lack of practical knowledge on machine use, use of single tool for all clients attending the barbershop and poor hygiene and sanitation skills of the equipment (12). Among the hygienic practices they are supposed to adhere to include hand washing before and after attending the client, cleaning and sterilization of the machine and its accessories, use of single hair trimmer per customer, proper razor blade disposal, use of appropriate sterilization methods such as antiseptic solution, ultraviolet radiation, and use of 70% alcohol (13). Effective killing of infective microorganisms is reported to be achieved by allowing the tools to be exposed for a long time in a set temperature or medium of sterilization as failure to adhere to the operational manual predisposes the barbershop customers to the risks of microbial contamination through equipment (4,7,14).

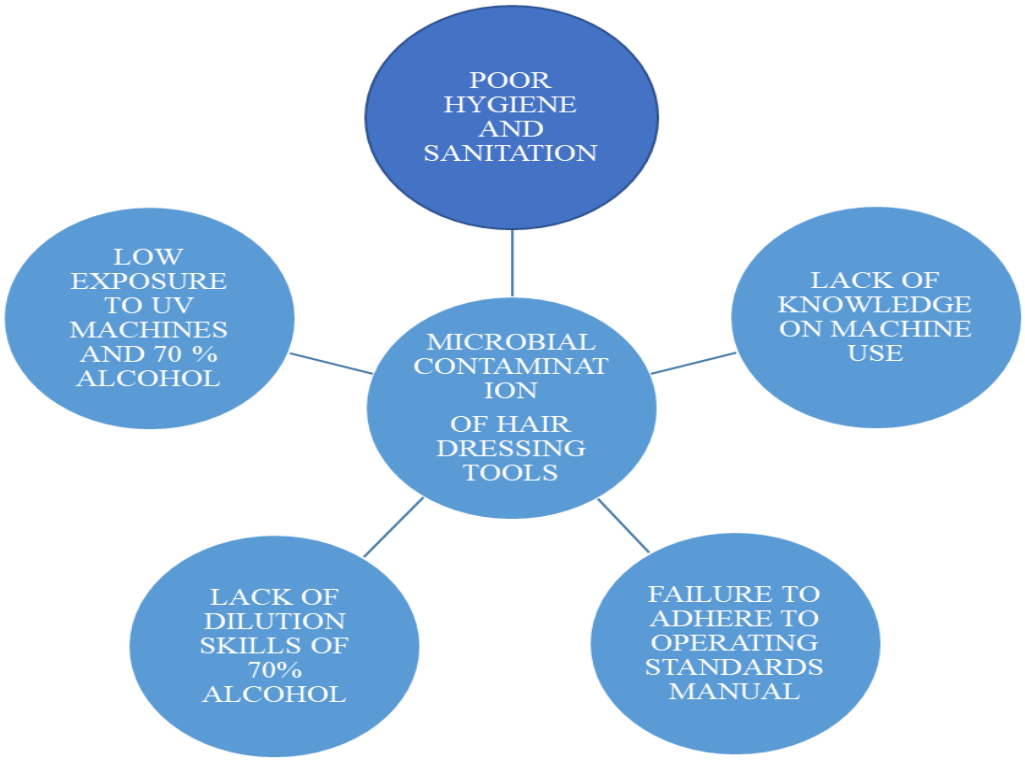


Figure 1: **Conceptual framework showing factors that increase the risk of microbial contamination of hair dressing tools.**

1.4 Rationale

Due to lack of data on microbial contamination and AST pattern of organisms from barbershop implements, this study was considered of importance as it will give knowledge that would help raise awareness to barbers and improve hygienic practices for barbershop used tools like combs, brushes, scissors and electric trimmers in Kinondoni Municipality, Dar es Salaam. Knowing individual microbes and their drug of choice will help health care givers, customers and the community in general to act upon once they are affected with any barbershop-associated scalp or skin infection. Our study findings may influence best practices in barbershops in our settings. The community will be aware of microbial contaminants and their control in barbershop hair dressing tools in which will help authorities in policy formulation.

1.5 Research questions

i. What is the extent of bacterial and fungal contaminations in combs, brushes, scissors and electric trimmers in Kinondoni Municipality?

ii. What are the factors associated with microbial contamination in combs, brushes, scissors and electric trimmers used in barbershops in Kinondoni Municipality?

iii. What is antimicrobial susceptibility testing pattern of the isolates?

1.6 Hypotheses

There is no relationship between microbial contamination of hair dressing tools with barbershop practical knowledge**.**

There is no significant difference on microbial contamination, AST pattern and factors associated with microbial contamination of hair dressing tools among barbershops.

1.7 Objectives

1.7.1 Broad objectives

To determine the magnitude, antimicrobial susceptibility pattern, and factors associated with microbial contamination of hair cutting implements in Kinondoni Municipality, Dar es Salaam.

1.7.2 Specific objectives

i. To determine magnitude of microbial contamination of combs, brushes, scissors and electric trimmers used in barbershops in Kinondoni Municipality.
ii. To determine antimicrobial susceptibility pattern of isolates recovered from combs, brushes, scissors and electric trimmers in Kinondoni.
iii. To determine the factors associated with microbial contamination of combs, brushes scissors and electric trimmers used among barbershops in Kinondoni Municipality.

1.8 Literature review

1.8.1 Role of barbershops in transmission of hair and skin infections

Barbershops are regarded as personal service agencies in the community and can lead to transmission of many diseases (15). Infection can be transmitted accidentally by any means through blood contact during haircut and shaving in barbershops and therefore, it is postulated that those who work in barbershops may play an important role in the spread or control of infections (4). Microorganisms including bacteria and fungi have the potential to colonize surfaces of any material including equipment and skin surface and sharing of such contaminated implements in barbershops can spread the microorganisms between clients. Infection can occur during hair dressing or trimming since implements like razors, scissors, combs, clippers and hairpins can accidentally penetrate and pierce the skin. Fluids from parts of the body including blood and sweats may not be visible or recognizable on instruments, equipment or working surfaces (11). There are several infections that can be spread in barbershops and they include infections on the scalp, face and neck such as impetigo and fungal infections. There is a possibility of skin to be burnt during hair dressing or trimming by accidental use of hot tongs, clippers, driers and steamers. If the skin is burnt the protective effect of its surface is destroyed become easily infected by contaminants such as bacteria and fungi and this may result into health complications like skin diseases. For that reason, any client who will come to shave in that barbershop and get in contact with any shared equipment will be at risk of being contaminated with microbes (16). A large number of barbershops in Kinondoni have no autoclave or oven or UV sterilizers, and 70% alcohol is the main disinfectant used. However, since most users are not aware of how to use these substances, in which provision of continuing trainings on this issue seems essential. Globally the same study was done in various areas including Kamyaran city Iran and it brought the same reasons for contamination of tools as those revealed in Kinondoni Municipality(5).

The same studies have been done regionally including countries like Nigeria which came with results of microbial contamination of hair dressing tools which was due to unhygienic procedures in barbershops.

Hairdressing salon and barbershops are in higher risk of microbial contamination because of procedures undertaken by barbers, like hair shampooing, waving or chemical application and the rinsing of these chemicals. Human hairs may function as an air-collecting agent for microbial contaminants, because the hairs are constantly exposed to air and can readily adsorb a variety of airborne particles via electrostatic attraction, grooved surfaces, thin and long structures, and biochemical affinity(1). It is often that, most of practices undertaken by barbers results in their repeated exposure to microbial contamination (4).To be contaminated by microbes sometimes cannot be seen by our eyes as it need body reactions to reveal it. Also contamination can be by visible organisms like lice or any parasites(17).

1.8.2 Magnitude of bacteria associated/ isolated contamination in barbershops

Various studies on microbial contamination in barbershop implements have been done in some countries the world including some African as countries. These studies were conducted to evaluate the microbial contamination on tools used in hairdressing salons and barbershops such combs, brushes, clippers, towels and hairdryers using standard microbiological procedures (18). Most of the reported studies revealed contamination with bacterial and fungal species including; *Staphylococcus aureus* 29.6%, streptococcus spp 14.5%, micrococcus spp 5%, Aspergillus spp 26.5%, Mucor spp 20.4%, *Cladosporium* 4.1%, *Trichophyton spp* 4.1%, *Mucor spp* 20.4%, Candida 18.4%, *Penicilium spp* 18.4% (5).

In these studies there were some practices which were observed by researchers on how the barbershop implements and tools were sterilized and disinfected (12). In all these studies it was shown that there was a statistically significant relationship between the barbing equipment and microbial exposure. In this regard, approximately 25-27% of microbial contamination was reported in barbershop used tools (4). One of the studies on mycological examination of the barber's tools about sources of fungal infections in Erzurum, East Anatolia of Turkey revealed infection of tools with the average magnitude of 25.44% (7). Also a study on evaluation of microbial contamination of tools used in hair dressing salons in Michael Okpara University of Agriculture, Abia State Nigeria reported a percentage of 28% (2).

Evaluation of bacterial and fungal contaminations in barbershops in Kamyaran city, Iran-summer 2015 revealed a prevalence of 28 % (5)**.**

In the study of evaluation of bacterial and fungal contaminations in barbershops in Kamyaran city, Iran, the prevalence was 29.6% for *Staphylococcus spp*. Other bacteria found included *gram positive cocci* (27.8%), *Micrococcus spp* (5%), gram negative bacilli (11%), gram positive bacilli (6%), and non-spore-forming gram positive bacilli (1.9%) (5). Also in a study on barbing equipment tools investigating transmission of *Tinea capitis* out of the 150 samples collected from hair barbing equipment 52(34.7%) were infected with fungal organisms. Hairbrushes 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 (electric trimmers). Dermatophytes recovery rate was 40(26.7%). The most common dermatophyte was *Trichophyton interdigitale* 12 (30.0%), followed by *Trichophyton rubrum* (22.5%) and tonsurans 6(15.0%).

Trichophyton soudanense 3(7.5%) was the least recovered isolate. Hair brushes were the most contaminated equipment 24 (60.0%) by dermatophytes and the least contaminated were the hair clippers 7(17.5%) (15).

1.8.3 Antimicrobial Sensitivity of isolates from combs, scissors, brushes and electric trimmers

In almost all studies done worldwide and regionally, there is only information for microbial contamination in barbershop tools without addressing AST of the isolates except for some studies done including that in Ugbowo, Benin city (9). Because of potential risks that might be associated with pathogens isolated from barbershop tools there is a need for AST to be done. This will provide results for use in determining the appropriate treatment choices (4,19). The AST by the clinical microbiology laboratory for the isolates in barbershop implements is important to confirm susceptibility to chosen empirical antimicrobial agents, or to detect resistance in individual bacterial isolates. This will help therapy to be effective for some bacterial pathogens. Susceptibility testing of individual isolates is important with species that may possess acquired resistance mechanisms (eg members of the

Enterobacteriaceae, Pseudomonas species, Staphylococcus species, Enterococcus species, and *Streptococcus pneumoniae*) (20).

One of the studies done on Bacteriological Assessment of Barber's Clipper in Barbers Shops in Ugbowo, Benin City revealed AST results, which were based on broth dilution methods. The results showed that *P. aeruginosa* was resistant to cephazolin, novobiocin, erythromycin and ampicillin, while it was susceptible to streptomycin, novobiocin, gentamicin and amoxicillin. *Escherichia coli* were resistant to all tested antibiotics. *Staphylococcus aureus* was resistant to cephazolin, ofloxacin, ciprofloxacin; sulphamethoxazole and novobiocin and susceptible to streptomycin and gentamicin. *K. pneumoniae* on the other hand was resistant to cephazolin, ofloxacin, ciprofloxacin and sulphamethoxazole (20).

1.8.4. Factors associated with microbial contamination of hair dressing equipment

There are many factors or predictors that may contribute to microbial contamination on barbering tools. Identified predictors from various studies like lack of practical knowledge, using a single tool for all clients, poor hygiene and sanitation will be used in our study as references to identify the microbial contamination of combs and electric trimmers in selected barbershops of Kinondoni Municipality. Mostly these factors of microbial contaminants in barbershop tools may lead to scalp infection, blood borne infection, *Tinea capitis* which is one of the most prevalent fungal microbial contaminant. Studies have been done in Africa especially in Nigeria among school children where it has been realized that, there are predictors for microbial contamination in barbering equipment which include poor hygienic practices in barbershops (4). In this study it was revealed that, in wealthy families children and their parents cut or dress their hair by considering and following all aspects of hygiene and sanitation, since most local barbers may not be familiar hence no contaminations of their barber tools and equipment. The same study revealed that, non-fee paying schools were the ones which were more contaminated with infection like *Tinea capitis* because this was the most lower socio- economic group while in the staff school, there was the lowest incidence of the disease and this is because the school was for the children from wealthy families who are attended by barbers with knowledge and practical skills with high hygienic practices (21).

Among all studies done to evaluate microbial contamination in barbershop tools like combs and trimmers results have reported contamination frequencies of 29.6% for Staphylococcus spp and 26.5% for Aspergillus spp which were the results of ineffective sterilization and disinfection by 58 % (22). In a daily routine practice, instruments should be washed in water and detergents simply by using1:10 to 1:100 dilution of the proposed solution like bleaching agents, as failure to adhere would lead to infection of microbes (23).

CHAPTER TWO

2.0 MATERIALS AND METHODS

2.1 Study Design

This was a cross sectional study to determine the prevalence, antimicrobial susceptibility pattern and factors associated with microbial contamination of hair dressing tools in Kinondoni Municipality. Dar es Salaam. Routine barbershop knowledge was retrieved from different sources including experienced barbers to complement the interview.

2.2 Study Area

This study was conducted in Kinondoni Municipality located in south, east, and west of Dar es Salaam region by random selection of 10 wards namely Bunju, Mbezi, Makongo, Kawe, Makumbusho, Kinondoni, Tandale, Mwananyamala, Wazo and Mzimuni. To the east is the Indian Ocean, to the north and west the Pwani Region of Tanzania. The area of Kinondoni is 531 km^2 (205 sq mi). It comprises of 20 wards by which, as a business centre, Kinondoni has a total population of 1496 estimated barbershops.

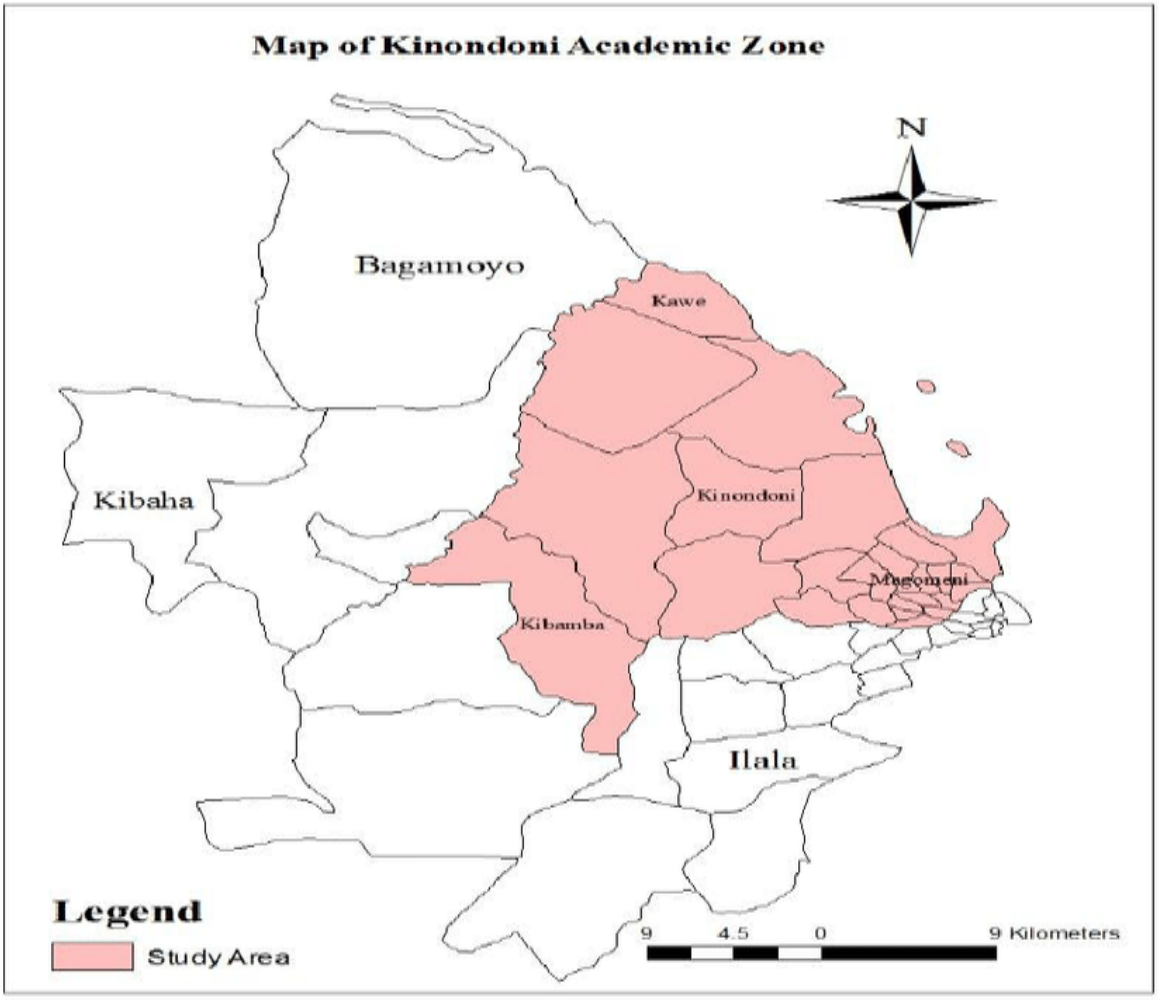


Figure 2: Location map of the study area Kinondoni Municipality (Dar es Salaam Region) in Tanzania.

2.3 Study Duration

The study was conducted for five months starting from August, 2020 - January 2021.

2.4 Study Population

The study population was 400 hair-dressing tools from 100 barbershops selected randomly from 10 wards located in Kinondoni Municipality, Dar es Salaam region.

2.5 Inclusion and Exclusion Criteria

2.5.1 Inclusion Criteria

All barbershops that use hairdressing tools namely combs, trimmers, scissors and brushes**.**

2.5.2 Exclusion Criteria

All barbershops not using dressing tools like combs, brushes, scissors and electric trimmers.

2.6 Sample Size

The sample size was calculated using the following formula: -

$$n = \frac{Z^2 p(1-p)}{e^2}$$

Where

n = Sample size (Number of hair dressing tools) z = at 95% confidence interval z value = 1.96

p = Prevalence, 50% for unknown proportion (Assumed because there is no study report on prevalence of barbershops with contaminated hair dressing tools).

e = Margin of error at 5% (0.05) Thus:

$$n = \frac{(1.96)^2 \times 50(100-50)}{(0.05)^2} = 384$$ hair dressing tools.

The minimum required sample size was least 400 hair dressing tools from 100 barbershops in Kinondoni Municipality.

2.7 Sampling method

A multistage sampling procedures were used to obtain the sampling units (barbershops). A systematic random sampling was first employed to sample wards within Kinondoni District, then barbershops and barbers were sampled by random and expert purposive sampling, respectively as described below.

2.7.1 Sampling of wards

Multistage sampling of wards was conducted randomly to obtain ten wards proportionate to the population size of all Kinondoni wards. This was achieved from taking total number of wards in Kinondoni and named by numbers which picked randomly and those which selected were included in a study namely Bunju, Bunju, Mbezi, Makongo, Kawe, Makumbusho, Kinondoni, Tandale, Mwananyamala, Wazo and Mzimuni.

2.7.2 Sampling of barbershops

A random sampling method was applied to select one hundred barbershops in Kinondoni Municipality from the population of all listed barbershops and this was due to the fact that, there was no enough data for the registered barbershops.

2.7.3 Sampling of barbers

Expert purposive sampling was used to select barbers based on the knowledge they have in barbershops. Interviews was conducted using simple structured questionnaire. During this stage, information collected includes social, economic and demographic characteristics, such as age, sex, education level, practical knowledge, and occupation status e.g. head of barbers, income, barbershop facilities, and health history. Before starting sampling, there was communication between investigator and barbers to seek their consent to participate in the study. The focus was to barbers since it was not possible to meet barbershop owners, because most delegated their shops to barbers.

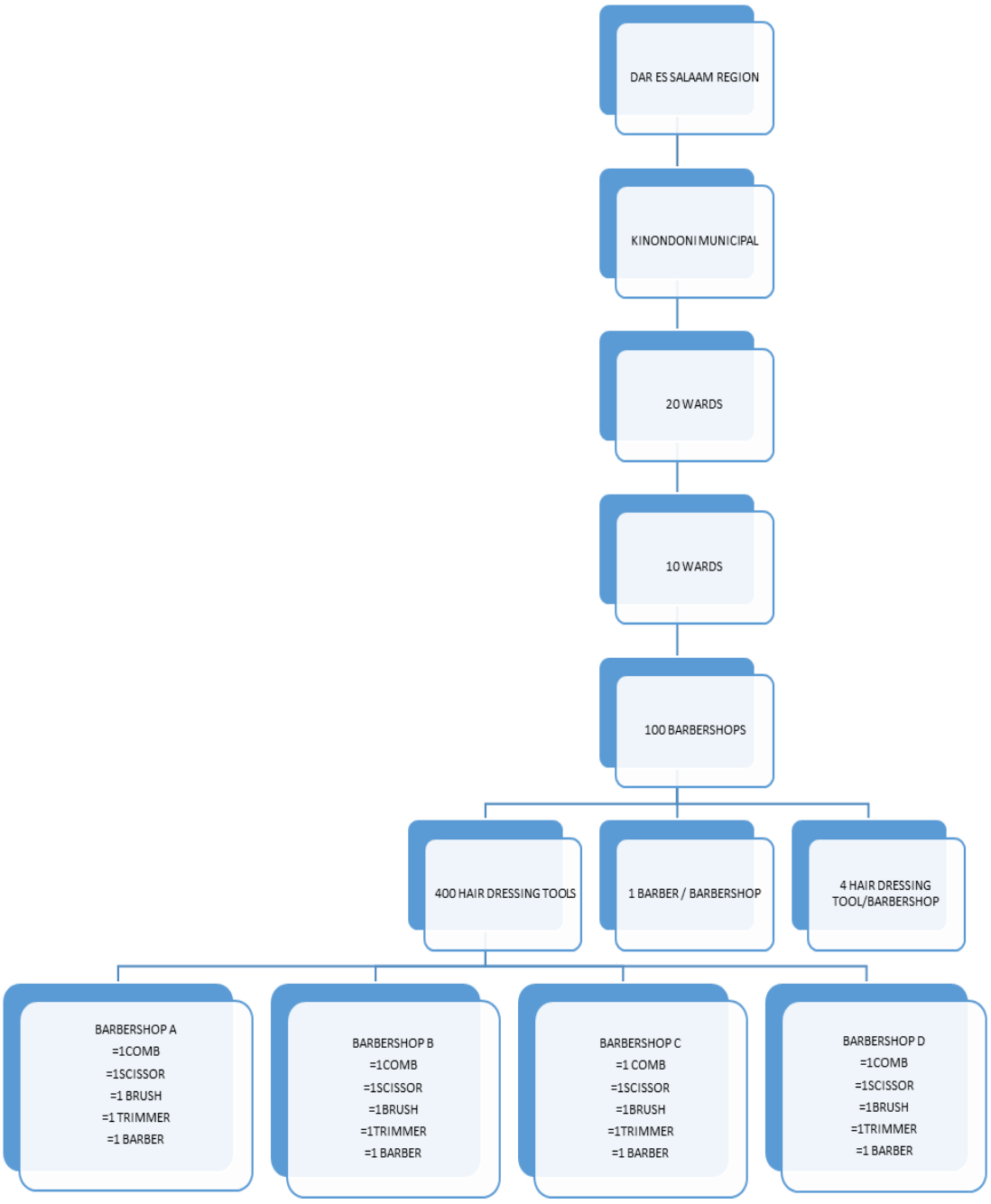


***Figure 3*: Flow Chart Showing Sampling Technique of Barbershops ,barbers and hair dressing tools**

2.7.4 Sampling of wards

Sampling of wards was conducted by cluster sampling randomly to obtain wards proportionate to the population size of all Kinondoni wards. This was achieved by taking total number of wards in Kinondoni and named by numbers which were picked randomly and those which were selected were included in the study namely Bunju, Bunju, Mbezi, Makongo, Kawe, Makumbusho, Kinondoni, Tandale, Mwananyamala, Wazo and Mzimuni. Ten wards selected at least to represent ahalf of the entire population of wards. Ten wards were selected by considering availability of resources including financial capability and time interval of study.

2.7.5 Sampling of barbershops

A random sampling method was applied to select one hundred barbershops in Kinondoni Municipality from the population of all registered barbershops. The selected barbershops were allotted with number during recruiting them in the study by using sample size calculation.

2.7.6 Sampling of barbers

Multistage sampling was done in which random sampling was used to select barbers based on availability of barbershops. Ten wards selected from which 100 barbershops were taken out of 1496 by considering availability of resources including financial capability and time interval of conducting the study.

Interviews were conducted using simple structured questionnaire. During this stage, information collected included social, economic and demographic characteristics, such as age, sex, education level, practical knowledge, and occupation status e.g. head of barbers, income, barbershop facilities, and health history. Before starting sampling, there was communication between investigator and barbers to seek their consent to participate in the study. The focus was to barbers since it was not possible to meet barbershop owners, because most delegated their shops to barbers.

2.8 Variables of the study

2.8.1 Independent variables

Independent variables were; Age of barber's, education level, materials used in disinfection, awareness of barbers, types of implements with different possibility of infection, hygiene practices used, antimicrobial susceptibility pattern and factors associated with microbial contamination of hair dressing tools.

2.8.2 Dependent variable

The outcome variable was the level of microbial contamination of hair dressing tools.

2.9 Data collection

2.9.1 Social demographic data collection

Random sampling was used to get barbers for interview, which helped to obtain information from barbers on their daily practices regarding disinfection and how they attend their clients. Barbers were recruited and interviewed at the barbershop where a structured questionnaire was used for face-to-face interviews.

This interview was done before taking swabs using structured questionnaire to get socio-demographic data that include sex, age, education, practical knowledge which was obtained by observing what they do and asking questions on practices, and health status of barbers, methods of disinfection and sterilization and number of workers per barbershop. The interview was conducted within the barbershop premises in a private space identified by the barber. Immediately after consenting, both interview and swab collection were done to avoid modification of practices by barbers, which could lead to false positive results. Informed consent was obtained from barbers because they the ones have the information of how the barbershops operate in a daily basis.

Interviews were also done by observing strict confidentiality, when there were no clients waiting to be served. All information obtained in a barbershop remained between an investigator and the barber and barbers requested not to share information with other persons.

Each barbershop was sampled by taking only one barber for interview regardless of the number of barbers present in each barbershop. Barbers to be interviewed were selected on the basis of being delegated as heads by the owner as the controller of all activities and issues concerning the barbershop and therefore were likely to have more information than owners themselves.

2.9.2 Specimen collection

The specimens for identified microbial contamination were taken from combs, scissors, brushes and electric trimmers using sterilized cotton swabs and sent to the Microbiology and Immunology laboratory at Muhimbili University of Health and Allied Sciences (MUHAS) for processing. Samples were taken using a moistened sterile cotton swab from all tools, which were stored in a UV sterilizer. Towels were not used to take swabs because they are the ones that were used frequently hence likely to have more bacteria carriage than any other tool. Swab sticks were placed back into their casings, which were labeled appropriately and put in a deep freezer for sample preservation. All the samples collected were transported to the laboratory for processing using standard methods (5).

2.10 Laboratory procedures

2.10.1 Microbial Isolation and Identification

Samples were inoculated on appropriate media for bacterial and fungal isolation.

For isolation of bacteria, samples were inoculated on nutrient agar, blood agar, MacConkey agar, and Mannitol salt agar. Sabouraud's Dextrose agar was used for fungal isolation. All microorganisms grown were identified by conventional methods. Samples aimed to recover bacteria were kept for 18-24 hours in an incubator at 37°C and identified by referring to microscopic characteristics, colonial characteristics, and biochemical tests as described in manual of clinical microbiology (24).

Fungal samples were kept at room temperature to observe the appearance of colonies, samples were identified through viewing under the microscope and fungal culture (4,24,25).

2.10.2 Antibiotic Susceptibility testing

AST of bacterial isolates from barbering implements were carried out using the Kirby Bauer disc diffusion method and interpreted using clinical laboratory standard institute (CLSI) guidelines for AST of 2019 (20,21).

AST analysis was interpreted as Susceptible, Resistant and Intermediate with appropriate drug disc (9). For gram-positive organisms, discs to be tested included ciprofloxacin (5µg), penicillin (10units), ampicillin (10µg), amoxicillin/clavulanate (20/10µg), ceftriaxone (30µg), gentamicin (10µg), tetracycline (30µg), clindamycin (2µg), trimethoprim/sulphamethoxazole (1.25/23.75µg) and chloramphenicol (30µg), erythromycin (15µg), (9)). For gram-negative organisms, discs to be tested included amoxicillin/clavulanate (20/10µg), ceftriaxone (30µg), ampicillin (10µg), ceftazidime (30µg), tetracycline (30µg), ciprofloxacin (5µg), Nalidixic acid (30µg), trimethoprim/sulphamethoxazole (1.25/23.75µg), chloramphenicol (30µg), cefotaxime (30µg) gentamicin (10µg), imipenem (10µg) and meropenem (10µg). After measuring the zones of inhibition and disc diameter, then the results were interpreted by using the CLSI guidelines of 2019 (20,26).

2.10.3 Quality Assurance

All procedures were carried out by well-trained staff following standards, and using quality supplies, reagents and antibiotic discs. Appropriate internal controls were included and for organisms identified from barbering implements reference strains were used including *Escherichia coli* ATCC 25922, *S. aureus* ATCC 25923, Aspergillus spp ATCC, Mucor spp ATCC 56650, Rhizopus spp 20577, 201291 and *S. aureus* ATCC 29213 for MRSA(27).

2.10.4 Data Analysis and Management

Raw data collected from laboratory experiments was recorded into forms, cross-checked and finally entered into computer software. All data were cleaned and analyzed by using statistical package for social sciences (SPSS) version 26. Descriptive statistics, frequencies and cross tabulation was used.

Prevalence was calculated by taking the total number of randomly selected one hundred barbershops tools having microbial contaminants in 100 barbershops and expressed as percentage.

Univariate and multivariate logistic regression were performed to examine the association between dependent and independent factors. Crude, adjusted odds ratios and 95% CI were determined in which P-value of < 0.05 was considered as statistically significant. The confounding factors were also considered in the analysis.

2.10.5 Dissemination of results

Following data analysis, copies of the report will be submitted to the director of postgraduate studies (MUHAS). Conference presentations and seminars will be done and at least one manuscript will be developed and submitted for publication in a peer- reviewed journal.

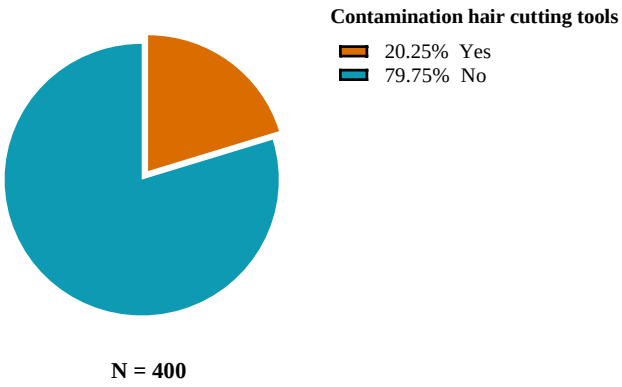
2.10.6 Ethical consideration

Ethical clearance to conduct the study was obtained from the MUHAS Senate Research and Publications Committee. Permission was obtained from local authorities including Kinondoni Municipal Council and District Medical Officer (DMO). Confidentiality of participants was ensured using codes instead of barbershop names and the information was not shared with any other participant. There was no any kind of report from our study that was given to any institution not responsible with human health issues like police, but only to the ministry of health and Tanzania Medicines & Medical Devices Authority. Every participant was educated on the benefits and risks of the study and participation was voluntarily

CHAPTER THREE

3.0 RESULTS

3.1 Prevalence of microbial contamination in hair dressing tools



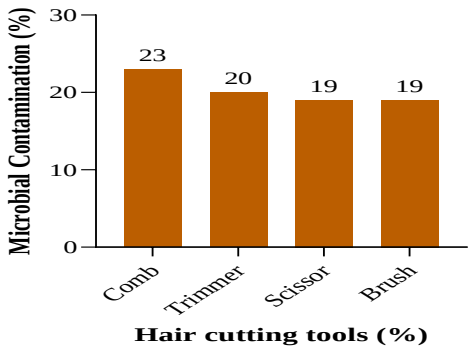


Figure 4: Prevalence of microbial contamination of hair cutting tools (n = 400) of the study participants

Overall, microbial contamination of hair dressing tools was 20.25 % in which the percentage of contamination of each tool was; comb 23 % highest to all tools, trimmer 20 % as the second, scissor 19% and brush 19%.

3.2 Antimicrobial susceptibility pattern of isolates from hair dressing tools

More than three-quarters of contaminants were bacteria with Pseudomonas *aeruginosa* comprising the majority (30.9%). Fungi made up nearly a quarter of contaminants, and all were Candida *albicans* is 22.2%. Figure 5 shows the proportion of microbial agents isolated from hair dressing tools.

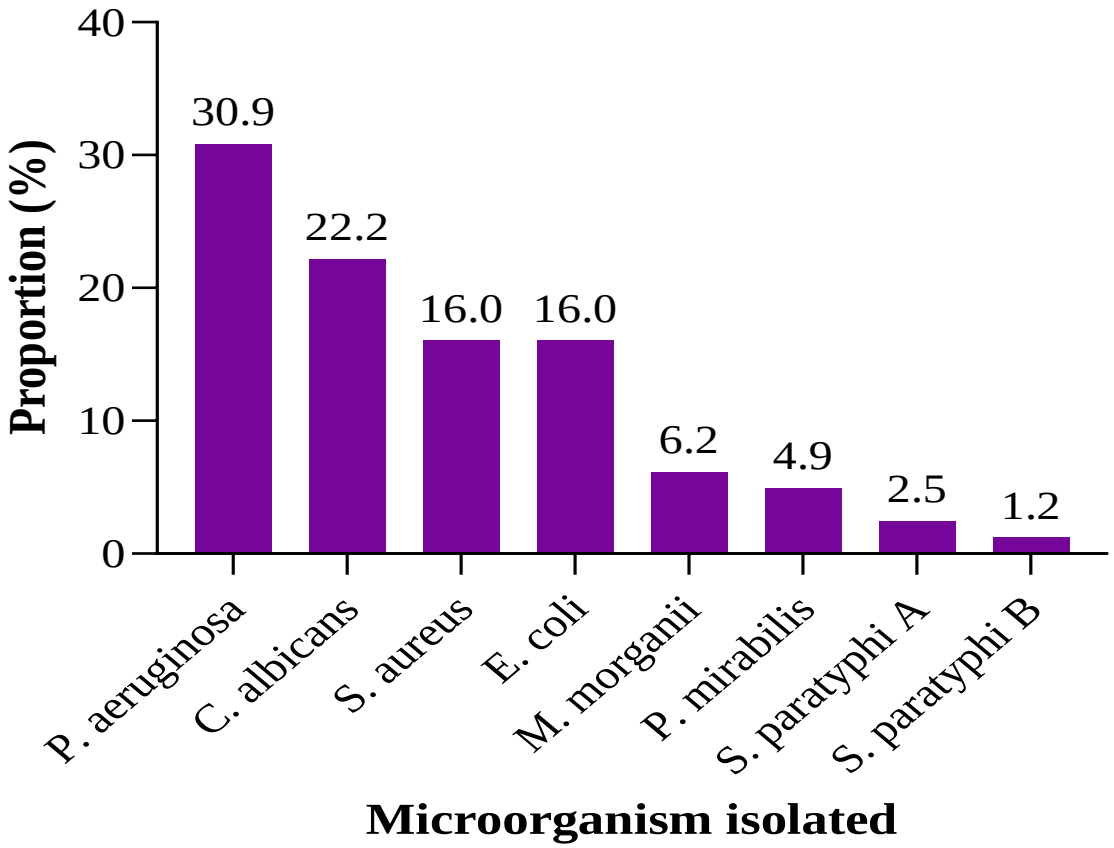


Figure 5: **Proportion of microbial isolates from hair dressing tools**

3.3 Antimicrobial resistance pattern

Pseudomonas aeruginosa and *Escherichia coli* were highly resistant to all first line antibiotics whereas *Staphylococcus aureus* were sensitive to Ciprofloxacin only. Table 1 below summarizes information on the resistance pattern of bacteria isolates.

Table 2: Antimicrobial resistance pattern

	Antimicrobial agents (%)								
Bacterial Isolates	Cipro	Pen G	Amoxyl	Ceftri	Genta	Clinda	Tetra	Chlora	Mero
S. paratyphi B (n = 1)	NA	NA	NA	100	0.0	0.0	0.0	NA	0.0
S. paratyphi A (n = 2)	NA	NA	NA	100	0.0	0.0	0.0	NA	0.0
P. aeruginosa (n = 25)	83.3	0.0	100	63.6	100	100	6.3	100	0.0
P. *mirabilis* (n = 4)	NA	NA	NA	100	100	100	100	NA	0.0
M. morganii (n = 5)	NA	NA	NA	100	0.0	0.0	0.0	NA	0.0
E. Coli (n = 13)	NA	0.0	100	0.0	100	100	100	100	0.0
S. aureus (n = 13)	15.4	NA	100	100	100	100	61.5	100	0.0

KEY: Cipro= Ciprofloxacin, Pen G= Penicillin G, Ceftri = Ceftriaxone, Genta = Gentamycin, Clinda = Clindamycin, Tetra = Tetracycline, Chlora = Chloramphenicol, Mero = Meropenem.

3.3 Factors associated with microbial contamination in hairdressing tools

Begin by setting the methods you used to analyze association

Barbers with older age were able to prevent contamination of hair dressing tools by sixty-four percent compared to those barbers with younger age protection with only 1% (OR= 0.36 (0.15 – 0.88), p <0.025). The likelihood of microbial contamination of hair dressing tools was six times higher in the barbershops that did not use methylated spirits compared to the ones that use (OR= 6.46 (2.83 – 14.74), p < 0001).

Similarly, in barbershops with more than 20 clients per day the chance of microbial contamination was 93% lower compared to barbershops with less than ten clients per day, was statistically significant (OR= 0.07(0.02- 0.2), p< 0.001). Microbial contamination of hair cutting tools was neither associated with levels of barbershops (Low, medium or high class barbershops) nor use of sterilizing machine. Table 2: reports on the factors associated with microbial contamination in hair dressing tools in Kinondoni Municipality.

Table 3: Univariable and Multivariable analysis of factors associated with microbial contamination of hair dressing tools

		Univariable analysis			**Multivariable analysis**		
Variable	**Categories**	**cOR**	**95% CI**	**P - value**	**aOR**	**95% CI**	**P – value**
Age of barbers	18 – 25	1.44	0.74 – 2.80	0.277	0.99	0.43 – 2.33	0.991
(years)	26 – 35	0.83	0.41 – 1.68	0.598	0.36	0.15 – 0.88	**0.025**
	36 – 45	Ref					
Methylated	No	8.34	4.26 – 16.36	< 0.001	6.46	2.83 – 14.74	**< 0.001**
Spirits	Yes	Ref					
Sterilization	Before	0.67	0.41 – 1.09	0.109	1.31	0.66 – 2.58	0.444
	Before & After	Ref					
Barbershop	Low	1.65	0.83 – 3.27	0.151	0.87	0.36 – 1.82	0.605
status	Medium	1.20	0.52 – 2.79	0.668	0.77	0.28 – 2.11	0.611
	Classic	Ref					
Number of							
clients per day	< 10	Ref					
	10 – 19	1.69	0.96 – 2.98	0.669	0.44	0.21 – 0.95	**0.036**
	≥ 20	0.30	0.12 - 0.73	0.008	0.07	0.02 – 0.22	**<0.001**

cOR: crude odds ratio, aOR: adjusted odds ratio, Ref: reference category.

CHAPTER FOUR

4.0 DISCUSSION

From this study revealed 6 species of microbial contamination in 20.25% of the hair dressing tools examined in Kinondoni Municipality, Dar es Salaam region. The species isolated were identified as *Pseudomonas aeruginosa* 25(25%), *Candida albicans* 18(18%), *Staphylococcus aureus* 13(13%) *Escherichia coli* 13 (13%) *Morganella morganii* 5(5%), *Proteus mirabilis* 4(4%), *Salmonella paratyphi A* 2(2%) and *Salmonella paratyphi B* 1(1%).

A relatively low prevalence of microbial contamination was found in this study (20%) was not the same as from other studies like in Benin city, Nigeria (40%) and in Kamyaran city, Iran (28%) which shown more prevalence(5,10).

This study demonstrated that the most common isolated bacteria were observed in combs by 23% and it was *Pseudomonas aeruginosa*, followed by trimmer 18% *Candida albicans* and lastly by brush 19% and scissor 19 % with *Escherichia coli* as the third. These high proportions of bacterial contamination in combs shows that human hair is highly contaminated with diverse microorganisms especially bacterial, some of which can be potential pathogens of public health importance(14).

Most of the visited barbershop in Kinondoni had shown a habit of their barbers to use equipment which were always likely to be contaminated after some customer usage as their sterilization and disinfecting methods were not explainable especially in tools like comb, scissors and brushes. The proportion of barbers who did not wash their hands before and after attending clients was 100% which could be the reason of those bacterial contamination which are not found on hairs. These contaminants especially E. coli are likely to be from contamination of the hair tools as most of barbers were not so keen in using and cleaning machines. Although some tools like trimmers were sterilized but the sterilization efficacy still is questionable since customers still get infected after barbershop visits. Combs had higher percentage of contamination due to frequent use by several clients who attend

barbershops and also an unusual way of sterilizing it as it applies in other tools like trimmers (14). Contamination of hair dressing tools suggests that these are the root cause of microbial contamination.

Most of the isolated bacteria in this study were similar to what has been reported in other studies like the one done in Michael Okpara University in Nigeria (11). Based on the cultural, morphological and biochemical characterization of the isolates, different microbial species were isolated and reported and they included *Pseudomonas aeruginosa, C. albicans*, *Staphylococcus aureus, Escherichia coli*. *Morganella morganii*, *Proteus mirabilis*, *Salmonella paratyphi A* and *Salmonella paratyphi B* (1). Other fungal species were not found in this study other than *Candida albicans,* which was recovered in 22% of hair dressing tools. Bacterial strains obtained from this study are potential pathogens implicated in various diseases of humans. *Escherichia coli* is known to cause various gastrointestinal disorders such as diarrhea, urinary tract infections and meningitis and *Pseudomonas spp.* have been implicated in respiratory tract infection especially in immune compromised individuals. *Staphylococcus spp* are causative agents of several human diseases including pneumonia, skin diseases and other pyogenic infections. These pathogens can easily be transmitted from one person to another most specifically when one clipper or comb is used for multiple customers as it was revealed in our study. This calls for awareness on the part of customers on the possibility of being infected. Tharmila et al, investigated the inhibitory effect of some traditional hair washing substances on hair borne bacteria, thus confirming the presence of bacterial pathogens on human hair(28). In another research study, five bacterial isolates including *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Streptococcus spp*, *Enterococcus* species and *Enterobacter spp* were reported(28). The presence of these potential pathogens is an indication that there is microbial contamination in hair dressing tools (26, 29).

In this study we demonstrated different resistance patterns of isolates to the commonly used antibiotics. For example, *Pseudomonas aeruginosa* isolated from contaminated hair dressing tools were more resistant to all first line antibiotics except Meropenem, Penicillin G and less

to Tetracycline. *Staphylococcus aureus* isolated from hair cutting tools were highly resistant to all first line antibiotics except Ciprofloxacin. *Escherichia coli* was less resistant to Meropenem, Ceftriaxone and Penicillin G. This finding does not concur with the previous studies reported forexample one of the studies in Nigeria that found majority of the isolates were highly resistant to ciprofloxacin (9,26).

There are many factors that might be sources that would contribute to microbial contamination on hair dressing tools. In other studies (10) age contributed to a significance of contamination, which was the same in our study.

Identified factors from various studies like lack of practical knowledge, using a single tool for all clients, poor hygiene and sanitation were used in our study as references to determine their association with the microbial contamination of combs, brushes, scissors and electric trimmers in selected barbershops of Kinondoni Municipality. More factors have been revealed to be source of microbial contamination of hair dressing tools in our study like limited knowledge on using sterilizing machines as most of them do not know, time of using sterilizers before and after attending the client as many of them sterilize only when they attend a client. Other factors include servicing of the sterilizing machine per time it is not done in almost all barbers, knowledge about using disinfectants and adherence to manufacturer's instructions are not clearly stated and practiced, washing hands by soap before and after attending the client is not done to all. Towels to clean clients and their numbers per barbershop as the studied barbershops seen with few towels and also the way cleaned were not appropriate. Storage of used tools after attending the client was not appropriate, awareness during attending a client, number of clients per day per barbershop as was affecting proportion of microbial contamination, opening of caps of methylated spirits after buying to mix with water also was one among the factors that would be the source of contamination of microbes in hair dressing tools. Mostly, these predisposing factors of microbial contamination in hair dressing tools may lead to scalp infection, blood borne infection and other skin diseases.

The relationship between bacterial contamination and hygiene levels with barbershop standards has been reported in previous studies. In the study by Farzaneh Janmohammad et al (5), a significant direct relationship was found between the number of bacterial colonies and the hygiene levels of the shop, such that reduced level of hygiene significantly increased the number of fungal and bacterial colonies. Also the same study reported contamination frequencies of 29.6% for Staphylococcus spp and 26.5% for Aspergillus spp which were the results of personal defaults of barbers for un-effective sterilization and disinfection by 58 % (5).

Finally, this study has identified many situations where there are several biological hazards in practitioners of the hairdressing sector. In this way, public health prevention strategies have to be set and implemented in order to improve education both about contamination of hair dressing tools, disinfection/sterilization procedures. therefore, it may be also desirable that public authorities produce appropriate educational materials for salons, establishing refresher course with guiding protocols about preventive measures in minimizing the risk of occupational infection with microbes.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATION

5.1 Conclusions

This study has shown that some (combs, trimmers, scissors and brushes) of the tools used in barbershops in Kinondoni Municipality harbor bacteria which can be potential pathogens that can be transmitted to clients. Most of bacteria were resistant to commonly used antibiotics. Lack of knowledge, use of a single tool for all clients, poor hygiene and sanitation were associated with the microbial contamination of hair cutting tools.

5.2 Recommendations

This underscores the need for barbers to take appropriate measures to ensure that the hair dressing tools they use are adequately sterilized and disinfected before they are used on their customers, in order to reduce the spread of infection.

Health education should be provided to barbers on appropriate methods of disinfecting hair-cutting tools.

Emphasis should be given on the proper use of sterilizing machines in barbershops.

The health authorities including District Medical Officer (DMO), Health environmental Officer and all Village and Ward Executive Officers (WEOs and VEOs) in Kinondoni Municipality may use the findings to establish regulations, guidelines for best practices in operation of hair cutting salons.

5.3 Study Limitations and mitigation

It was not possible to collect swabs from the whole range of equipment in the barbershops that were included in the study due to limited resources for laboratory testing, time and financial capability. Swabs were therefore only taken from randomly selected combs and trimmers and these were processed properly so that the results obtained can shed light to the status of microbial contamination of hair dressing tools in barbershops in Kinondoni.

5.4 Study Strength

This study is very important for the public health in Tanzania since it is the first to be conducted in the country and has informed on the practices associated with microbial contamination in the barbershops.

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APPENDICES

Appendix I: Informed consent form (English version)

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

Title: **Evaluation of Prevalence, Antimicrobial Susceptibility Pattern and Factors Associated with Microbial Contamination of Hair dressing Implements in Kinondoni Municipality, Dar es Salaam.**

Identification Number.....

Greetings!

My name is Michael Charles Mgimba; I am a postgraduate student at MUHAS, conducting research titled "Prevalence, Antimicrobial Susceptibility Pattern and Factors Associated with Microbial Contamination of Hair Cutting Implements in Kinondoni Municipality, Dar es-Salaam".

Study Purpose

To Evaluate the Prevalence, Antimicrobial Susceptibility Pattern and Factors Associated with Microbial Contamination of hairdressing Implements in Kinondoni Municipality, Dar es Salaam.

Participants

If anyone agrees to join the study, he/she will be interviewed using questionnaire, detailed information on social demographic characteristics, past and present barbershop history will be requested. For lab tests, pure colonies of organisms as control will be requested from trusted institution dealing with microbiological organisms and will be cultured for quality control

Confidentiality

Identification number will be used on all collected information instead of names. The principal investigator, research assistance, supervisor and MUHAS at large are obliged to maintain confidentiality of all data or information collected from you. No unauthorized persons will have access to the data collected.

Benefits

If you agree to participate in this study, the benefits may be direct or indirect. You will benefit by knowing the result of the contaminants of the barbering implements. There will be health improvement to both barbers and their clients. The study benefits including human health, safety to clients during services, raise barbers income as their services will be improved, hygiene and sanitation practices to be improved.

Risks and alternatives

No harm is expected to happen to you because of your participation in this study.

Compensation

You will not be compensation for participating in the study.

Rights to withdraw

Participation in this study is completely voluntary. You can decide to participate or not, and you are allowed to stop participating in this study at any stage, even if you have already given your consent without any penalty or loss of any benefits entitled to you.

Contact Personally

For any inquiries on this study, please contact the Principal Investigator: Michael Charles Mgimba, or The Supervisors: Prof Eligius Lyamuya, Dr Frank Msafiri of Muhimbili University of Health and Allied Sciences, MUHAS, P. O. Box 65001, Dar es Salaam, or Dr. Bruno Sunguya, The Chairperson of the Senate Research and Publications Committee, P. O. Box 65001, Telephone: +255 22 2152489, Dar es Salaam.

Signature:

Do you agree?

Participant agrees …….. …….Participant does NOT agree ……...

I..... have read the contents in this form. My questions have been answered. I am willing to participate in this study.

Signature of participant ……Date…….…….....

Signature of witness (if mother/caretaker cannot read)……Date……

Signature of Researcher/Research Assistant ……..Date…….....

Appendix II: Fomu ya ridhaa

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

Jina la Utafiti: Utambuzi wa aina ya wadudu wanaoweza kuwepo kwenye vifaa vya kunyolea ,usugu wao katika dawa na sababu zinazo pelekea kuathiriwa na wadudu hao katika vifaa hivyo Manispaa ya Kinondoni Dar es Salaam.

Namba ya utambulisho.....

Salamu!

Jina langu ni Michael Charles Mgimba mwanafunzi wa shahada ya uzamili katika Chuo kikuu cha Afya na Sayansi Shirikishi Muhimbili (MUHAS).

Nafanya utafiti wenye lengo la kuangalia wadudu wanao weza kupatikana kwenye vifaa vitumikavyo kwa vinyozi na dawa wanazo tumia zinazo weza waua au zisizo weza waua, sababu zinazo pelekea vifaa hivyo kuathiriwa na wadudu hao katika manispaa ya wilaya ya Kinondoni mkoa wa Dar es Salaam.

Madhumuni ya utafiti

Kuangalia wadudu wanaoweza kupatikana kwenye vifaa vitumikavyo kwa vinyozi na dawa zinazo weza au zisizo weza waua na sababu zinazo pelekea vifaa hivyo kuathiriwa na wadudu katika manispaa ya wilaya ya Kinondoni mkoa wa Dar es Salaam. Kuangalia aina na idadi ya wadudu (Bakteria na fangasi) wanao weza athiri vifaa vya kunyolea na dawa zinazoweza kuwaua au zisizo weza kuwaua.Pia utafiti huu unafanywa kwa lengo la kutimiza sehemu ya matakwa ya shahada ya uzamili ya mikrobaolojia na kingamaradhi.

Jinsi ya kushiri

Ukikubali kushiriki katika utafiti huu, utasailiwa kwa kujibu maswali kutoka kwenye dodoso lililoandaliwa, utaulizwa kuhusu masuala yanayo kuhusu wewe mwenyewe na historia ya uelewa kuhusu wadudu,vifaa unavyo tumia na taaluma au utaalamu wako katika fani ya kinyozi.

Usiri

Taarifa zote zitakazo patikana kutoka kwako zitakuwa ni za siri, Namba ya utambulisho itatumika badala ya jina katika kukusanya taarifa zinazo takiwa.Mtafiti mkuu, msaidizi, msimamizi na MUHAS kiujumla wana wajibu wa kutunza siri za taarifa zote zilizo kusanywa kutoka kwa mshiriki. Hairuhusiwi kwa mtu wa aina yoyote kupata taarifa zilizo kusanywa kutokakwako.

Faida

Hakutakuwa na faida yoyote ya moja kwa moja kwa ushiriki kwako katika utafiti huu. Hata hivyo, ushiriki wako utatusaidia kujua kufahamu kama mashine na spiriti utumiazo vina uwezo wa kiwango gani katika kuzuia na kuwakinga wateja na wewe mwenyewe dhidi ya wadudu wa aina hii mwilini mwako au vimelea vingine vinavyo sababisha magonjwa vita onekana utapewa taarifa na utaambiwa dawa inayo stahili kutumika na utashauriwa ipasavyo. Taarifa hizi zita wanufaisha na wengine kutokana na utambuzi wa vimelea aina ya bakteria au fangasi vilivyo katika mzunguko na pia dawa zinazoweza kuwatibu au zisizo na uwezo wa kuwatibu watu walio ambukizwa.

Athari na mbadala wake

Hakuna madhara au athari inayoweza kutokea kwako kwa sababu ya kushiriki kwako katika utafiti huu kwani utafiti huu hauhusishi binadamu isipokuwa vifaa kama vile chanuo na mashine za umeme za kunyolea zitumikazo kwenye maduka ya vinyozi

Gharama

Malipo yoyote kwa kushiriki katika utafiti huu

Uhuru wa kushiriki na haki ya kujitoa Kushiriki kwenye utafiti huu ni hiari.

Napenda kusisitiza kuwa kushiriki kwako kwenye utafiti huu ni hiari.Unaweza kushiriki au kutoshiriki na hii haitakuondolea haki ya kupata haki binafsi au taarifa muhimu za utafiti kupitia wizara husika au shirika la viwango la taifa ambazo zitasaidia kuboresha usafi wa vifaa vitumikavyo katika maduka ya vinyozi.Unaweza kuamua kuacha kushiriki katika utafiti huu wakati wowote bila malipo yoyote wala kuathiri faida ambazo umeambiwa.

Taarifa/ Mawasiliano

Endapo utahitaji kupata maelezo zaidi au taarifa yeyote kuhusu utafiti huu wasiliana na Michael Charles Mgimba, au wasimamizi ambao ni, Profesa Eligius Lyamuya na Dk. Frank Msafiri wa Chuo Kikuu cha Afya na Sayansi Shirikishi (MUHAS) S.L.P 65001, Dar es Salaam. Kama utakuwa na maswali kuhusu haki yako kama mshiriki, Unaweza kuwasiliana na Mwenyekiti wa Utafiti, S.L.P 65001, Dar es Salaam. Namba ya simu: +255 22 2152489 Dar es Salaam.

Uthibitisho

Je, unakubali kushiriki kwenye utafiti?

Ndiyo.....Hapana.....

Mimi .....nimesoma nanimeelewa yaliyomo katika fomu hii. Maswali yangu yamejibiwa na nimekubali kushiriki kwa ridhaa yangu. Sahihi ya mshiriki/mlezi.....

Sahihi ya ushahidi.....

Sahihi ya mtafiti.....

Tarehe ya ridhaa.....

Appendix III: Questionnaire

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

Title: **Evaluation of Prevalence, Antimicrobial Susceptibility Pattern and Factors Associated with Microbial Contamination of Hair dressing tools in Kinondoni Municipality, Dar es Salaam.**

Serial number……..

Date of interview …… Registration number……..

Name of care and treatment centre…….Phone number ……

A. Participants socio-Demographic information

1. Participant's name…….
2. Current physical address/barbershop……
3. Mobile number……..

4. District……..

5. Village/Street……..

6. Age in years……

7. Weight (Kg)……..

8. Level of education (put tick): None ( ) Primary ( ) secondary ( ) University ( ) Other (Specify)…….

9(i).Methods of sterilization and disinfection (put tick): UV sterilizer Yes ( ) No ( ) if yes specify type of Mini UV sterilizer used…….

(ii) Is sterilizer used all the time before and after attending/shaving the individual

/client ?……..

10(i). Use of Methylated Spirits (put tick): Yes ( ) No ( )

if yes specify type of Methylated spirits used…….

(ii) Is methylated spirit used all the time before and after attending/shaving the individual/client ?……..?

11. Do you perform the following hygienic practices?

i. Washing hands using soap before and after shaving (put tick): Yes ( ) No ()

ii. Washing hands using soap before and after shaving (put tick): Yes ( ) No ( )

iii. Do you have indicators on maximum sterilization in mini UV machines? (put tick): Yes ( ) No ( )

iv. What indicator do you use to recognise there is maximum sterilization of equipment in a machine?: mention (1).....(2)..... (3).....If no, state how you know there is maximum sterilization ( )

v. Using boiled water for sterilizing equipment (put tick): Yes ( ) No ( )

vi. What methods is used to boil equipment?: mention (1).....(2)

if no state ( )

B. Participant's Social information on contamination of hair dressing implements

i. Where do participant's (barbers) get information on microbial contamination of hair dressing tool?

-Television YES ( ).....NO ( ).....

If YES.....explain..... If NO.....Explain.....

-Radio YES ( ).....NO ( ).....

If YES.....explain..... If NO..... Explain.....

-Newspapers

If YES ( ).....explain..... If NO.....explain.....

-Healthcare centres

If YES.....explain.....If NO.....explain.....

-Training

If YES.....explain.....If NO.....explain.....

Which method of disinfecting hair dressing tools do you use?

1. Heating metal tools that have no plastic parts
   a) Not at all
   b) Seldom
   c) Very often
   d) Always

2. Use chemicals to destroy micro-organisms on materials such as plastic that cannot withstand high temperatures
   a) Not at all
   b) Seldom
   c) Very often
   d) Always

3. Use a disinfectant spray on their clippers between clients
   a) Not at all
   b) Seldom
   c) Very often
   d) Always

Which steps do you follow when disinfecting your hair dressing tools?

S/No	Step	Yes	No
1	Removing all physical debris from the instruments	1	2
2	Cleaning the object with soap	1	2
3	Cleaning the object with water	1	2
4	Drying the object with a new, clean paper towel	1	2
5	Immersing the object in an approved disinfectant solution	1	2

6	Removing the object from the solution with tongs or a gloved hand	1	2

Appendix IV: Dodoso

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

Jina la Duka la kinyozi.....Namba ya utambulisho ya mshiriki (Kinyozi/mwenye duka).....

Jina la msaili.....

A. **Taarifa zamshiriki**

1. Jina lamshiriki…….
2. Anuani kamili yamshiriki……
3. Namba ya simu……..
4. Wilaya atokayo……..
5. Kijiji/Mtaaatokao……..
6. Umri……
7. Uelewa kuhusu mashine na kemikali (spiriti)……
8. Kiwango cha elimu (weka tiki): Sijasoma ( ) msingi ( ) sekondari ( ) chuo/koleji ( ) elimu nyingine itaje)……..

9(i)Matumizi ya machine au dawa (weka tiki): Ndiyo ( ) Hapana ( ) Kama Ndiyo, taja aina ya mashine…….

(ii) Machine au dawa inatumikaje? (elezea)……

10. Unafanya mambo yafuatayo yahusuyo usafi kiujumla katika duka lako la kinyozi?

i. Kunawa mikono kwa kutumia sabuni kabla na baada ya kunyoa mteja (weka tiki):Ndio ( ) Hapana ( )

(iv) Kunawa mikono kwa kutumia sabuni kabla na baada ya kuosha vifaa vilivyo tumika na wateja (weka tiki): Ndio ( ) Hapana ( ) Maandalizi ya vifaa katika hali ya usafi (weka tiki):Ndio ( ) Hapana ( )

(v) Kutumia maji yaliyo chemshwa kusafishia vifaa (wekatiki):Ndiyo ( )Hapana ( )

B. Taarifa za afya zamshiriki

1. Tarehe yakuandikishwa……
2. Je duka la kinyozi liko katika hali nzuri?…..……
3. Idadi ya wateja kwa siku……....
4. Matumizi ya mashine za umeme za kunyolea (zungushia moja):
    a. Ndio ( )
    b. Hapana ( ).
5. Matumizi ya spiriti na mashine za kunyolea (zungushia moja):
    a. Ndio ( )
    b. Hapana ( ).

Appendix V: Approval for ethical clearance

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
OFFICE OF THE DIRECTOR OF POSTGRADUATE STUDIES

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Ref. No. HD/MUH/T.303/2018 **20th August 2020**
IRB#: MUHAS-REC-07-2020-398

Michael C. Mgimba,
MSc. Microbiology/Immunology,
School of Medicine,
MUHAS.

RE: APPROVAL OF ETHICAL CLEARANCE FOR A STUDY TITLED "EVALUATION OF PREVALENCE, ANTIMICROBIAL SUSCEPTIBILITY PATTERN AND FACTORS ASSOCIATED WITH MICROBIAL CONTAMINATION OF HAIR DRESSING TOOLS IN KINONDONI MUNICIPALITY, DAR ES SALAAM. "

Reference is made to the above heading.

I am pleased to inform you that, the Chairman has, on behalf of the Senate, approved ethical clearance for the above-mentioned study. Hence you may proceed with the planned study.

The ethical clearance is valid for one year only, from **20th August, 2020 to 19th August, 2021.** In case you do not complete data analysis and dissertation report writing by **19th August, 2021,** you will have to apply for renewal of ethical clearance prior to the expiry date.

Dr. Emmanuel Balandya
DIRECTOR OF POSTGRADUATE STUDIES

cc: Director of Research and Publications
cc: Dean, School of Medicine, **MUHAS**

Appendix VI: Introduction Letter

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
OFFICE OF THE DIRECTOR OF POSTGRADUATE STUDIES

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Ref. No. HD/MUH/T.303/2018

20th August, 2020

The Municipal Director,
Kinondoni Municipal Council,
P.O. Box 31902,
DAR ES SALAAM.

Re: INTRODUCTION LETTER

The bearer of this letter is Michael C. Mgimba, a student at Muhimbili University of Health and Allied Sciences (MUHAS) pursuing MSc. Microbiology/Immunology.

As part of his studies he intends to do a study titled: "***Evaluation of Prevalence, Antimicrobial Susceptibility Pattern and Factors Associated with Microbial Contamination of Hair Dressing Tools in Kinondoni Municipality, Dar es Salaam.***"

The research has been approved by the Chairman of University Senate.

Kindly provide him the necessary assistance to facilitate the conduct of his research.

We thank you for your cooperation.

Ms. Victoria Mwaluko
For: DIRECTOR, POSTGRADUATE STUDIES

cc: Dean, School of Medicine, **MUHAS**
cc: Michael C. Mgimba