

Bacterial and Fungal Contamination of Tools Used in Women Beauty Salons in Aqqala, Iran

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Abstract

Aim: Women beauty salons are considered as public places that can contribute to the transmission of many diseases. The present study aimed to assess the sanitary status of women beauty salons in Aqqala City in 2018. **Methods:** The present descriptive-analytical study was conducted on a total of 480 samples of applied equipment in women beauty salons such as combs, scissors, tweezers, and aprons. The samples were selected through census, and sampling was done by sterile swab, which was wetted with trypticase soy broth, from the external surface of instruments, and they were then inoculated into differential selective culture media. Isolated colonies were identified by standard biochemical tests. **Results:** Two hundred and two (42.08%) out of 480 cultured samples were positive in terms of microbial contamination. The most bacterial and fungal contamination was reported in combs (42.5%) and aprons (31.66%), respectively. There was a significant relationship between the amount of microbial and fungal contamination ($P \leq 0.005$). The highest levels of bacterial and fungal contamination belonged to *Staphylococcus aureus* (17.5%) and *Candida albicans* (7.5%). **Conclusion:** Given the high level of contamination in the present study, the attention should be paid to effective methods of sanitation and disinfection of hairdressing equipment, and such places should be monitored in a fully organized way.

Keywords: Beauty salons, microbial contamination, public health

INTRODUCTION

Control of environmental factors plays an important role in promoting human health. Environmental contaminants have a wide range and variety; hence, they can endanger physical, psychological, and social dimensions of the human health.^[1] It is important to pay attention to the improvement and health of the human environment. Maintaining health and sanitary conditions could considerably prevent factors that lead to the development of diseases.^[2] Women and girls are among the most vulnerable classes of the society, and their health is considered as a criterion for the social development. Hairdresser's salons are the most hazardous places that are specifically used by this group.^[3]

As public places, the hairdresser's shops are responsible for providing hair and makeup services and many times routine beauty activities, or some measurements such as removal of tattoos and moles.^[4-6] The attention to the sanitation of hairdresser's is significantly important because the use of

contaminated tools and noncompliance with health can lead to the spread of many diseases.^[1]

The infection can occur in different steps and methods of hairdressing. Devices such as the safety razors, combs, and bobby pins can accidentally damage the skin.^[7,8] The blood and body fluids on the instruments or work surface can transmit infectious diseases such as human immunodeficiency virus and hepatitis C. The blood and fluids may be very slight and invisible.^[9] Therefore, both clients and users are at risk. Furthermore, combs, hairbrushes, hand towels, and infected aprons can transfer pathogenic agents as ringworm, lice, herpes,

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and infections caused by *Staphylococcus* and *Streptococcus* bacteria.^[4,10,11] A great number of reports have been published on the transmission of hepatitis B and C through the shared usage of contaminated razors, forceps, safe razor machines, and tattoo instruments in different countries.^[12] Factors such as the hairdressers' lack of knowledge about diseases related to hairdressing and then the neglect of disinfection of makeup instruments, reuse of some disposable tools, the usage of shared tools, and insanitation provide infrastructures for transmitting a variety of infectious diseases.^[4,10,11] Skin diseases such as warts and piedra are transmitted in these places.^[13] These diseases are infectious and can be transmitted by sweating, skin cuts, wounds, contact with secretions, contaminated tools, and hands.^[5,6]

Instruments such as tweezers and scissors are sharp and widely used devices in hairdresser's shops, particularly the women beauty salons, and can easily transmit diseases from one person to another.^[14] Transmission of diseases in beauty salons as a public place is very important, and it may be ignored. In general, diseases, which can be transmitted in beauty salons, including diseases associated with blood and skin.^[15] If a wound is made during shaving, it may increase the risk of transmission of blood-borne diseases, especially hepatitis and acquired immunodeficiency syndrome (AIDS). The combs are also a tool that is in direct contact with the hair and head skin and increases the potential for disease transmission (mainly fungal). To protect the health of clients in hairdressers' shops, all instruments, along with other items, which can be shared, should be disinfected with an effective disinfectant.^[14]

According to guidelines of the European Communities (93/35/EEC), when a cosmetic product is used in normal and reasonable conditions, it should not harm the human health and should be safe for consumers.^[11] In recent decades, visiting hairdresser's has significantly increased due to the increased public income, the emergence of different hairstyles, and the use of athletes and actors as models.^[16] The present study aimed to evaluate the bacterial and fungal contamination rates in women beauty salons of Aqqala city to determine the risk levels of effective ways in the spread of pollution and its control ways.

MATERIALS AND METHODS

This cross-sectional study was conducted from June 12, 2018, to December 29, 2018, in twenty women beauty salons in Aqqala, North of Iran. A total of 480 samples were randomly collected by the census through sterile swab, which was wetted with Tryptic soy broth, from surfaces of equipment including combs, scissors, tweezers, and aprons, and the time before using the equipment was a criterion for the evaluation of bacterial and fungal contamination. The collected specimens were transferred to the laboratory under sterile circumstances and were incubated for 24–48 h at 37°C after inoculation in eosin methylene blue agar, blood agar, Sabouraud Dextrose Agar (SDA), and cornmeal agar culture media and were examined for the growth or nongrowth of bacteria and fungi.

The identity of contaminants was determined by standard staining and biochemical tests.

In summary, the Gram staining was first performed to determine the identity of bacteria, and then the culture on Mannitol salt agar, catalase, DNase, sensitivity to Novobiocin, and Bacitracin disks were done for Gram-positive bacteria, and the culture on Triple Sugar Iron, sulfide-indole-motility, Methyl red, Voges-Proskauer, Simmons' citrate, and Urea Agar for Gram-negative bacteria.^[17,18] In addition, to confirm the diagnosis of a bacteria, the API 20E (identification of Enterobacteriaceae and other non-fastidious Gram-negative bacteria), API NE (identification of Gram-negative non-Enterobacteriaceae), API Staph (identification of Staphylococci and Micrococci), and API CHB (identification of bacillus) medium tests were performed in accordance with the manufacturer's protocol (BioMérieux, 69280, Marcy l'Etoile, France).

SDA, cornmeal agar, complementary methods of staining, and microscopic observations, Germ tube test, and slide culture were utilized to isolate the environmental, saprophytic, dermatophytes, and *Candida* fungi.^[19] Finally, the obtained results were analyzed using SPSS statistics V22 software (IBM Corporation, Armonk, New York, USA) and descriptive statistics and Chi-square tests.

Ethical Approval

This research was approved in Ethics Committee of the Golestan University of Medical Sciences (No. IR.GOUMS.REC.1398.012).

RESULTS

The collected data from 480 cultures indicated that 202 (42.08%) instruments in women beauty salons had microbial contamination, whereas 186 (38.75%) and 102 (21.25%) samples were contaminated with bacteria and fungi. Among studied instruments, the highest bacterial and fungal contamination was reported in combs (42.5%) and aprons (31.66%), respectively [Table 1] ($P = 0.005$).

The highest microbial contamination was related to *Staphylococcus aureus* (17.5%), *Enterobacter* (11.25%), *Escherichia coli* (10%), *Pseudomonas* (7.5%), and *Candida albicans* (7.5%). Furthermore, the least contamination belonged to *Cladosporium* (2.5%) and *Alternaria* (2.5%). Table 2 presents

Table 1: Correlation between microbial contamination rate in sampled tools from women beauty salons

Tools	Number of samples	Microbial contamination rate			
		Bacteria		Fungi	
		n (%)	P	n (%)	P
Comb	120	51 (42.5)	0.69	19 (15.83)	0.005
Scissor	120	47 (39.16)		18 (15)	
Tweezers	120	42 (35)		27 (22.5)	
Apron	120	46 (38.33)		38 (31.66)	
Total	480	186 (38.75)		102 (21.25)	

Table 2: Frequency of microbial contamination in sampled tools from women beauty salons

Microorganisms	Comb (n=120), n (%)	Scissor (n=120), n (%)	Tweezer (n=120), n (%)	Apron (n=120), n (%)	Total (n=480), n (%)
<i>Escherichia coli</i>	12 (10)	10 (8.33)	11 (9.16)	15 (12.5)	48 (10)
<i>Enterobacter</i>	14 (11.66)	14 (11.66)	7 (5.83)	19 (15.83)	54 (11.25)
<i>Pseudomonas</i>	10 (8.33)	6 (5)	8 (6.66)	12 (10)	36 (7.5)
<i>Staphylococcus aureus</i>	31 (25.83)	17 (14.16)	19 (15.83)	17 (14.16)	84 (17.5)
<i>Staphylococcus epidermidis</i>	4 (3.33)	6 (5)	8 (6.66)	6 (5)	24 (5)
<i>Micrococcus</i>	3 (2.5)	9 (7.5)	9 (7.5)	3 (2.5)	24 (5)
<i>Bacillus – Spore forming</i>	7 (5.83)	6 (5)	1 (0.83)	4 (3.33)	18 (3.75)
<i>Candida albicans</i>	6 (5)	8 (6.66)	11 (9.16)	11 (9.16)	36 (7.5)
<i>Aspergillus</i>	3 (2.5)	6 (5)	4 (3.33)	17 (14.16)	30 (6.25)
<i>Cladosporium</i>	1 (0.83)	4 (3.33)	3 (2.5)	4 (3.33)	12 (2.5)
<i>Alternaria</i>	1 (0.83)	2 (1.66)	1 (0.83)	8 (6.66)	12 (2.5)
<i>Microsporium</i>	11 (9.16)	3 (2.5)	10 (8.33)	6 (5)	20 (4.16)
<i>Trichophyton</i>	1 (0.83)	5 (4.16)	4 (3.33)	8 (6.66)	18 (3.75)

the distribution frequency of the obtained samples according to the types of contaminated microbes in women beauty salons.

DISCUSSION

Disease transmission through hairdresser's shops is a serious problem which is sometimes taken for granted. These kinds of illnesses include blood and skin diseases. Blood diseases include sicknesses that are transmitted to a healthy person through blood (even in small amount) and skin scratches. Skin diseases such as fungal diseases and skin acne are transmitted through instruments such as contaminated combs, brushes, and towels. The Piedra fungus is a major skin fungus. Hairdresser's transmitted diseases such as AIDS, hepatitis B and C, warts, fungal and bacterial infections, and other contagious diseases, some of which even have the risk of death.

The skin allergy due to applied materials for hair, nails, or face can be dangerous for both clients and hairdressers. Diseases are usually transmitted in hairdresser's shops through minor cuts during the hairdressing or working on nails. Some activities such as threading make the skin thinner and open skin pores, thereby increasing the risk of transmitting skin diseases.

The research results indicated that 42.08% of sampled instruments were contaminated by bacteria and fungi among which the highest bacterial contamination was seen in combs (42.5%), scissors (39.16%), aprons (38.33%), and tweezers (35%), and the highest fungal contamination belonged to aprons (31.66%), tweezers (22.5%), combs (15.83%), and scissors (15%), respectively. Sajjadi *et al.* reported the highest bacterial contamination in scissors (13.7%), combs (8.28%), and tweezers (7%), and the highest fungal contamination in tweezers (20.55%), combs (20.55%), and scissors (15%).^[14] A survey by Mwabu *et al.* indicated that the highest levels of microbial contamination were found in safety razor machines (40%), cosmetics shelves (32%), and aprons (24%).^[20] Uslu *et al.* reported the highest contamination in headrests of chairs (50%), hairbrushes (32%), combs (25.3%), and

shaving brushes (7.7%).^[21] Hazrati *et al.* studied the applied equipment in women beauty salons and found that the highest contamination belonged to scissors (76.2%), tweezers (68%), and combs (58.3%).^[12]

In hairdresser's shops, people can be exposed not only to contaminated equipment but also to a wide range of chemical and thermal hazards. Fungal Piedra is a disease caused by dermatophytes and easily transmitted through person-to-person contact or contact with contaminated objects and towels. If the towel, comb, scissor, tweezers, and apron of an infected customer are continuously used without proper cleaning and disinfecting, the probability of spread of contamination and infectious diseases will be almost definite. In the present study, the most common bacteria isolated from women beauty salons included *S. aureus* (17.5%), *Enterobacter* (11.25%), *E. coli* (10%), and *Pseudomonas* (7.5%), and the most common isolated fungi were *C. albicans* (7.5%), *Aspergillus* (6.25%), *Microsporium* (4.16%), and *Trichophyton* (3.75%).

Several microbiological reports have supported the view that hairdresser's shops spread infectious diseases and allergic conditions such as dermatitis, fungi Piedra, and galls. Shakeri reported the highest levels of contamination by *Penicillium* (10.7%) and *C. albicans* (6.8%).^[10] Sajjadi *et al.* estimated the contamination with *C. albicans*, *Microsporium*, Gram-negative bacilli, and *S. aureus* with 9.5%, 4.1%, 4.1%, and 1.36% rates, respectively.^[14] In a study by Janmohammadi *et al.*, the highest bacterial contamination was caused by *S. aureus* (29.6%), Gram-negative bacilli (11%), Gram-positive bacilli (6%), and *Micrococcus* (5%), and the highest fungal infection belonged to *Aspergillus* (26.5%), *Mucor* (20.4%), *Candida* (18.4%), and *Penicillium* (18.4%).^[16] In a study by Hassan *et al.*, the highest contamination was due to *Staphylococcus* (37%), *C. albicans* (13%), *Streptococcus* (12%), and *Enterococcus* (5%).^[13] Mwabu *et al.* reported the frequency of bacteria in instruments as *Staphylococcus aureus* (68%), *E. coli* (56%), *Pseudomonas aeruginosa* (56%), and *Klebsiella* (44%).^[20] Furthermore, Spengane *et al.* reported

that 8% of scissors of hairdresser's shops were infected with hepatitis B virus.^[22] The presence of these microorganisms, some of which are pathogenic, suggests that hairdressers can contribute to the spread of skin and blood-borne diseases.^[23] The present study indicated that hairdressing techniques, especially in the studied region, increased the bacterial and fungal infection risk possibly through the use of weak disinfectants and improper handling of infected people. Therefore, hairdressers can play major roles in the potential transmission of indirect bacterial and pathogenic fungal infections in the society, and this is a very terrifying issue and needs immediate action to effectively control infections in parlors by involving all relevant groups and sectors.

CONCLUSION

According to the above cases, the beauty salons are suggested to use strong disinfectants while sterilizing the equipment. It is also necessary to use separate towel and apron for each person; otherwise, clients should ask the hairdresser to use disposable towels and aprons. The women beauty salons should disinfect the thread with ethanol before starting the threading and finally apply zinc oxide ointment to reduce the skin inflammation in customers. For external customers, the hairdressers should have several ready sterile tweezers and use single tweezers per person every day and put all tweezers into ethanol for disinfection at the end of the day. After every haircut, scissors should be disinfected externally. Careful hairdressers can help with customers' health if they see any suspicious spot or mole, hair loss, and nail changes that are hidden from person's eyes. Furthermore, they should not use a razor for more than one person, and combs should be washed out after each usage and kept in a container of ethanol.

It is also suggested paying special attention to sanitary practices in beauty salons and routinely monitor and manage them by governmental organizations. It is also better to perform practical and perfectly organized training on how to disinfect the hairdressers' instruments with an emphasis on the proper use of strong disinfectants.

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Conflicts of interest

There are no conflicts of interest.

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