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Could beauty salon brushes be a potential candidate for transmitting bacterial infections?

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ABSTRACT

Background: Brushes used in beauty salons to apply cosmetics should be clean and not contaminated with any bacteria, especially since they are used around the eyes, mouth and nose. If they are contaminated, then they could be a probable source of infection. This study aimed to assess the contamination status of the cosmetic brushes. One hundred brushes were collected from beauty centers, in Alexandria. They were stored in 5 ml Nutrient broth and then cultured on blood and MacConkey's agar for bacterial isolation and identification. All brushes (100%) were contaminated with bacterial isolates. *Klebsiella* spp. was the most frequently isolated bacteria. It was isolated from 84% of the brushes, followed by *E. coli* in 6%, and *Bacillus* in 10%. Both *Klebsiella* and *E. coli* are considered as potential pathogens. Due to this high contamination rate of the brushes, it's highly recommended to give good care for cleaning and decontaminating these tools.

Introduction

Cosmetics are generally a mixture of chemical compounds derived from natural (such as coconut oil) or synthetic sources intended to be applied to the human face and body for cleansing, beautifying or altering the appearance without affecting the body's structure or functions. Recently, cosmetics and distribution brushes played an important role in the spread of infections of the eyes, skin and soft tissues [1].

Powdery cosmetics used by a huge number of people can be a potential source of bacterial infections through their brushes. The residues on the used brushes make the salon an ideal environment for the proliferation of different type of bacteria, thus contributing to the spread of various diseases

[2]. When the skin is damaged or disrupted due to breaks or allergies, the risk of bacterial entry and infections increase significantly [3].

As the ingredients of most beauty products includes sugar, starch protein, amino acids, organic acids and much more; almost all cosmetics fulfill all the requirements for microbial growth. In addition, most of these ingredients are water soluble, which is an essential factor for the growth of microorganisms [4].

Unfortunately, cosmetic brushes are not periodically and permanently disinfected or exposed to high temperature after each use and from one person to another; more over cosmetic contamination awareness and health risks are very poor among the users of all age groups. There is no

established law or guidelines for many public make-up testers.

Most of beauty centers and make-up specialists are not aware of the importance of infection control guidelines that involve wearing mask, medical gloves, and head coverings to preserve their safety and the safety of their customers. They don't also know how to properly clean and disinfect their tools. They can't realize how critical their role can be in transmitting bacterial infections.

All cosmetic tools are kept wet for a while, and transferred to hands, clothes, boxes; hence they are exposed to all kinds of contamination. Therefore, this study aimed to assess the contamination status of cosmetic tools such as brushes whether they are contaminated or not and identify the bacterial isolates to know if they are potential index pathogens and can cause serious infections.

Materials and methods

A sample of one hundred brushes were collected from beauty centers, in Alexandria during the period from December 2021 to February 2022. As the brushes are the main source of disease transmission more than makeup preparations itself, all brushes samples were subjected to the same criteria in collection, storage and culturing.

All Brushes must have been in constant use, not neglected or old, and must have been used for more than a month.

The brushes were collected and stored in 5 ml nutrient broth. Subsequently, aliquots of these broth suspensions were cultured on blood and MacConkey's agar media, then all plates were incubated, for 24 hours at a temperature of 37° C. Samples were semi-quantitatively cultured directly after vortexing the sterile cup. Cultures were done using calibrated 10 µl sterile loop.

Primary identification was performed by colony morphology and then microscopically by Gram-stained smears. Standard biochemical tests were used to identify the bacterial isolates (urease - indole - oxidase - glucose fermentation - lactose fermentation - nitrate) [5,6].

Further identification for some isolates was done by (BD Phoenix) for further automated identification and susceptibility testing system according to the manufacturer's protocol. Aliquots of each isolate were inoculated in LB-Glycerol and stored in the freezer at -80 °C for later investigations.

Results

Bacteriological examination

Bacterial examination resulted in isolation of 100 isolates from lipstick brushes, contours and powders brushes and finally eyes brushes.

All brushes (100%) were contaminated with different bacterial isolates. *Klebsiella* spp. was the most frequently isolated bacteria. This study showed the growth of *Klebsiella* in (84%), *E coli* in (6%) and *Bacillus* in (10%).

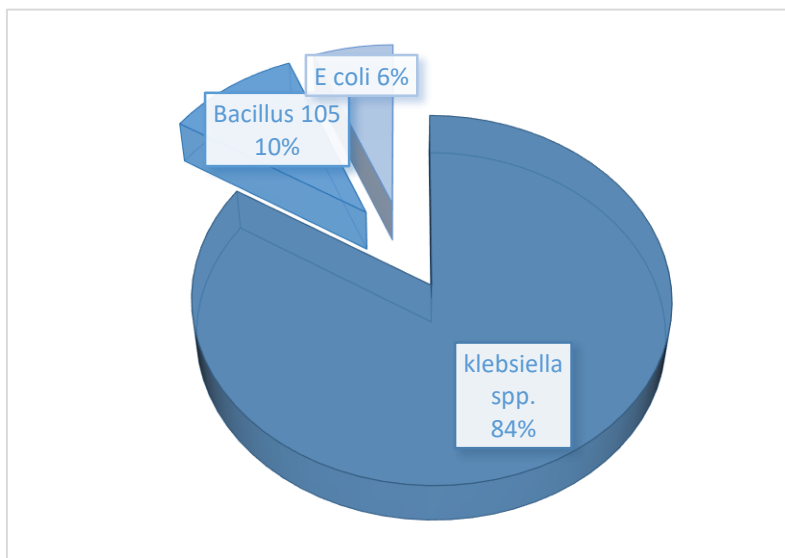
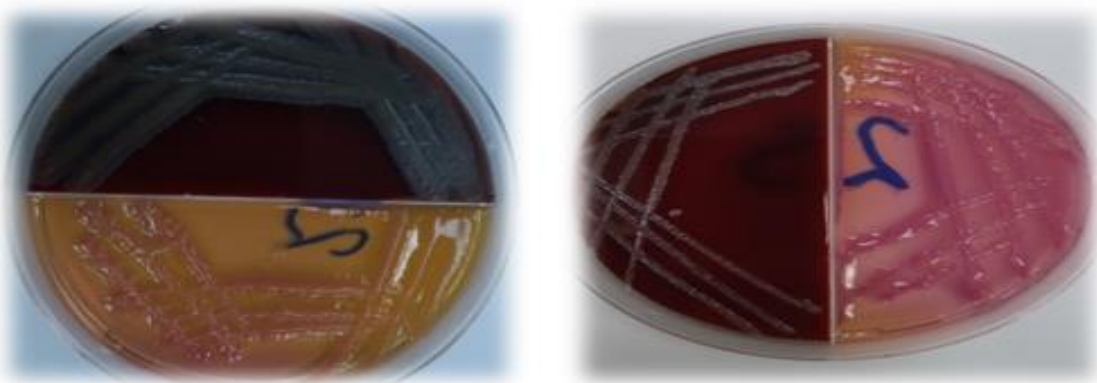
The most contaminated among the brushes were the brushes used for the eyes and around the eyes, which were carefully examined and was found to have bacterial deposit thanks to the humidity at the surface of the eyelashes and eyelid and the environmental bacteria surrounding it, which makes its user more susceptible to inflammation of the eyes and the eye retina.

As shown in **Table(1)**, the highest contamination was found in the tools used for the eye, and the most common type of bacteria was a *Klebsiella* which is considered as a highly pathogenic life-threatening bacterial isolate.

Not only index pathogenic organisms were isolated, but also their bacterial load was found to be very high, as shown in **figure (2)**.

Table 1. Total number of microorganisms isolated from each cosmetic tool

Cosmetic tool category	Name of bacteria	Number of samples with the microorganisms
Lipsticks Brushes	<i>E. coli</i>	1
	<i>Bacillus</i>	4
Contours and Powders Brushes	<i>E. coli</i>	1
	<i>Bacillus</i>	2
	<i>Klebsiella</i>	23
Eye Brushes	<i>Klebsiella</i>	61
	<i>E. coli</i>	4
	<i>Bacillus</i>	4
Total		100

Figure 1. The percentage of each microbial growth isolated from different cosmetic brushes**Figure 2.** Samples from eye brushes showed the growth of both *E. coli* and *Klebsiella* spp. in high colony count

Discussion

Cosmetics and cosmeceutical formulations are widely distributed across the whole world. Recently, a massive concern is rising upon control of infections that are usually transmit through such

preparations. Unfortunately, there are no guidelines for the use of these cosmeceuticals. In this study, a high percentage of contamination was found in the tools used for cosmetics. Thus, these brushes can be considered as a potential source of transmitting

infections, which lead to development of bacterial infection of the skin, eyes, and lips [7].

This study included a total of 100 brush samples from different beauty salon across Alexandria, Egypt. *Klebsiella* spp. was isolated from 64% of the brushes, *E coli* from 6% and *Bacillus* from 10%. *Bacillus* is considered an environmental bacteria and do not cause infections except in severely immunocompromised patients. On the other hand, both *Klebsiella* and *E coli* are considered to be highly pathogenic organisms that have shown rising antibiotic resistant patterns in the recent years.

Bacterial infections caused by *Klebsiella* and *E. coli* are accountable for a large number of deaths annually across the world. However, rapid and accurate diagnosis of symptomatic and asymptomatic patients is a cornerstone of the global elimination of such infections. They can cause different diseases such as necrotic skin infection in diabetic patients and patients who suffer from immunodeficiency, and if they are transmitted to the blood can cause bacteremia leading to death [8].

This study has also shown that lipstick brushes can be also highly contaminated. These brushes can be a source of transmitting infections through oral route and can cause lip infections. They can also infect the gums, teeth and oral cavity [9].

Conclusion

Most of the beauty centers do not follow guidelines protocol in handling and dealing with brushes and other cosmetics tools.

National guidelines, Center of Disease Control and World Health Organization are the main sources that we can deduce a good protocol in controlling disease transmission between contaminated tools such as brushes.

Unfortunately, these tools can be of great threat upon public health as they are a potential source of infection and communicable diseases, thus care about cleaning and disinfection techniques should be put into consideration.

Failure to get rid of the bacteria found on cosmetic tools will definitely aid in spreading of infections.

Recommendations

Based on the results of this research, we suggest establishing of an infection control guidelines protocol for handling and using of cosmetics tools such as brushes. Infection control practices should apply also to cosmetics products

and tools. Further investigation and inspection of materials and tools used in beauty salons as the forceps, scalpels, scissors and fomites should be done.

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Conflict of interest. None.

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