

Research Article



Microbiological study of cosmetics testers in Gujranwala district

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Abstract | Cosmetic testers are rich in pathogens like bacteria, virus and cause high risk of skin irritation and infections. Multiple applications and poor handling of cosmetic testers produces contamination in it. The current study identified a variety of bacteria from cosmetic products bought from different makeup stores in Gujranwala. Five samples of each cosmetic product, foundation, mascara, eyeliner, lipstick, and face powder were collected from Gujranwala makeup stores. Cosmetic samples were inoculated on nutrient agar for bacterial growth by using spreading technique. Bacteria isolated from cosmetic testers were identified by using gram staining and biochemical testing. Results indicated that cosmetic testers consisted of different species of bacteria, including *Pseudomonas aeruginosa*, *Klebsiella species*, *Staphylococcus aureus*, *Staphylococcus epidermidis*, and *Staphylococcus species Coagulase Negative*. *Staphylococcus epidermidis* (28%) was the dominating bacteria isolated from all samples of cosmetic testers. The highest bacterial contamination was found in eye liner testers while the least bacteria contamination was seen in lip stick tester samples. It was concluded that consumers could not use cosmetic testers because it is highly contaminated with skin-infected bacteria.

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Introduction

Cosmetics are products used to improve or alter the appearance of a person's face or body. They may consist of fragrances, cosmetics, and personal hygiene products for the skin, hair, and nails. Since these blenders are used to combine liquid cosmetics, such as foundation, they frequently come into contact with hands and faces. Cosmetic products have always

been used carelessly so they have become contaminated and may pose a risk to consumers by fostering the growth of fungi and bacteria ([Bashir and Lambert, 2020](#)). Cosmetic products used for personal hygiene are vulnerable to microbial contamination because they contain a variety of components that promote microbial growth. Survival and growth of bacteria and fungi enhances in warm and humid climates ([Huda, 2017](#)).

Bacteria can grow in cosmetic products over time, particularly due to improper storage. High bacterial contamination was found in cosmetics products usage after expiration date. Infections brought on by bacteria can occasionally be hazardous or even fatal ([Aleem et al., 2020](#)). Cosmetics are prone to microbial contamination during manufacturing and storage because they are primarily used for cleansing, beautifying, and protecting ([Elmorsy et al., 2016](#)). Cosmetics are made at a specific location using a drawn-out process that increases the risk of contamination from people, equipment, and the environment. Consequently, microbiological contamination could occur during the production of these cosmetics. New cosmetics can become contaminated and cause issues for the general public and business community ([Kim et al., 2020](#)). The risk of bacterial contamination and infection from cosmetics can be avoided by creating some hygiene practices, such as hand washing before applying makeup, and avoiding sharing cosmetics with others. Furthermore, it's imperative to use items before expiration dates and store them correctly, such as in a cold, dry environment. Most cases of allergic contact dermatitis were brought on by facial cosmetics, hair products, and skin care products ([Alswedi and Jaber, 2019](#)). Herpes can cause sores on the lips and around the mouth when shared makeup tools are used. Other people may develop allergic contact dermatitis from lipsticks and powder brushes that come into contact with particular areas of their faces ([Belinda, 2015](#)). *Pseudomonas* species and *P. aeruginosa* are among the germs that are frequently found in eye makeup, such as mascara and eyeliner. Irritation, conjunctivitis, pink eye, redness, and watery discharge have all been related to *P. aeruginosa* and have the potential to cause permanent blindness. Moreover, cosmetics tools have the capacity to provide bacteria with an ideal environment ([Noor et al., 2015](#); [Alshehrei, 2023](#)).

Keeping in view the importance of usage of cosmetics in our daily lives, this study was designed to isolate the bacterial species from cosmetic testers.

2. Materials and Methods

2.1. Sample collection

Twenty-five cosmetic testers samples of following categories: lipsticks, face powders, mascaras, foundations, and eyeliners were collected from different makeup stores in Gujranwala. Five testers samples of each cosmetic products were taken by using sterile moistened swabs and then carried to laboratory by using transport media and then stored at room temperature for 24hours.

2.2. Bacterial isolation and purification

Nutrient agar was used to cultivate different types of bacteria. Swabs of all samples of cosmetic testers were inoculated on sterilized solidified media and incubated for 24 hours at 37°C. After incubation, all the plates were observed for the growth of bacterial colonies to identify colony morphology. Gram staining was performed to identify the gram positive and gram negative bacteria. Different biochemical tests of standard protocols were performed for the identification bacteria to species level ([Jolt et al., 1994](#)). Spread plate method was used to count the bacteria to calculate colony forming unit (CFU/ml). Then streaking method was used to purify the culture of each bacterial strain.

3. Results

A total of five pathogenic bacteria named *Staphylococcus epidermidis*, *Pseudomonas aeruginosa*, *Staphylococcus* species Coagulase negative, *Klebsiella species* *Staphylococcus aureus*, were isolated from different cosmetic testers samples. Eyeliner showed high contamination with bacteria, while lipstick showed the least contamination among all cosmetic tester

samples. Highest percentage of contaminated bacteria was *Staphylococcus epidermidis* (28%) followed by *Staphylococcus aureus* and *Klebsiella species* (20%), *Staphylococcus species Coagulase Negative* and *Pseudomonas aeruginosa* (16%) (Table 1, Figure 1). Different samples of cosmetic testers are contaminated with both gram-positive (*Staphylococcus aureus*, *Staphylococcus species Coagulase Negative*, *Staphylococcus epidermidis*) and gram negative bacteria (*Pseudomonas aeruginosa*, and *Klebsiella species*). All bacterial species were non-spore forming bacteria (Table 2). Total number of viable colonies were seen in different cosmetic testers samples. Eyeliners showed the highest viable count (156±27.08) while lipstick showed the least viable bacterial colonies (40.52±18.12). Eye liner testers showed highest count of viable bacterial while lipstick testers showed least viable bacterial count (Table 3).

Table 1: Total number of bacterial species isolated from cosmetic products

Cosmetic testers samples	Bacterial Species isolated from cosmetic testers samples	No. of bacterial species
Face Powder	<i>Klebsiella species</i>	1
	<i>Staphylococcus epidermidis</i>	1
	<i>Staphylococcus aureus</i>	1
	<i>Staphylococcus species Coagulase Negative</i>	1
Mascara	<i>Pseudomonas aeruginosa</i>	1
	<i>Staphylococcus aureus</i>	2
	<i>Staphylococcus species Coagulase Negative</i>	1
Eye Liner	<i>Pseudomonas aeruginosa</i>	2
	<i>Staphylococcus epidermidis</i>	3
	<i>Klebsiella species</i>	2
	<i>Staphylococcus aureus</i>	2
	<i>Staphylococcus species Coagulase Negative</i>	1
Foundation	<i>Staphylococcus aureus</i>	1
	<i>Klebsiella species</i>	1
	<i>Staphylococcus epidermidis</i>	1
Lip Stick	<i>Klebsiella species</i>	1
	<i>Staphylococcus epidermidis</i>	2
	<i>Staphylococcus species Coagulase Negative</i>	1
Total number of bacterial species		25

Table 2: Biochemical characterization of bacterial species isolated from cosmetic testers

Sr.	Bacterial species isolated from cosmetic testers	Gram Straining	Endospores staining
1.	<i>Staphylococcus aureus</i>	+ve	-ve
2.	<i>Pseudomonas aeruginosa</i>	-ve	-ve
3.	<i>Staphylococcus epidermidis</i>	+ve	-ve
4.	<i>Staphylococcus species Coagulase Negative</i>	+ve	-ve
5.	<i>Klebsiella species</i>	-ve	-ve

Table 3: Total viable count of bacteria isolated from all samples of cosmetic testers

Cosmetics testers Samples	Total viable bacterial count (Mean±SE)
Face powder	112±23.6
Mascara	109±15.13
Foundation	136±30.5
EyeLiner	156±27.08
LipStick	96±18.12

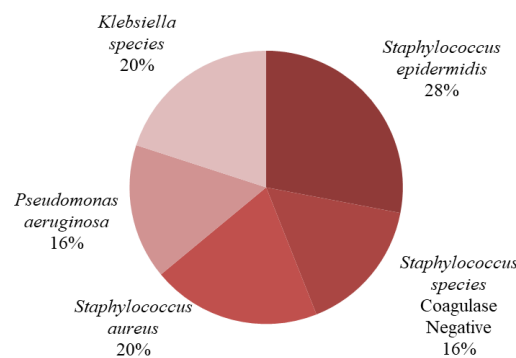


Figure 1: Percentage of isolated bacteria isolated from cosmetic testers samples

4. Discussion

Microbial contamination in cosmetics is very dangerous to human health. The present study showed that *Staphylococcus epidermidis* was the dominant contaminated bacteria found in cosmetic testers samples. *Staphylococcus epidermidis* was considered as the part of

normal skin flora. *Staphylococcus species coagulase-negative* and *Klebsiella species* were isolated from face powder, Mascara, eye liner and lipstick. Bacterial species like *coagulase-negative staphylococcus*, *S. epidermidis*, causes severe skin infections and damage by desquamation and acne ([Lee and Anjum, 2023](#)). *Staphylococcus aureus* was the predominated gram positive cocci pathogen in cosmetic samples of face powder, foundation, eyeliner and mascara. *Staphylococcus aureus*, a gram positive cocci causes severe infections in the outer and inner eye tissues cause conjunctivitis. It also damages cornea and tear ducts ([Roy et al., 2023](#)). It causes high risk serious primary and secondary skin infections like impetigo, folliculitis, furuncles, and primary abscesses. In case of secondary skin infections caused by *Staphylococcus aureus*, secondary abscesses, lymphangitis, cellulitis and wound infection was formed ([Del Giudice, 2020](#)). *Pseudomonas aeruginosa*, gram negative bacteria were isolated from only eye makeup products i.e., eye liner and Mascara. It causes severe eye infections like conjunctivitis, ophthalmitis and keratitis. This pathogen also causes severe infection in immunosuppressed person having chronic disease. *Klebsiella species*, a gram negative bacteria is responsible for skin ulcers and pustules ([Xie et al., 2024](#)).

It was observed that people should be careful for using cosmetic products. Microbial safety of cosmetics is the major criteria of to determine the quality of cosmetic products ([Dimri, 2022](#)). Significant amount of pathogenic bacterial contamination poses serious health risks. Customers must avoid testers because of high microbial load. They must use sealed cosmetic products. Improper use of cosmetic products, shared cosmetic products and cosmetic testers enhances the bacteria growth that cause severe skin and eye infections. Bacterial contamination in cosmetics produces metabolites and

endotoxins which cause severe allergic reactions and skin infections ([Akhand et al., 2023](#)). Imported cosmetic products packaging sometimes do not have expiry dates and become major cause of microbial contamination. Cosmetic testers are usually exposed to environment many times and are not cleaned properly. Cosmetic testers used by various customers which try them to know the quality of cosmetics. This makes the cosmetic tester highly contaminated with bacteria ([Dadashi and Dehghanzadeh, 2016](#)). Same cosmetic testers were used by more than one person and improper hand hygiene are responsible for the pathogenic bacterial contamination in cosmetic testers which enhance the skin, eye and lips infections ([Yazici and Eryilmaz, 2023](#)). All the cosmetic products should be manufactured in sterilized condition and expiry dates should be mentioned.

5. Conclusion

Proper education and awareness should be given to cosmetic users about the hygienic use of cosmetics. Due to frequent use of cosmetic testers by various customers, cosmetic testers are highly contaminated with pathogenic microbes. Customers should avoid the usage of cosmetic testers because it poses a severe health risk.

6. Author's Contribution

All the authors contributed equally in the design, analysis and write-up of article.

7. Conflict of Interest

There was no conflict of interest among the authors regarding the article publication.

8. Novelty Statement

Present study clearly indicated that cosmetic testers of shopping malls of Gujranwala are full of bacterial

contamination and cause severe allergic and skin infections.

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