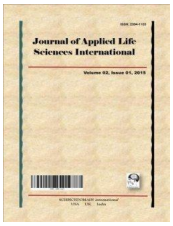

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# Spoilage Fungi Associated with Selected Body Lotions Commonly Used amongst Students of the University of Port Harcourt

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***Authors' contributions***

*This work was carried out in collaboration between all authors. Author EE designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors HOS and CJU managed the analyses of the study. Author EE managed the literature searches. All authors read and approved the final manuscript.*

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## ABSTRACT

Body Lotions which are intended to beautify and protect the skin are often prone to fungal contaminations either in the course of their preparation, transportation and/or accidentally, during use by the consumers which may lead to their spoilage. The purpose of the study was to investigate the spoilage fungi associated with selected body lotions commonly used amongst students of the University of Port Harcourt. Five used and unused lotions were obtained from students within the University and purchased from cosmetics shops. The Influence of the body lotion on the fungal composition of the skin was determined from skin swabs collected before and after use of the lotion from 25 different study subjects for a period of 10 consecutive days. Fungal counts were determined using the spread plate method. Fungal count of skin swabs ranged from 2.0 ± 1.1 to 192.0 ± 1.1 and from 12.0 ± 1.1 to 209.0 ± 1.1 respectively. Fungal counts of used lotion samples ranged from 4.83 to 5.75 log sfu/ml and unused from 0 to 3.77 log sfu/ml respectively. Fungal genera isolated include: *Fusarium, Penicillium, Candida* and *Aspergillus*. The

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study also showed incomplete label disclosure. The study revealed the presence of fungi of public health significant in both used and unused lotion samples. Hence the need to adopt and maintain strict hygiene practices at the manufacturing and consumer stage.

*Keywords: Spoilage fungi; body lotion; candida; penicillium.*

## 1. INTRODUCTION

The Council Directive (76/768/EEC), established in 1976 stated that a cosmetic product is any substance or preparation, which can be applied onto different parts of the human body (e.g. nails, face, hair, teeth). Its role is to keep the body in a good condition, change its appearance as well as remove body odours via perfuming, cleansing or protection [1]. The production of cosmetics is not a sterile process and the storage temperature is nearly optimal for microbial growth [2]. Cosmetics might contain microbes, due to impurity of raw material and might be contaminated during usage [3,4]. The raw materials used mostly contain water and form an appropriate media for microbial growth. Most cosmetics contain lots of ingredients and additives like plant extracts, fatty acids and vitamins which are also good for microbial growth. Several microorganisms have been noted to cause product contamination and those commonly found are *Staphylococcus aureus, Pseudomonas aeruginosa,* some Gram negative bacteria, yeasts and moulds [5,6]. Microbial spoilage can not only alter physical properties of the product such as colour, taste, odour and viscosity, but also deactivate essential constituents depriving cosmetic of its features [7,8]. The aim of this study was to determine the spoilage fungi associated with commonly used body lotions by students of University of Port Harcourt.

## 2. MATERIALS AND METHODS

### 2.1 Collection of Samples

Used body lotion samples were obtained from students in the University of Port Harcourt and unused lotion samples were bought commercially within same area. Samples were transported to microbiology laboratory for immediate analyses.

### 2.2 Media Used

Potato dextrose agar was used for the isolation and enumeration of yeasts and moulds. Peptone water was used in the isolation and of determination of the fungal load of the sample. The media were reconstituted and sterilized according to the direction of the manufacturer.

### 2.3 Skin Swab Analysis

Sterile swab sticks were swabbed on posterior parts of the forearms of 25 students (five students each) using the five lotion samples studied. The exercise was carried out for a period of 10 consecutive days and swabs were collected after bathing before using the lotion, and 30 minutes after using lotion. Participants were advised not to use towels but expose themselves to atmospheric air. A total of 500 swabs were obtained in the study and characterized for fungi count. The swab sticks were suspended in 10 ml peptone water contained in Bijou bottle and permitted standing for 30 minutes. A 0.1 ml volume was plated out on the surface of sterile plates containing potato dextrose agar.

### 2.4 Yeasts and Moulds Count of the Body Lotion Samples

From the last three dilutions prepared as stated above, one ml was inoculated on Sabouraud dextrose agar plates using spread plate method. The plates were then incubated at 25°C for 2-3 days. Colonies were counted after three days. Results of colony count was expressed as yeasts and moulds counts per gram.

### 2.5 Identification of Fungal Isolates

All fungal isolates were identified based on their macroscopic and microscopic appearance with reference to standard manual [9].

### 2.6 Ethical Consideration

Informal ethical clearance was obtained from the University of Port Harcourt before conducting this study. Informed consent from individual students was obtained before their enrolment.

## 3. RESULTS

Table 1 shows total fungal counts of skin swab collected from student participants using lotion. It

**Table 1. Fungal counts of skin swab obtained from participants using lotions**

| Day | Period of use | A | B | C | D | E |
|---|---|---|---|---|---|---|
| 1 | Before | 2.0±1.1[a] | 11.0± 1.1[a] | 51.0 ± 1.1 [a] | 2.0± 1.1[a] | 192.0 ± 1.1 [a] |
| | After | 13.0± 1.1 [b] | 43.0± 1.1[b] | 88.0 ± 1.1 [b] | 247.0± 1.1[b] | 209.0 ± 1.1 [b] |
| 2 | Before | 3.0± 0.5[a] | 13.0± 1.1[a] | 33.0± 1.1[a] | 18.0± 1.1[a] | 26.0 ± 1.1 [b] |
| | After | 18.0± 0.5[b] | 34.0± 1.1[b] | 45.0± 1.1[b] | 72.0± 1.1[b] | 12.0 ± 1.1 [a] |
| 3 | Before | 7.0 ± 1.1 [a] | 27.0 ± 1.1 [a] | 24.0± 1.1[a] | 13.0 ± 0.5 [a] | 19.0 ± 1.1 [a] |
| | After | 24.0 ± 1.1 [b] | 64.0 ± 0.5 [b] | 71.0± 1.1[b] | 69.0 ± 1.1 [b] | 39.0 ± 0.5 [b] |
| 4 | Before | 15.0 ± 0.5 [a] | 9.0 ± 0.5 [a] | 17.0± 0.5[a] | 21.0 ± 1.1 [a] | 28.0 ± 1.1 [a] |
| | After | 39.0 ± 0.5 [b] | 31.0 ± 0.5 [b] | 22.0± 0.5[b] | 87.0 ± 1.1 [b] | 46.0 ± 0.5 [b] |
| 5 | Before | 11.0 ± 0.5 [a] | 12.0 ± 0.5 [a] | 27.0± 1.1[a] | 43.0 ± 0.5 [a] | 23.0 ± 0.5 [a] |
| | After | 58.0 ± 1.1 [b] | 16.0 ± 1.1 [b] | 41.0± 1.1[b] | 113.0 ± 0.5 [b] | 54.0 ± 0.5 [b] |
| 6 | Before | 17.0± 1.1 [a] | 18.0± 0.5 [a] | 31.0± 1.1 [a] | 29.0± 1.1 [a] | 31.0± 1.1 [a] |
| | After | 61.0± 1.1 [b] | 39.0± 0.5 [b] | 62.0± 1.1 [b] | 86.0± 1.1 [b] | 62.0± 1.1 [b] |
| 7 | Before | 13.0± 1.1 [a] | 23.0± 1.1 [a] | 26.0± 1.1 [a] | 26.0± 1.1 [a] | 27.0± 1.1 [a] |
| | After | 73.0± 1.1 [b] | 52.0± 1.1 [b] | 51.0± 1.1 [b] | 79.0± 1.1 [b] | 59.0± 1.1 [b] |
| 8 | Before | 16.0± 1.1 [a] | 14.0± 1.1 [a] | 47.0± 1.1 [a] | 41.0± 1.1 [a] | 22.0± 1.1 [a] |
| | After | 76.0± 1.1 [b] | 41.0± 1.1 [b] | 74.0± 1.1 [b] | 91.0± 1.1 [b] | 84.0± 1.1 [b] |
| 9 | Before | 21.0± 1.1 [a] | 8.0± 1.1 [a] | 38.0± 1.1 [a] | 22.0± 1.1 [a] | 18.0± 1.1 [a] |
| | After | 81.0± 1.1 [b] | 56.0± 1.1 [b] | 68.0± 1.1 [b] | 117.0± 1.1 [b] | 67.0± 1.1 [b] |
| 10 | Before | 24.0± 1.1 [a] | 17.0± 1.1 [a] | 21.0± 1.1 [a] | 18.0± 1.1 [a] | 37.0± 1.1 [a] |
| | After | 79.0± 1.1 [b] | 47.0± 1.1 [b] | 77.0± 1.1 [b] | 87.0± 1.1 [b] | 76.0± 1.1 [b] |

***LEGENDS***

*Before – skin swabs were taken after bathing/before use of lotions*
*After – skin swabs taken after bathing/after use of lotions*
*Means with same superscripts are statistically insignificant (P > 0.05)*
*Means with different superscripts are statistically significant (P < 0.05)*
*A, B, C, D, E – Lotion samples used by subjects*
*Statistical analysis was done using SPSS (mini tab version 2.0)*

was noticed that high counts were recorded for this study from students after all lotion samples were used. That is, it was observed in all five samples that fungal counts recorded after use of lotion samples were significantly higher (P < 0.05) compared to fungal counts before use of lotion sample. Table 2 shows percentage (%) response of study subjects for used lotions.

**Table 2. Percentage (%) response of study subjects for used lotions**

| Reaction | Yes | No |
|---|---|---|
| Profuse perspiration | 72 | 28 |
| Rash | 12 | 88 |
| Itch | 60 | 40 |
| Change in Colour | 4 | 96 |

Fig. 1 shows fungal count for used and unused lotion samples collected from participating students.

Table 3 shows cultural and morphological characteristics of the fungal isolates. Table 4 shows fungal percentage (%) occurrence for used and unused lotion. Table 5 shows label disclosure details of lotion samples and table 6 shows physicochemical parameters of used and unused lotion samples.

## 4. DISCUSSION

High fungal counts were recorded for all student participants after use of lotion and this further strengthens the position that cosmetic lotions are highly nutritive, providing necessary nutrients needed for microbial growth. These lotions could have served as nutrients for growth of the fungi already present in the skin.

This research study showed that the manufacturers of these lotion samples examined did not comply with the standards stipulated by International Microbiological Standards (IMS). The IMS recommended that moulds should not exceed $1.0 \times 10^2$ cfu/g [10]. Three lotion samples out of five studied complied with the mycological standard.

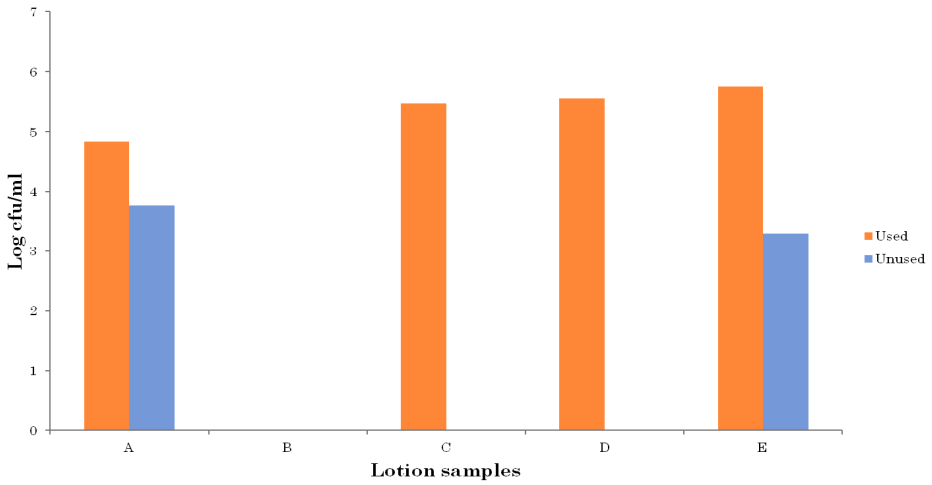


**Fig. 1. Fungal count obtained from used and unused lotion samples**

**Table 3. Cultural and morphological characteristics of the fungal isolates**

| Macroscopy | Microscopy | Probable genera |
|---|---|---|
| White, smooth, glabrous yeast-like. | Short-ovoid to long-ovoid, budding blastoconidia | *Candida* sp |
| Yellow-green surface taming black with formation of numerous black dots with a creamy cracked reverse. | Appearance of dark brown furling head on white mycelium. | *Aspergillus* sp. |
| Characteristic blue-grey colouration with a fanjet of white. | Long awl-shaped halides producing cylindrical one celled conidia mostly in slimy heads. | *Penicillum* sp. |
| White fluffy colour with cottony aerial mycelium on a reverse surface. | Phialides are cylindrical, with a small collarette. | *Fusarium* sp |

**Table 4. Fungal percentage (%) occurrence for used and unused lotion**

| Organisms | Used | Unused |
|---|---|---|
| *Fusarium* | 11 | 16 |
| *Candida* | 75 | 84 |
| *Aspergillus* | 3 | - |
| *Penicillium* | 11 | - |

The high fungal counts noticed in unused lotion samples (A and E) could be attributed to the unsanitary practices by manufacturers such as negligence of staff during packaging and use of contaminated water during production. For used lotion samples, the very high fungal counts recorded can be linked to unhygienic practices by consumers and improper storage after use. A survey carried out during the study showed that

**Table 5. Label disclosure details of lotion samples**

| Samples | Date of production | Expiry date | NAFDAC no. | Batch no. | Manufacturer's address |
|---|---|---|---|---|---|
| A | + | + | + | + | + |
| B | - | - | + | + | - |
| C | + | + | - | + | - |
| D | + | + | + | + | + |
| E | + | + | + | - | + |

**Table 6. Physicochemical parameters of used and unused lotion samples**

| Sample | Fe | Zn | Pb | Moisture | pH | Temp | Colour |
|---|---|---|---|---|---|---|---|
| **A. U** | 6.9±0.1 [a] | 1.1±0.0 [a] | <0.01 | <2.00 | 3.98±0.0[a] | 31.2±0.0 [a] | Yes |
| **A. Un** | 7.0±0.0 [a] | 1.1±0.0 [a] | <0.01 | <2.00 | 3.50±0.0 [b] | 31.2±0.0 [a] | No |
| **B. U** | 8.0±1.1 [a] | 1.1±0.0 [a] | <0.01 | <2.00 | 6.95±0.0 [a] | 30.7±0.0 [a] | No |
| **B. Un** | 12.3±0.1 [b] | 1.1±0.0 [a] | <0.01 | <2.00 | 7.00±0.0 [a] | 30.7±0.0 [a] | No |
| **C. U** | 28.0±0.5 [b] | 3.3±0.1 [b] | <0.01 | <2.00 | 3.40±0.0 [a] | 30.8±0.0 [a] | No |
| **C. Un** | 17.0±0.5 [a] | 2.0±0.0 [a] | <0.01 | <2.00 | 3.40±0.0 [a] | 30.7±0.0 [a] | No |
| **D. U** | 12.4±0.2 [a] | 1.0±0.0 [a] | <0.01 | <2.00 | 7.06±0.0 [a] | 30.2±0.0 [a] | No |
| **D. Un** | 16.1±0.0 [b] | 1.3±0.2 [a] | <0.01 | <2.00 | 7.02±0.0 [a] | 30.2±0.0 [a] | No |
| **E. U** | 9.4±0.2 [a] | 2.0±0.0 [a] | <0.01 | <2.00 | 6.91±0.0 [a] | 30.5±0.0 [a] | No |
| **E. Un** | 9.3±0.2 [a] | 1.9±0.1 [a] | <0.01 | <2.00 | 6.82±0.0 [a] | 30.9±0.0 [a] | No |

*LEGENDS*
*Means with same superscript are statistically insignificant (P > 0.05)*
*Means with different superscript are statistically significant (P < 0.05)*
*A, B, C, D, E – lotion samples*
*U – Used*
*Un – Unused*
*Permisible limits pH 6.5 - 8.5 (WHO, 2008), Concentration of Lead in lotions, Suggested safe levels of 10 (Health Canada, 2007). Fe and Zn (no available internationally acceptable maximum limits for these elements.*

some consumers tend to transfer excess lotion back into the containers from their hands which could lead to the introduction of contaminants. Others tend to leave the containers open for a long time after use allowing air into it and this could encourage fungal contamination.

The present study agrees with the findings of Babalola and Eze [6] who reported that *Candida* was the dominant fungi in their study. This result differs from that of Okeke and Lamikanra [11] in that fungus was not isolated by them. The high fungal contamination of some lotions in our study may be attributed to the fact that products are often water in oil emulsions, with high solute concentration and low water activity which could favour microbial growth.

The present study analysis of label information was in agreement with that of Mwambete and Simon [12] where they reported incomplete label information on products to guide consumers.

## 5. CONCLUSION

As shown from this study, body lotion samples were contaminated by spoilage fungi and to find these microbes in lotion is a risk to public health. The study also revealed that 2 unused lotion samples did not meet microbiological standards mandated; implying that first point of contamination was in the production process. The fungal counts of used lotion samples were generally higher compared to the unused samples, further implying that unhygienic practices of users contribute to their presence in lotion samples. The results further revealed that some lotion product manufacturers do not adopt a system of complete container label disclosure of their products. For consumer safety, manufacturers of cosmetic products should adhere strictly to the principle of good manufacturing practice and regulatory bodies such as NAFDAC should monitor registered companies more closely for compliance.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. The Council of the European Communities. Council Directive of 27 July 1976 on the Approximation of the Laws of the Member States Relating to Cosmetic Products 76/768/EEC. Jounal of European Commission. No. L 262/170; 1976.
2. Siegert W. Microbiological quality management for the production of cosmetics and toiletries. Cosmetic Science and Technology. 2005;189.
3. Pinon A, Alexandre V, Cupferman S, Crozier A, Vialette M. Growth, survival and inactivation of *Pseudomonas aeruginosa* and *Staphylococcus aureus* strains of various origin in the presence of ethanol. International Journal of Cosmetic Science. 2007;29:111-119.

4. Rope BL. Conquering contamination part I. Global Cosmetic Industry. 2002;170: 40-43.
5. Ezenna E, Stanley HO, Stanley CN. spoilage bacteria associated with selected body lotions commonly used amongst students of the University of Port Harcourt, Nigeria. Journal of Pharmaceutical Research International. 2017;19(5):1-7.
6. Babalola MO, Eze M. Microbiological quality and characterization of potential pathogens associated with selected brands of commercial cosmetic products in Nigeria. British Microbiology Research Journal. 2015;9(5):1-17.
7. Osungunna MO, Oluremi BB, Adetuyi A. Bacteriological and antibiotic sensitivity patterns of bacterial isolates from creams and lotions Hawked in Sagamu, Ogun State. Pakistan Journal of Nutrition. 2010; 9:773-775.
8. Yorgancioglu A, Bayramoglu EE. Production of cosmetics purpose collagen containing antimicrobial emulsion with certain essentials oils. Industrial Crops and Products. 2013;44:378-382.
9. Larone DC. Medically important fungi: A guide to identification. American Society of Microbiology. Washington, DC. 3rd Ed. 1995;77-81.
10. Omorodion NJ, Ezediokpu MN, Grant E. Microbiological quality assessement of some brands of cosmetics powders sold Within Port Harcourt, Rivers state, Nigeria. Report and Opinion. 2014;6(2):7-11.
11. Okeke IN, Lamikanra A. Bacteriological quality of skin-moisturizing creams and lotions distributed in a tropical developing country. Journal of Applied Microbiology. 2001;91:922-928.
12. Mwambete KD, Simon A. Microbiological quality and preservative capacity of commonly available cosmetics in Dar es Salaam, Tanzania. East and Central African Journal of Pharmaceutical Sciences. 2010;13:3- 11.



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