

Creams Used by Hand Eczema Patients are often Contaminated with *Staphylococcus aureus*

Michael D. Lundov¹, Jeanne D. Johansen¹, Claus Zachariae² and Lise Moesby³

¹National Allergy Research Centre, ²Department of Dermato-Allergology, Gentofte Hospital, and ³Department of Pharmacology and Pharmacotherapy, Faculty of Pharmaceutical Sciences, University of Copenhagen, Ledreborg Alle 40, 1., DK-2820 Gentofte, Denmark. E-mail: midylu01@geh.regionh.dk
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Skin lesions, such as atopic dermatitis and eczema, are often colonized with high densities of microorganisms, especially *Staphylococcus aureus* (1–3). Severity and persistence of both atopic and hand eczema has been associated with *S. aureus* colonization (2, 4).

Besides colonizing eczema *S. aureus* is also one of the most frequently found contaminants in cosmetic products (5–7), and cosmetics contaminated with *S. aureus* have previously been identified as the cause of dermal infection (8).

Studies on contamination of different types of cosmetics during use have shown that *Staphylococcus* spp. in particular *S. epidermidis*, are found in the products (5, 9–12). In addition, yeast and mould, such as *Candida* spp. and *Aspergillus* spp., are also frequently found in used cosmetics (9, 11, 13). This study investigated hand creams used by patients with hand eczema for microbial contamination, focussing especially on *S. aureus*.

MATERIALS AND METHODS

Hand creams used by 20 patients with hand eczema were collected while the patients underwent routine patch testing at the Dermato-Allergology Department at Gentofte Hospital. In order to quantify the number of microorganisms present in each product parts of the protocol 2.6.12 from the European Pharmacopoeia 6.5 “Microbiological examination of non-sterile products: microbial enumeration tests” were followed (14). Briefly, 1 g cream was dissolved in 9 ml buffered NaCl-peptone solution (pH 7.0) and serially diluted to 10⁻³ g/ml. From each dilution 0.1 ml was dispersed on two 5% sheep blood agar plates (OXIOD) and incubated at 37°C for 5 days. The number of new colonies was recorded on each of the 5 days. The total number of colony forming units (CFU) was counted and the CFU/g cream was calculated based on the mean number of CFU on two plates from the same dilution if the number of CFU was between 10 and 200 on each plate. Characterization of the colonies was performed by selecting morphologically different colonies and several similar colonies from the blood plates. Each isolated colony was transferred to a new blood plate in order to ensure pure colonies. All isolates underwent microscopy, and bacterial isolates were Gram-stained. To identify *S. aureus* all Gram-positive cocci were tested for coagulase (Staphaurex® REMEL).

It was also tested whether the contact areas of the cream were contaminated. With an inoculation loop a small quantity of cream was removed from the opening of tubes or the edge of

jars and suspended in 1 ml NaCl-peptone solution. 0.5 and 0.1 ml volumes of the solution were dispersed on blood plates and incubated at 37°C for 5 days. The characterization procedure for these isolates was identical to the previous procedure.

RESULTS

A total of 32 different products was collected from the 20 different patients, 6 jars and 26 tubes. Microorganisms were found in 20 of the 32 products (63%). In 11 (55%) of the 20 products microorganisms were isolated from the cream itself. From the creams we only isolated a small number (0–10) of microorganisms on each blood plate, which made it unreliable to calculate the exact number of CFU/g.

From the opening of the tubes and the edge of the jars we found microorganisms in all 20 contaminated products, except one. In total, 49 microorganisms were isolated from the cream itself and 85 microorganisms were isolated from the opening of the tubes or edge of the jars. All 134 isolates were characterized (Table I). Gram-positive cocci were found in 18 (90%) of the contaminated products, while Gram-positive and -negative rods, filamentous fungi and yeasts were found in 10–30% of the contaminated products (Table I). *S. aureus* were found in 6 (30%) of the 20 products, these 6 products came from 3 different patients. One product had visible contamination, with growth inside the jar and discoloration of the cream around the edge.

DISCUSSION

We isolated microorganisms from 63% of the products, and 30% of the contaminated products contained *S. aureus*. The majority of the microorganisms were isolated from the opening of the tubes or edges of the jars of the products, which indicates that the contaminants are from the users and not intrinsic. This is also indicated by our quantification, which showed that none of the products were contaminated by large numbers of CFU/g cream. A study on used sunscreen products also showed that the openings of the containers are the most frequent contaminated part (11).

Table I. Prevalence of type of microorganism found and the number and place of isolated microorganisms

| | Cocci (Gram ⁺) | Rod (Gram ⁺) | Rod (Gram ⁻) | Filamentous fungi | Yeast |
|-----------------------------------|----------------------------|--------------------------|--------------------------|-------------------|--------|
| Products, n (%) | 18 (90) | 6 (30) | 4 (20) | 2 (10) | 4 (20) |
| Isolated from the cream, n | 37 | 7 | – | 1 | 4 |
| Isolated from the opening/edge, n | 52 | 10 | 6 | 3 | 14 |

In the majority of the products we could isolate and identify all the microorganisms that were visible after 5 days of incubation. However, in some cases the plate was completely covered and we selected colonies that represented the whole community of microorganisms based on visible differences in morphology. All these overgrown plates were from the opening or edge of the containers.

According to European Union (EU) legislation cosmetic products must not contain more than 1,000 CFU/g cream and *S. aureus*, *Pseudomonas aeruginosa* and *Candida albicans* must not be detectable in 0.5 g of the product. We did not find any products with more than 1,000 CFU/g cream. We did find *S. aureus*, but this was probably caused by in-use contamination. We also found yeast and Gram-negative rods, which could be *Candida albicans* or *Pseudomonas aeruginosa*, but again it is not known whether these pathogens proliferate in the cream or are transient on the opening or edge of the product containers. The pathogenic microorganisms can potentially colonize or infect the hand eczema of the patients and thereby prolong healing of the skin (4, 8). The findings of this study show that the majority of creams are contaminated. It is important that the patients exercise care in using creams and limit contact between the opening/edge of the container and their skin. A previous study showed that products where the user has less direct contact with the cream is at lower risk of becoming contaminated during use (9). From jars in particular, it would be preferable to use a spatula or a spoon in order to avoid direct contact by inserting fingers into the jar. Furthermore, we do not recommend that leftover cream is returned to the jar or wiped off on the edges of the container. In cases of infected hand eczema or other dermal infections it is important to ensure that the patients minimize direct contact between the infected site and their creams and other cosmetic products in order to avoid transfer of microorganisms, which may prolong healing or infect other users of the products.

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