

CONFLICTS OF INTEREST

The authors have nothing to disclose.

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<https://doi.org/10.5021/ad.2019.31.5.588>



Contribution of Container Types on Cosmetics Contamination

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Dear Editor:

BB cream has surged in popularity worldwide¹. CC cream has also been released, and the BB and CC cushion com-

pact is setting the trend in base makeup. The cushion compact is composed of a urethane puff and a sponge soaked with BB or CC cream that forms a reservoir for the pro-

Received January 27, 2019, Revised April 15, 2019, Accepted for publication April 29, 2019

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duct. The cream is applied by pressing the puff into the moistened sponge and patting the puff onto the face. The repetitive use of the wet puff with BB or CC cream can result in bacterial growth. Therefore, we conducted a comparative study on the prevalence of *Cutibacterium acnes* in BB and CC cushion compacts and other forms, such as tubes, pumps, and solid foundation compacts and discussed their association with acne.

Two sets of subjects using the BB or CC cushion and BB or CC cream in other containers were recruited from June 2014 to August 2014. Eighty-one participants in their 20s to 40s that applied makeup daily were recruited. All participants were female. Eighty-one samples were collected; 45 samples (55.6%) from subjects using a cushion compact, and 36 samples (44.4%) from subjects using BB or CC cream in a tube, pump container, or solid foundation compact were analyzed. The number of subjects used the tubes were 13, pumps were 16, and solid foundation compacts were 7.

Samples were collected aseptically from each container using a sterilized dry swab. The specimens were placed in Luria-Bertani broth (Affymetrix Inc., Santa Clara, CA, USA) without antibiotics and incubated for 12 to 16 hours at 37 °C with shaking at 250 rpm². The samples that turned opaque were selected and streaked onto plates with specific media to identify *C. acnes*, *Staphylococcus*, and *Streptococcus*, *Clostridium* spp. and the plates were incubated for 12 to 16 hours at 37°C.

Differences for hypothesis testing of proportions were estimated between the groups. A $p < 0.05$ was considered significant. p -values were calculated using proportion hypothesis testing.

C. acnes was isolated in 10 of the 81 specimens (12.3%).

Table 1. Comparison of *Cutibacterium acnes* isolation in a BB or CC cushion compact with other types

	BB or CC cushion (%)	Other* types (%)	p -value [†]
Number of samples	45	36	
Isolation of <i>C. acnes</i> [‡]	9 (20.0)	1 (2.8)	0.04534
Isolation of <i>Staphylococcus aureus</i>	5 (11.1)	0	
Isolation of Streptococci spp.	6 (13.3)	0	
Isolation of <i>Staphylococcus epidermidis</i>	1 (2.2)	0	

Values are presented as number only or number (%). *Includes pump or tube containers and the solid foundation compact type.

[†] p -values were calculated using proportion hypothesis testing.

[‡]Of the nine subjects using cushions that harbored *C. acnes*, four had acne. One subject using BB cream in a pump container did not have acne.

Of the 10 samples, nine were the cushion type, and one was a pump type (Table 1). The frequency of *C. acnes* isolates was significantly different between the cushion compact and the other container groups (9 [20.0%] and 1 [2.8%], respectively; $p < 0.05$). One specimen from the pump type revealed a plate culture of only *C. acnes*, while all nine specimens from the cushion compact type grew *C. acnes* and other Gram-positive species, such as *Staphylococcus aureus*, *Staphylococcus epidermidis*, and *Streptococcus* spp. (Table 2). Of the nine subjects using cushions that harbored *C. acnes*, four had acne. One subject using BB cream in a pump container did not have acne. No direct correlation was detected between *C. acnes* isolates and acne.

Kligman and Mills³ proposed the concept of “acne cosmetica” in 1972, which suggests that daily use of cosmetics causes minor acne in women. Acne cosmetica is characterized by closed comedones on the chin and cheeks of women aged 20 to 50 years with or without an acne history³.

The results show that the *C. acnes* isolation rate was higher in the cushion compact than that of other containers. All cushion compacts that harbored *C. acnes* also had other gram-positive species. However, no correlation was found between isolating *C. acnes* and acne.

C. acnes is one of the normal skin flora. However, in healthy adults, *C. acnes* is barely detectable. Typical cosmetic products use phenoxyethanol, butylhydroxytoluene, glyceryl caprylate and parabens as a preservative. This may reduce the isolation rate of *C. acnes* in our study. However, despite preservatives, two or more bacteria were recovered together in all cushion compact with bacteria identified.

Table 2. Types of bacteria identified in the cushion and other* container types

Cushion compact with bacteria recovered	
Sample #1	<i>Staphylococcus aureus</i> , <i>Cutibacterium acnes</i>
Sample #2	<i>C. acnes</i> , Streptococci spp.
Sample #3	<i>C. acnes</i> , Streptococci spp.
Sample #4	<i>C. acnes</i> , Streptococci spp.
Sample #5	<i>S. aureus</i> , <i>C. acnes</i> , Streptococci spp.
Sample #6	<i>S. aureus</i> , <i>C. acnes</i>
Sample #7	<i>S. aureus</i> , <i>C. acnes</i>
Sample #8	<i>S. aureus</i> , <i>C. acnes</i> , Streptococci spp.
Sample #9	<i>Staphylococcus epidermidis</i> , <i>C. acnes</i> , Streptococci spp.
Pump type BB cream with bacteria recovered	
Sample #1	<i>C. acnes</i>

*Includes pump or tube containers and the solid foundation compact type.

Most women alternate patting the puff into the BB or CC cream liquid soaked sponge of a cushion compact and applying it to the face when using cushion compact. Because the polyurethane sponge is always wet and enclosed in a container, the humidity and temperature in the cushion compact are suitable for bacterial growth. Frequently re-applying make-up during the day allows air pollutants, skin secretions, and sweat to contaminate the cushion compact.

However, not all subjects using product harboring *C. acnes* had acne. Because the pathogenesis of acne is multifaceted, the presence of *C. acnes* is insufficient to explain the development of acne⁴. In addition, subjects with normal skin barrier function are not easily affected by *C. acnes* or other Gram-positive bacteria in cosmetics. Nevertheless, patients with sensitive skin or skin with decreased barrier function, particularly those with acne, rosacea, or atopic dermatitis, may be vulnerable to skin infections from contaminated products, and an underlying skin disease could be aggravated as presented in the study of Lopez et al.⁵ that investigated the effects of beta hemolytic streptococcus group B on skin lesions. Therefore, dermatologists should warn patients about the possibility of bacterial growth in cushion compacts and educate cushion compact users to wash the puff at least once weekly and not to share it with other users.

Our study had some limitations. First, it was not a matched case-control study. The baseline characteristics were not homogeneous; thus, it was difficult to evaluate the association between bacterial isolation and the development of acne. Second, we could not match the formulations of BB or CC product. Differences in formulation could account for dissimilar recovery of organisms beyond those attributed to the puff and packaging. Third, we investigated the skin bacteria species colonizing the cosmetic goods, not the extent of microbial contamination. However, identifying the quantitative number of the bacteria of interest would provide the basis for determining the microbiological hazard to consumers. Fourth, the effect of preservatives on the isolation rate of *C. acnes* from the cos-

metics was not examined. It would have been helpful to know if the preservative were adequate and capable of preventing growth of skin microflora accidentally introduced into the product.

Our results emphasize the importance of appropriate use, and containers of cosmetics. A case-control study to evaluate the association between cushion compacts and acne should be conducted in the future.

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The authors have nothing to disclose.

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