

Accuracy of Product Ingredient Labeling: Comparing Drugstore Products With Online Databases and Online Retailers

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Background: Patients with allergic contact dermatitis rely on ingredient lists published in databases and by online retailers to find safe skincare products.

Objective: The aim of this study was to determine the accuracy of product ingredient labeling by comparing drugstore product labels to ingredient lists published online.

Methods: Amazon was queried for best-selling items in several categories of skincare, generating a list of 93 products. These products were then found at a local Target and Walgreens and online on Contact Allergen Management Program, SkinSAFE, and Consumer Product Information Database. Drugstore product labels were compared with online ingredient lists and analyzed for discrepancies.

Results: There were 31 occurrences in which an allergen listed in the 2017 American Contact Dermatitis Society Core Allergen Series was omitted (present on the in-store label but missing from an online list.) Seven omissions occurred on Contact Allergen Management Program, 11 occurred on SkinSAFE, 5 occurred on Consumer Product Information Database, and 8 occurred on Amazon.

Conclusions: Definitive treatment of allergic contact dermatitis is avoidance of allergens found on patch testing. These data suggest that patients may be at risk of inadvertent exposure to allergens from products, which are supposedly deemed safe according to online ingredient lists.

The diagnosis of allergic contact dermatitis (ACD) is based on clinical features and history in combination with patch testing, which allows the identification of allergens that should be avoided.¹⁻³ Allergen avoidance is the mainstay of treatment, although topical corticosteroids, barrier creams, and topical nonsteroidal anti-inflammatory drugs can help control symptoms.^{1,2}

The prevalence of ACD from personal care products in the general population has been projected at approximately 1%,⁴ but this is likely an underestimation because many patients forego seeking medical advice during a reaction. The North American Contact Dermatitis Group reported that 21.8% of patients referred for patch testing had a reaction associated with a personal care product,⁵ whereas a pooled review article concluded that the prevalence of skincare product-associated ACD was likely around 9.8%.⁴ After a diagnosis of ACD to personal care items, patients are tasked with

replacing allergen-containing products with safe skincare products. Both patients and providers rely on online ingredient databases and ingredient lists published on retailer websites to guide their selection of safe, hypoallergenic products.

Commonly used online databases for this purpose include the American Contact Dermatitis Society's (ACDS's) Contact Allergy Management Program (CAMP) (www.ContactDerm.org), SkinSAFE (<https://www.SkinSafeProducts.com>, HER Inc./Mayo Clinic), and the Consumer Product Information Database (CPID) (www.whatsinproducts.com/). Each of these databases is updated and maintained by separate organizations and includes thousands of ingredient lists (Table 1). Patients can use these resources to access lists of "safe" personal care products. SkinSAFE and CPID are accessible to any member of the public, through the web or mobile app, whereas patients access CAMP via their ACDS member dermatologist. Patients may also look up product ingredient lists on websites such as Amazon.com, and consumers are increasingly choosing to purchase their skincare items from online retailers instead of at drugstores.⁶ In fact, Amazon is now the largest online beauty retailer in the United States, cornering 36% of the market.⁶

The Federal Drug Administration (FDA) mandates that companies label all ingredients in a skincare product sold in the United States.⁷ The FDA does not require skincare companies to file product information, but manufacturers can voluntarily submit formulations to the Cosmetic Registration Program.⁸ Companies can change product formulations

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TABLE 1. Properties of Online Ingredient Databases

Database Name	Website	Developer	Mobile App	Approximate No. Products in Database	Cost for Access
Contact Allergen Management Program (CAMP)	https://www.contactderm.org/resources/acds-camp	American Contact Dermatitis Society	Yes	5000	Free to patients; Physician ACDS membership (US \$300/y) includes CAMP access
SkinSAFE	https://www.skisafeproducts.com/	Owned by HER Inc., created in collaboration with Mayo Clinic	Yes	43,000	Free to patients; physician membership US \$288/y (basic profile) or US \$480/year (advanced features)
Consumer Product Information Database	https://www.whatsinproducts.com/	DeLima Associates	No	8000	Free
Amazon	https://www.amazon.com	Amazon	Yes	>100,000	Free

at their discretion, and beyond a voluntary amendment made to the Cosmetic Registration Program, there is no mechanism to ensure other online databases are reporting the most up-to-date ingredient lists. Because of this frequent updating of formulations, we hypothesized that there may be discrepancies between sources.

Patients with ACD must continuously avoid allergen-containing products. We sought to determine whether significant differences existed between ingredients listed on online retailers, on databases, and in drugstores. Patients with contact allergy can prevent flares by avoiding their allergic triggers, but they need accurate ingredient lists to do so.

METHODS

In April 2018, the major online retailer Amazon (www.amazon.com) was queried for 100 best-selling skincare products in the following categories: shampoos, sunscreens, body lotions, body washes, and face washes. These lists were then compared with products available in-store at Target and Walgreens. Seven products were excluded because they were not found in stores, resulting in a list of 93 total products. This final list of products included only items that were both in stock at local Walgreens and Target stores in Madison, WI, and included on an Amazon Best Seller list. Of the 93 products examined, 23 were body lotions, 13 were sunscreens, 22 were shampoos, 21 were body washes, and 14 were face washes. The ingredients of the Amazon products were recorded and saved into a Microsoft Excel spreadsheet (Microsoft Corporation, Redmond, WA). Ingredient lists for Amazon products were found either under “Product Details,” in a photograph of the product, or in customer questions and answers.

Ingredient lists for the 93 products were then collected directly from in-store product bottles at 2 Walgreens locations and 1 Target location in Madison, WI. A photograph was taken of each in-store ingredient label, and the ingredients were then entered into the Excel spreadsheet with the help of optical character recognition software (iText), which converted the pictures of product labels to

text. Each line of text was manually checked with the photograph to ensure accurate transcription. In June 2018, each of the 93 products was searched for on SkinSAFE, CAMP, and CPID, and if an ingredient list was available, it was added to the spreadsheet for comparison.

Finally, using the in-store product labels as the standard, the ingredient lists from all sources were manually compared for errors. The FDA requires products to list ingredients in descending order of concentration,⁷ but because SkinSAFE lists ingredients in alphabetical order, we did not consider the order of ingredients in our analysis. SkinSAFE omits water from its ingredients, so the addition or omission of water in a list was not considered an error. Additionally, fragrance is considered a trade secret, and as such, companies are not required to list the components of fragrance on skincare products in the United States. If one source listed “fragrance” as an ingredient and another source instead listed the components of fragrance for the same product, this was not counted as an error.

Every ingredient omission or addition was recorded in the spreadsheet. An omission was defined as an ingredient present on an in-store product label that was missing from an online ingredient list. Because we consider omissions of ingredients from online lists to be of most consequence to patients with ACD, our data analysis focused on omissions.

RESULTS

Two hundred fifty-six online ingredient lists were compared with in-store labels. Lists were not available for every product on each database. SkinSAFE had 87 (94%) of 93 ingredient lists available, which was the highest proportion of the online databases. Fifty-eight (62%) of 93 product ingredient lists were available on CAMP. The CPID had only 18 (19%) of 93 products listed.

Seventy-one (27.7%) of 256 online ingredient lists did not match the in-store label. Amazon was the most accurate of the 4 websites, with only 15/93 (16.1%) containing an error of omission. Eighteen (31%) of 58 CAMP ingredient lists, 24 (27.6%) of 87 SkinSAFE lists, and 14 (77.8%) of 18 CPID lists contained omissions.

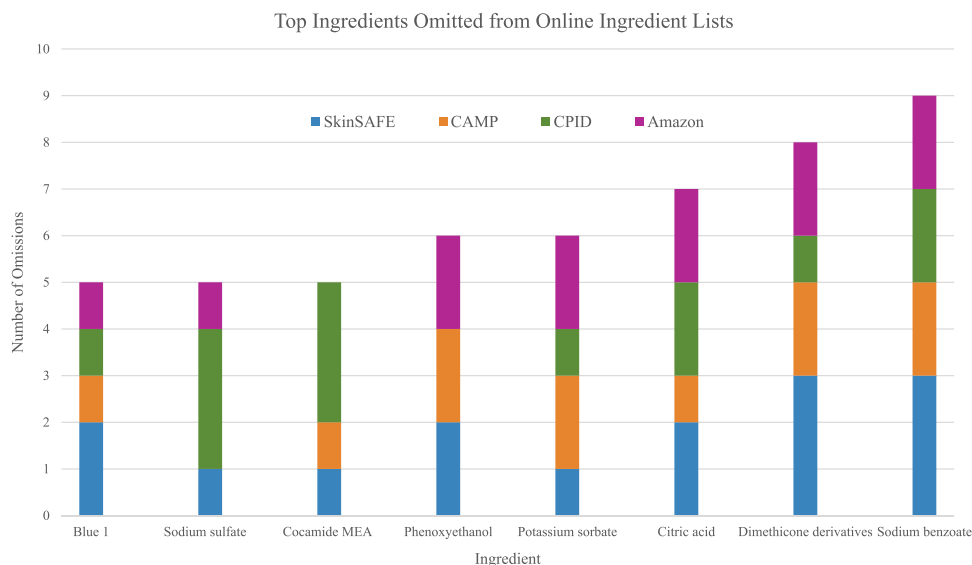


Figure 1. Top ingredients (both allergenic and nonallergenic) listed on a drugstore label but omitted from an online list.

Across both allergenic and nonallergenic ingredients, the most commonly omitted ingredient was sodium benzoate (Fig. 1). Other nonallergenic ingredients with a high frequency of omission were the dimethicone family, potassium sorbate, blue 1, cocamide monoethanolamine, and sodium sulfate (Fig. 1).

Importantly, there were 31 occurrences in which an allergen listed in the 2017 ACDS Core Allergen Series⁹ was present on an in-store label but omitted from an online ingredient list (Fig. 2). The most commonly omitted allergen was sodium benzoate ($n = 9$), followed by phenoxyethanol ($n = 6$). Other allergen omissions included methylchloroisothiazolinone (MCI) ($n = 4$), methylisothiazolinone (MI) ($n = 3$), propylene glycol ($n = 3$), ethylparaben ($n = 2$), ethylhexylglycerin ($n = 1$), dimethylol dimethyl hydantoin ($n = 1$),

diazolidinyl urea ($n = 1$), and iodopropynyl butylcarbamate (IPBC) ($n = 1$).

Of the 31 ACDS core allergen omissions, the highest proportion occurred on CPID (5 [27.7%] ACDS core allergen omissions of 18 available lists). SkinSAFE had 11 core allergen omissions (12.6%) of 87 lists, CAMP had 7 (12.07%) of 58 lists, and Amazon had 8 omissions (8.6%) of 93 lists (Fig. 3).

Of the 31 allergen omissions from online ingredient lists, 16 occurred on a body wash label (Table 2). There were 0 occurrences of allergen omission from sunscreen ingredient lists.

There was 1 instance of discrepancy between in-store product labels. The product “Amlactin Alpha-Hydroxy-Therapy Daily Moisturizing Body Lotion” had different ingredients listed on nearly

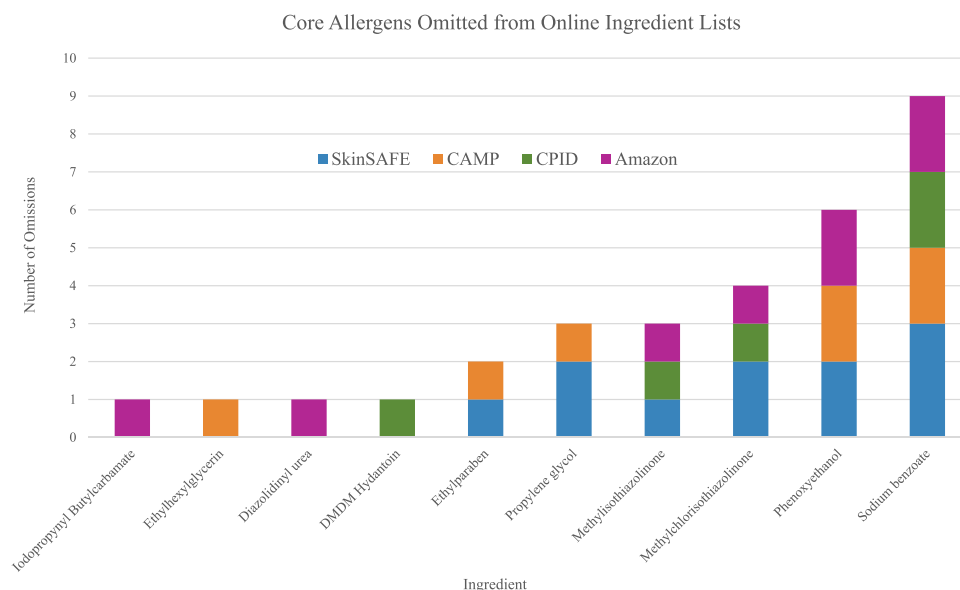


Figure 2. Frequency of 2017 ACDS Core Allergen omission from an online list.

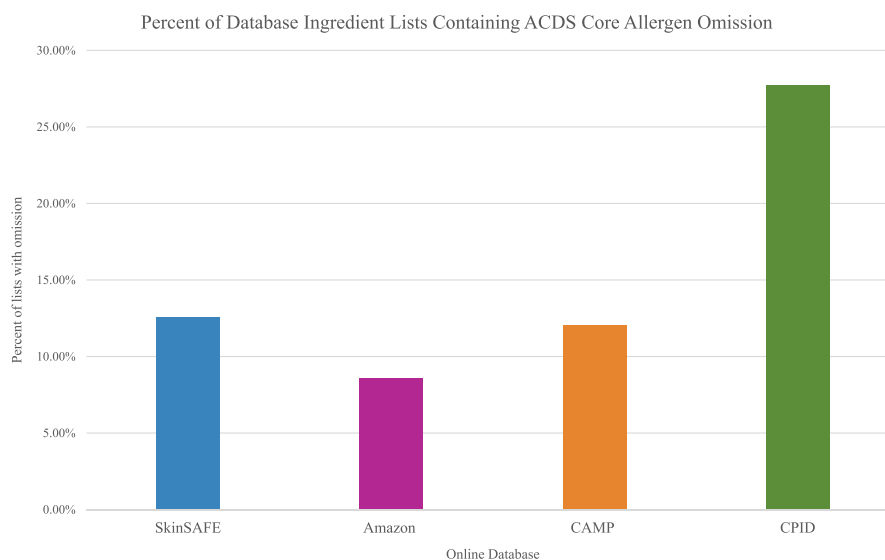


Figure 3. Percent of online ingredient lists containing an ACDS Core Allergen omission.

identical bottles in stores (Fig. 4). Walgreens had both formulations on the shelf, whereas Target had only 1 formulation in stock.

DISCUSSION

Our results suggest that online ingredient lists may differ from in-store product labels. Skincare companies regularly change their product formulations, and it is likely that online databases update ingredient lists at varying frequencies, resulting in discrepancies. These inconsistencies put patients at risk of inadvertent allergen exposure from products previously deemed safe. There were several omissions of known contact allergens (as per the 2017 ACDS Core Allergen Series) in online databases. Sodium benzoate and phenoxyethanol⁹ were the allergens most commonly missing from online lists. Luckily, both are relatively rare allergens with low reported allergy rates. In a European retrospective analysis involving 79,046 patch-tested patients, 0.69% were found to have a positive reaction to sodium benzoate.¹⁰ A study from Singapore analyzed 3177 patch-tested patients and established a 0.34% positive reaction rate to phenoxyethanol.¹¹

More common allergens, such as MI, MCI, propylene glycol, formaldehyde-releasing preservatives, and IPBC were also omitted online but found on the in-store label. Methylisothiazolinone has a reported positive reaction rate of 13.4% and the highest Significance-Prevalence Index Number (SPIN), a parameter that incorporates both frequency of reactions and clinical relevance to evaluate the relative importance of an allergen.¹² MCI/MI, number 4 on the 2015 to 2016 North American Contact Dermatitis Group SPIN ranking, has a positive reaction rate of 7.3%.¹² Propylene glycol has a positive reaction rate of 4%, and the widely used water-based preservative IPBC has a positive reaction rate of 3.9%.¹² The formaldehyde-releasing preservatives diazolidinyl urea and dimethylol dimethyl hydantoin have positive reaction rates of 1.2% and 0.8%,

respectively, but any reaction to these agents could indicate an allergy either to the chemical itself or to the released formaldehyde.¹³

These data suggest that online product databases may contain errors that can inadvertently lead to allergen exposure. Although online resources may help patients select “safe” products for use, there should be no substitute for properly counseling a patient on careful label reading before using any product.

LIMITATIONS

This study is bound by several limitations. The sample size was small and limited to stores in Madison, WI. Batches may be different between drugstores, or patients may have older formulations of these products at home. Human error should be discussed as a limitation for this study. Ingredient labels were entered into the spreadsheet with the help of optical character recognition software, but each list was then compared manually. This allows for the possibility of inaccuracies in describing label differences. Additionally, it should be noted that database ingredient lists may contain typos in spelling, punctuation, or spacing. Any typo in an online list could result in an allergen-containing product being erroneously included in a list of safe items. We did not study whether online databases properly eliminated allergenic products if a typo was present.

TABLE 2. Number of ACDS Core Allergen Series Omissions per Product Type

Product Type	No. Products Analyzed	No. Allergen Omissions
Body lotion	23	4
Shampoo	22	6
Body wash	21	16
Face wash	14	5
Sunscreen	13	0



Figure 4. A, Two bottles of the same in-store product (Amlactin Alpha-Hydroxy Therapy Daily Moisturizing Body Lotion). B, Ingredient labels differ between the bottles.

In this study, the product bottle purchased in the drugstore was considered to be the standard for comparison to online lists. However, it is important to note that a product with a single universal product code often has multiple formulations because universal product codes are often reused by companies. Thus, online databases must contend with having no single benchmark for which to compare their product ingredient lists as ingredients may change with time. As Figure 4 illustrates, products with the same name in drugstores may differ because of reformulation, meaning there is no true gold standard for ingredient lists. As such, there is no substitution for understanding where allergens are found and reading product labels at the time of purchase.

Finally, Amazon best-selling products may not represent current trends in skincare purchasing. Given the wide consumer base of Amazon, our product list may not accurately reflect the top product choices of dermatology patients suffering from ACD.

CONCLUSIONS

Definitive treatment for ACD is avoidance of allergens as identified by patch testing. Many patients utilize online product databases to identify safe products, later purchasing products either online or in a drugstore. All consumers today are inundated with a wide array of product choices, but ACD patients must also contend with long ingredient lists and with the extensive alternative nomenclature

associated with each of their allergens. Complicating patients' ability to find safe products, our data imply that ingredient lists are not necessarily consistent between online databases and in-store labels. It is imperative that patients double check labels for presence of their allergens before applying a product. In addition, an improved mechanism for providing patients the best possible resources for managing their contact dermatitis is needed.

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