

Prevalence of Contact Allergens in Personal Care Products for Babies and Children

Jonathan G. Bonchak, MD,* Megan E. Prouty, MD,† and Salma F. de la Feld, MD*

Background: Personal care products marketed for babies and children are often regarded as “safe” or “gentle.” However, little is known about the prevalence of contact allergens in these types of products.

Objective: This study assessed the prevalence of important sensitizers in personal care products marketed for babies and children. A secondary objective of this study was to determine whether a product’s cost correlates with content of sensitizing ingredients.

Methods: The ingredient lists of 533 unique personal care products were analyzed for presence of fragrance, betaines, propylene glycol, methylchloroisothiazolinone, methylisothiazolinone, formaldehyde, lanolin, and neomycin. Price per ounce was determined for each product as well.

Conclusions: Most personal care products for babies and children contain 1 or more sensitizers. Products containing more sensitizers tend to cost less than those without any sensitizing ingredients.

Allergic contact dermatitis (ACD) is a type IV hypersensitivity reaction that occurs in both children and adults. In the past, many experts believed that ACD was rare in the pediatric population secondary to decreased allergen exposure and immature immune systems.¹ However, over the past 2 decades, the diagnosis of ACD in children is increasing.² This is due to improved accessibility to premade patch testing, proven safety and efficacy of patch testing in children, and increased awareness of ACD in the pediatric population.^{2,3} Patterns of sensitization are different for children and adults.^{4–7} Despite this, database information of allergens in personal care products is largely geared toward adults. This work represents the first analysis of the prevalence of common contact allergens in a wide range of products marketed for children and babies, including wipes, diaper care, soaps, moisturizers, shampoos, and sunscreens.

Patch testing is effective for identifying clinically relevant allergens in children with suspected ACD or refractory dermatitis. Admani and Jacob⁷ found that as many as 95% of pediatric patients with suspected ACD had positive patch tests (PPTs), and these were clinically relevant in up to 92% of cases. In the United

States, most PPTs are clinically relevant in children.⁷ The North American Contact Dermatitis Group (NACDG) data show no significant difference in the proportion of relevant PPTs in children versus adults.⁴ Even the youngest patients may be sensitive to common allergens. Bruckner et al⁸ showed that 24% of 85 healthy participants between the age of 6 months and 5 years had a PPT to at least 1 allergen. Several studies have found PPTs to be more common in younger children than in adolescents.^{2,7,9} This suggests that patch testing in children can be extremely helpful given the right clinical indicators.

Past studies by NACDG (from 2005 to 2012) have found that the most common PPTs in children are neomycin, balsam of Peru, lanolin alcohol, and fragrance mix.⁴ Cocamidopropyl betaine has been identified as a common allergen in pediatric patch testing, especially in the setting of atopic dermatitis.¹⁰ Methylisothiazolinone (MI) has received much attention in the press given its presence in diaper wipes, and some studies suggest that it is a common allergen in children.¹¹ Although propylene glycol is only the 15th most prevalent and clinically relevant PPT in the pediatric population,¹² sensitization at a young age through products containing this ingredient could eventually cause problems because it is frequently added to foods and topical medications.^{13,14} Furthermore, child-friendly medications such as chewable or liquid antihistamines commonly contain this allergen,¹⁵ representing a unique source of exposure for kids with pruritic conditions such as atopic dermatitis.

Although the focus herein is on ACD in children, consideration of the role parents play in taking care of these patients is important. Occasionally, a parent’s personal care products can cause contact dermatitis in their children and vice versa.¹⁶ Because parents are often responsible for applying personal care products to their children, baby products such as diaper wipes can cause ACD in

From the *Department of Dermatology, Emory University School of Medicine, Atlanta, GA; and †University of Kansas Medical Center, Kansas City.

Address reprint requests to Jonathan G. Bonchak, MD, Department of Dermatology, Emory University School of Medicine, 1525 Clifton Rd, Suite 100, Atlanta, GA 30329. E-mail: jonathan.bonchak@emory.edu.

The authors have no funding or conflicts of interest to declare.

Supplemental digital content is available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal’s Web site (www.dermatitisjournal.com).

DOI: 10.1097/DER.0000000000000348

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TABLE 1. Allergen Keywords and Prevalence

Allergen	Keywords	No. Products (%)
Fragrance	Alpha amyl cinnamic aldehyde, amylcinnamic alcohol, anisyl alcohol, aroma, balsam of Peru, benzyl alcohol, benzyl salicylate, cinnamic alcohol, cinnamic aldehyde, citral, citronellol, coumarin, eugenol, farnesol, geraniol, hexylcinnamaldehyde, hydroxycitronellal, isoeugenol, lylal, <i>Myroxylon pereirae</i> , musk, oak moss, parfum, perfume	255 (48)
Betaines	betaine, sultaine, dimethylamine	98 (18)
Propylene glycol		48 (9)
MCI/MI	Kathon	16 (3)
Formaldehyde	DMDM hydantoin, imidazolidinyl urea, diazolidinyl urea, 2-bromo-2-nitropropane-1,3-diol, bronopol, quaternium-15	14 (3)
Lanolin	Wool alcohol	33 (6)
Neomycin		

adults.¹⁷ Therefore, the data gathered from this article are important for both parents and their children.

METHODS

To determine the allergen composition of products marketed for babies and children, we used the search terms “baby,” “babies,” “kids,” “kid,” and “children” to identify products available on Drugstore.com (Walgreens Inc, Bellevue, WA) that are targeted to this demographic. Information for each product, including brand name, product name, active and inactive ingredient lists, and price, were tabulated into an Excel spreadsheet (Microsoft Corporation, Redmond, WA) for analysis.

On the basis of prevalence of PPTs reported for both children and adults, we selected fragrance (including balsam of Peru), betaines, propylene glycol, methylchlorisothiazolinone (MCI) and MI, formaldehyde (and formaldehyde releasers), neomycin, and lanolin as the allergens to be screened. See Table 1 for additional keywords used to identify each of these allergens. The correlation between price and allergens per product was determined using analysis of variance.

RESULTS

In total, 533 unique products marketed to babies and children were identified, representing 123 different brands. The array of products analyzed included moisturizers, body wash, shampoos, wipes, and sunscreens (Table 2). Products contained an average of 16.8 individual ingredients. Most ($n = 294$ [55%]) contained at least one of the screened allergens. There were 134 products that contained at least 2 distinct contact allergens and 52 that contained at least 3 distinct

allergens (Table 3). Six products contained 6 allergens (interestingly, all were Suave products). The products containing fewer allergens tended to cost more. The average price per ounce of all products with zero allergens was \$4.35 per ounce, compared with \$1.39 per ounce for those containing 2 or more allergens (among all liquid products for which a price and product volume were listed). There was a moderately strong and statistically significant correlation between price per ounce and number of allergens per product ($P < 0.05$) (Fig. 1).

Fragrance allergens were the most prevalent—255 products contained one or more of the fragrance allergens screened. Most of these ($n = 202$) simply listed “fragrance” as an allergen. The remaining 53 listed a fragrance ingredient, but not the words “fragrance,” “perfume,” or “parfum” on their ingredient lists. Benzyl alcohol, which is a constituent of balsam of Peru and has been called a “covert fragrance,” was present in 32 of those products.¹⁸ Betaines and propylene glycol were present in 98 (18%) and 48 (9%) products, respectively. Methylisothiazolinone/MCI was found in only 16 products, and formaldehyde releasers were found in only 14 products. Lanolin, regarded for its emollient and barrier properties, was present in 33 products (6%). Neomycin, a common sensitizer in children¹⁹ that is commonly found in wound care products, was not present in any of the products screened.

Of the products screened, brands that contained more allergenic ingredients than the average included Suave, MZB for Kids, L’Oreal Paris, Fisher Price, and Mustela. On the other hand, CeraVe, Exederm, and SheaMoisture products tended to contain fewer sensitizers. A list of products that contained zero allergens screened at the time of writing is included in the Supplemental Table (<http://links.lww.com/DER/A8>).

DISCUSSION

Five hundred thirty-three products were analyzed in this study, and 55% of them contained at least 1 documented contact allergen.

TABLE 3. Prevalence of Screened Allergens in Baby Products

No. allergens	0	≥1	≥2	≥3	≥4	≥5	≥6
No. products	239	294	134	52	9	5	6

TABLE 2. Number of Products Analyzed (N = 533)

Wipes	51
Diaper care	46
Soap	154
Moisturizer	137
Shampoo	130
Sunscreen	95

Some products are classified as more than 1 product type, for example, a combination of soap and shampoo.

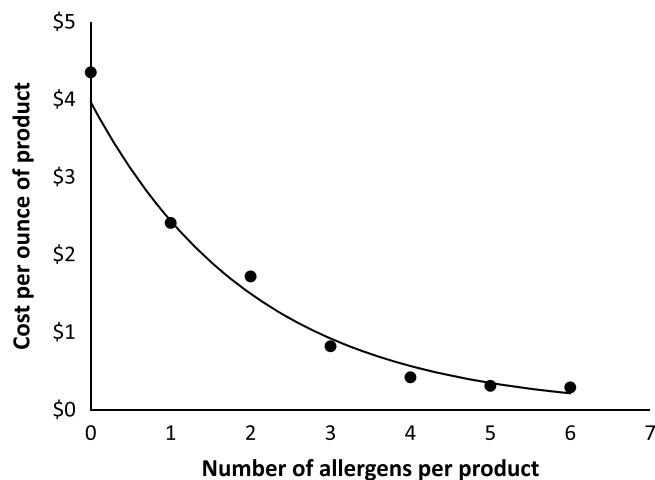


Figure 1. The cost per ounce of liquid personal care products is closely correlated to the quantity of screened allergens present in each product. Items that contain fewer allergens tend to be more expensive.

Although items marketed to this demographic are often touted as “safe” or “gentle,” these results suggest that contact allergens are fairly prevalent in personal care products for babies and children. Sensitization can occur in infants,⁸ and the prevalence of contact sensitization in children younger than 3 years with suspected ACD is as high as 63%.⁹ Thus, there should be a low threshold for patch testing pediatric patients with suspected contact dermatitis, even for those who are using only personal care products targeted for babies. On the other hand, rates of sensitization to allergens such as propylene glycol⁹ and formaldehyde¹⁹ are fairly low in children, so early exposure to products containing these allergens may be less relevant. A list of products containing none of the screened allergens is included in the Supplemental Table (<http://links.lww.com/DER/A8>).

There are no industry or government standards by which a product is deemed “safe for babies.” The US Consumer Product Safety Commission is a governmental agency that regulates how products are labeled and has specific guidelines for verbiage on children’s product labels but no guidance on personal care product composition. Thus, companies can create their own standards for what comprises a personal care product for babies. Johnson & Johnson, for example, considers a product suitable for babies if it “contains only ingredients that are necessary and have been evaluated...for safety” and “...is safe, mild, and nonirritating, and appropriate for babies,” among other criteria.²⁰

The most prevalent allergen found within the product database was fragrance ($n = 255$ [48%]), providing that “fresh baby” smell parents desire. Only a small number of products contained formaldehyde releasers (3%) or MCI/MI (3%). In another analysis of 1200 cosmetic products conducted in 2011, 10% were found to contain either MCI or MI.¹⁹ In recent years, allergy to MCI/MI has received much attention, and baby wipes containing this ingredient in particular have been featured in the press.⁸ This has put pressure on manufacturers to reduce MI/MCI content in their

products, which is reflected in its scarce presence in products marketed for children.

Betaines were present in 18% of the products we evaluated. Betaines are foaming agents that are used in the manufacture of shampoos, soaps, and bath gels.²¹ The most commonly used betaine present in personal care products is cocamidopropyl betaine, a derivative of coconut oil. In a large study of children younger than 3 years with suspected ACD, cocamidopropyl betaine was the third most prevalent allergen to which patients were sensitized.⁹

Propylene glycol was found in 9% of the products cataloged in our database. Propylene glycol is a manmade compound found in a wide array of household products, topical corticosteroids, cosmetics, medications, and foods.²² Furthermore, 2.2% of children developed a PPT to propylene glycol in the 2005–2012 NACDG data.²³ It is of particular interest as an allergen associated with systemic contact dermatitis and can be found in food products, chewable tablets, and liquid-based medications such as hydroxyzine syrup.^{14,15}

Six percent of products contain lanolin, a substance produced by the sebaceous glands of sheep and extracted from sheep’s wool for use in soaps, shampoos, and ointments.²⁴ In a study of 1094 children younger than 12 years with suspected ACD, sensitization to lanolin was seen in 10.1%, the third most prevalent allergen in the study.¹⁹ Lanolin allergy develops more frequently in patients using lanolin-containing medications to treat skin breakdown, such as in eczema or chronic stasis dermatitis.²⁵ This proclivity to sensitization is interesting because products for diaper rash often contain lanolin. However, there is controversy regarding the true frequency and importance of lanolin allergy (the so-called “lanolin paradox”). Whether these products truly should be avoided in this population is unclear.²⁶

There was a statistically significant correlation between price and number of allergens found in these products. More expensive items tend to have fewer allergens than cheaper products within the database. This correlation could be due to increased raw material costs associated with designing hypoallergenic products. Perhaps, there is an increased demand for “hypoallergenic” products, which, by virtue of their perceived “safety,” fetch a higher price from concerned parents. Regardless, brands with fewer allergens charge more per ounce of product, which unfortunately means that truly hypoallergenic products are, on average, more expensive.

In summary, fragrance and betaines are especially abundant allergens in these personal care products and will be difficult to avoid. Methylchloroisothiazolinone/MI and formaldehyde releasers, on the other hand, are quite uncommon, perhaps due to negative press regarding their allergenicity. Selecting affordable, allergen-free personal care products for babies and children can be difficult despite an increased desire for “safe” and “natural” products for this population. Families with strong atopic and contact allergy histories will especially benefit from such products. Although there are many benefits to patch testing in the pediatric population, logistical issues exist. Empiric trials of less allergenic products may prove helpful in some children who are awaiting patch testing appointments.

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