

Prevalence of potential contact allergens in baby cosmetic products

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Summary

Allergic contact dermatitis (ACD) is an increasing problem in children. We sought to investigate the extent of haptens or contact allergens present in baby cosmetic products. Computer programming scripts were written to web-scrape UK supermarkets and pharmacies. In total, 438 unique 'baby products' were identified, and constituent ingredient information was extracted. Data were cross-referenced against 10 standardized patch test reference series. We found that 88% of products had at least one reference contact allergen. There was a mean of 2.21 (range 1–15) reference allergens per product. The most abundant compounds were parabens, fragrances, cetyl/steryl alcohol, methylisothiazolinone, sodium lauryl sulfate and lanolin alcohol. Branded products and those marketed as 'sensitive/gentle/organic/fragrance-free' appeared to contain a greater number of reference allergens than those not marketed as such. This study highlights the increasing number of cosmetic products targeted to children in the UK, and the extent of potential allergens present in these products.

Allergic contact dermatitis (ACD) is an increasing problem in children.^{1,2} It is recognized that in early life the skin barrier is not yet fully developed. Although controversial, recent work has raised concerns that children with atopic dermatitis (AD), in whom archetypal skin barrier dysfunction is demonstrated, may be at increased risk of sensitization to contact allergens (including components of skincare products) and that the risk of sensitization may significantly correlate with disease severity.³ The long-term risks of early or repeated hapten exposure of immaturely developed skin in younger children (or subsequent consequences for adults) have not yet been elucidated.

In 2008, White and McFadden⁴ analysed 38 baby cosmetic products and highlighted the notable presence of potential haptens in the products. Since then, there has been a marked increase in the number of

consumer products targeted towards this demographic.^{4,5} This descriptive study therefore sought to further characterize the degree and prevalence of potential contact allergens present in these products in the UK.

Report

Python computer programming scripts were written to web-scrape four major UK supermarkets and three major UK pharmacy chains on 15 June 2017. A novel dataset of baby products and their constituent ingredients was created. Products were categorized into four types: wash-off (shampoos, conditioners, bath soaps or washes), leave-on (creams, lotions, ointments), toileting (wipes, nappies) and sunscreen products. Manual cleaning of the data followed to correct for duplicates, alternative and compound nomenclatures and missing data points. Data were cross-referenced against 261 unique ingredients across 10 standardized series including the European Standard, Cosmetics, and Fragrance series (Fig. 1).

Products marketed with the keywords 'sensitive/gentle/organic/fragrance-free/chemical-free/healing/eczema' and supermarket 'basics/essentials/value' products were

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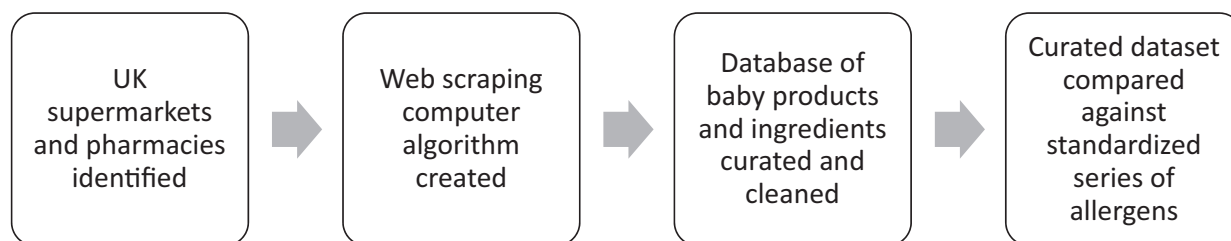


Figure 1 Methodology: 438 unique baby products and their constituent ingredients were extracted from commercial online websites and compared against 10 standardized series.

further identified and extracted for additional subgroup comparison.

The final dataset identified 438 unique baby products and contained a total of approximately 5700 constituent ingredients.

Of the 438 products, the vast majority ($n = 382$; 88%) contained at least 1 reference allergen, with a range of 1–15 reference allergens per product. The majority of reference allergens identified were accounted for in the cosmetic (35%), European Standard (27%), hairdressing (17%) and fragrance (10%) series.

On average, each product contained 15.1 unique ingredients, and of these, approximately 2.21 (mean 14.6%) ingredients per product were reference allergens. This varied by product grouping, with reference allergens comprising 10.4% of ingredients in wash-off, 15.7% in leave-on, 15.5% in sunscreen and 16.8% in toileting products, respectively (Table 1).

The most abundant reference compounds noted were parabens, fragrances, methylisothiazolinone (found in 13% of wash-off products), cetyl/steryl alcohol (32% of leave-on and 37% of sunscreen products); sodium lauryl sulfate (7% of wash-off products); and lanolin alcohol (5% of leave-on products) (Table 2).

Products marketed as either 'sensitive', 'gentle', 'organic', 'fragrance-free', 'chemical-free', 'healing' or 'for eczema' were grouped and classed as 'premium'

Table 1 Average number of ingredients and reference allergens per product across all product categories.

	Wash-off	Leave-on	Sunscreen	Toileting
Products, n	173	107	41	117
Ingredients/ product, n	16.7	12.3	29.8	8.3
Mean	2–29	1–33	20–37	5–17
Range	1.75	1.93	4.60	1.38
Reference allergens/ product, %	10.4	15.7	15.5	16.8

Table 2 Percentage of wash-off, leave-on and sunscreen products that contained the selected reference allergens.

Reference allergen*	Total products, n	Reference allergen present, % of products		
		Wash-off	Leave-on	Sunscreen
Cetyl/steryl alcohol	52	2	32	37
Methylisothiazolinone	23	13	1	0
Sodium lauryl sulphate	12	7	0	0
Lanolin	7	2	5	0

*These reference allergens were not found in toileting products, thus those products were not assessed.

products. These were found to have an average of 38% more reference allergens than products that did not make such claims. This again varied by product category, with an average of 57%, 48% and 10% more reference allergens in 'premium' toileting, wash-off and leave-on product categories respectively, compared with non-'premium' products.

Supermarket 'basics/essentials/value' range products (classed as 'basic') were also grouped and further compared with branded products. Apart from 'basic' wash-off products (which had an average of 20% more reference allergens), all other product categories featured an average of 27.9% fewer reference allergens compared with their branded counterparts. This ranged from an average of 39.5%, 27% and 17.3% fewer allergens across 'basic' leave-on, sunscreen and toileting product categories, respectively.

This study builds upon previous work by White and McFadden,⁴ and highlights the growing range of unique cosmetic products targeted at children in the UK as well as the high likelihood of potential contact allergen exposure, with at least one reference allergen found in 88% of products.

Recent US market research⁵ estimates a global growth of 20.8% in the baby product market (since 2013), with an expected 6.9% annual increase until

2025. The sheer number of products and potential ingredients, together with frequent reformulations, creates a significant challenge for both clinicians and parents to quantify and assess the risks of using them.

The online presence of many retailers, together with a trend towards consumer transparency and online publication of constituent ingredients, has allowed an approach that leverages technology in order to mine, clean, analyse and organize comprehensive datasets more efficiently than would have otherwise been manually practical and to generate information that may be helpful in considering this problem.

A major limitation of this study is that the appearance of reference allergens alone in products does not necessarily imply true clinical relevance; however, by contrast, there are almost certainly new potential haptens present within the 5700 ingredients that are not covered within the standard reference series, which may prove to be clinically relevant in the future.^{6,7} Additionally, factors such as compound concentration, individual irritant thresholds,⁸ contact time, and synergistic and sequential exposures,⁹ which play a part in influencing clinical manifestations of contact allergy, were not assessed.

In summary, the consequences of early childhood exposure to potential contact allergens when the skin barrier is immature or dysfunctional (particularly in AD) are not known. A high number of cosmetic products targeted towards children contain potential contact allergens, and the prevalence and scope of these appear to be increasing. Testing remains challenging because of the high number of new potential compounds and the dynamically changing sensitivity profiles of these products.

Learning points

- The number of cosmetic products in the UK market targeted towards babies and infants appears to be growing rapidly.
- This work identified over 400 unique products containing approximately 15.1 ingredients each.
- We found that 88% of products contained at least one potential reference allergen.

- There was a mean of 2.21 (range 1–15) reference allergens per product.
- Products that were marketed as 'sensitive/gentle/fragrance-free' had approximately 38% more reference allergens than products that did not make such claims.
- Supermarket 'basics/essentials/value' products had approximately 28% fewer reference allergens than branded products.

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