

Non-fragrance allergens in specific cosmetic products

Ana Rita Travassos^{1,2}, Lieve Claes², Lies Boey², Jacques Drieghe² and An Goossens²

¹*Clínica Universitária de Dermatologia, Hospital de Santa Maria, 1649-028 Lisboa, Portugal and* ²*Contact Allergy Unit, Department of Dermatology, University Hospital, Katholieke Universiteit Leuven, B-3000 Leuven, Belgium*

doi:10.1111/j.1600-0536.2011.01968.x

Summary

Objectives. Reports about the nature of the ingredients responsible for allergic contact dermatitis caused by specific cosmetic products are scarce.

Methods. Between January 2000 and December 2010, the specific cosmetic products having caused allergic contact dermatitis, as well as the individual allergenic cosmetic ingredients present in them, were recorded by use of a standardized form.

Results. Among 11 different categories of cosmetic product, skin care products, followed by hair care and body-cleansing products, were most often involved. The presence of the allergenic ingredient(s) in a specific cosmetic product was confirmed according to the ingredient label in 959 of 1448 records. Six hundred and twenty-one of 959 concerned non-fragrance components, preservatives being responsible for 58% of them. Reactions to formaldehyde and formaldehyde-releasers were most often correlated with body-cleansing products, particularly 2-bromo-2-nitropropane-1,3-diol and skin care products. They were followed by the methylchloroisothiazolinone/methylisothiazolinone mixture, most frequently found as allergens in hair care and intimate hygiene products, and facial cleansers (in the last category together with diazolidinyl urea). Octocrylene was by far the most frequent (photo)allergen in sun care products.

Conclusions. This study provides information on the presence and frequency of allergens in specific causal cosmetic products.

Key words: allergic contact dermatitis; cosmetics; fragrances; preservatives; sunscreens; vehicle components.

Allergic contact reactions to cosmetic products are increasingly being observed (1). Indeed, in our department, during the previous decade (1990–1999), 1055 (16%) of the 6596 patients tested suffered from adverse reactions to cosmetics, as compared with 1296 (21%) of 6234 tested during the last 11 years (2000–2010). Of the 3526 patients presenting with at least one positive allergic reaction during the first period, 29% reacted to cosmetic ingredients, in contrast to 37% during the latter period. Of

course, our interest in cosmetic allergies and the reasons for patient referrals may have influenced this percentage.

Besides fragrance chemicals, preservatives are the most important cosmetic allergens, but reactions also often occur to vehicle components, emulsifiers, and ingredients of category-specific products, such as nail resins and sunscreen agents. In fact, many types of cosmetic ingredient may cause contact allergy (1–3).

This study sought to identify the nature of allergens responsible for allergic contact dermatitis caused by specific cosmetic products.

Material and Methods

This was a cross-sectional survey for which all data were retrieved from, and evaluated with, in-house-developed databases in our contact allergy unit in Leuven (4). It was

Correspondence: Professor An Goossens, Contact Allergy Unit, Department of Dermatology, University Hospital St Rafaël, Katholieke Universiteit Leuven, Kapucijnenvoer 33, B-3000 Leuven, Belgium. Tel: +32 16 33 78 60; Fax: +32 16 33 70 12. E-mail: an.goossens@uzleuven.be

Conflicts of interest: The authors have declared no conflicts.

Accepted for publication 23 July 2011

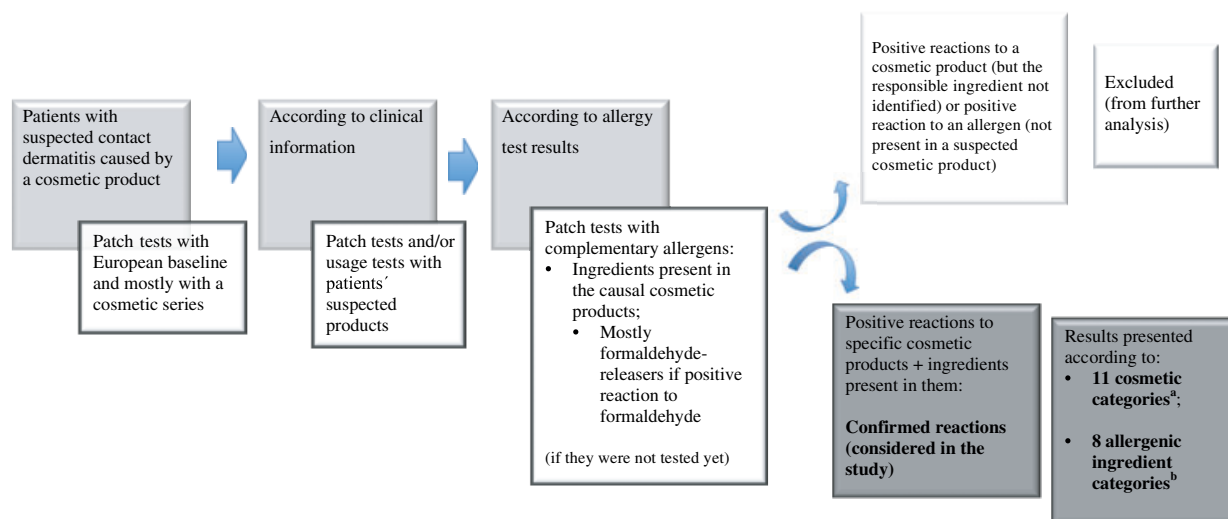


Fig. 1. Algorithm of the selection process in the present study. ^aThe cosmetic categories included were: skin care products, hair care products, body-cleansing products, sun care products, facial cleansers, intimate hygiene products, nail cosmetics, deodorants, make-up, shaving products, and depilatory products. ^bThe allergenic ingredient categories were: emulsifiers/surfactants, conditioning agents, preservatives, antioxidants, plant extracts, vehicle components, and ultraviolet absorbers/filters. Note: we excluded individual fragrance allergens, which were the subject of a previous study.

not a clinico-epidemiological study, but a study on cosmetic products having caused allergic contact dermatitis. The selection process for the products considered was quite heterogeneous: the European baseline series was tested in all patients, and individual ingredients or special series were tested according to the presentation of each individual case.

Between January 2000 and December 2010, the causal specific cosmetic products, as well as the individual allergenic cosmetic ingredients present in them, were recorded, by use of a standardized form (3); cosmetic products in which a specific allergen could not be identified were eliminated from further analysis (Fig. 1).

In contrast to our previous study (3), fragrance components are not discussed in detail, and here only the confirmed allergens are taken into account, that is, those present in the causal cosmetics according to the ingredient labelling.

A reaction to a specific allergen present in a product does not imply that only this allergen was responsible for the presenting dermatitis, as a patient may have reacted to another ingredient as well.

From November 2005, January 2006 and April 2006, we routinely tested methylisothiazolinone (MI) in water at 1000, 1500 and 2000 ppm, respectively (obtained from M. Bruze, Malmö, Sweden), later with 1000 ppm, and from May 2010 with 500 ppm (Trolab, Almirall Hermal GmbH, Reinbek, Germany). The determination of the ideal patch test concentration of MI has not been

easy, and recent studies refer to the use of different MI concentrations, that is, 300 ppm and 1000 ppm (5), 2000 ppm (6) and, more recently, 500 ppm (7), although with almost identical frequencies of sensitization being observed.

Most, but not all, patients (unfortunately, the exact number of them could not be retrieved in our records) reacting to formaldehyde were also tested with formaldehyde-releasers that are not present in the baseline series, namely 2-bromo-2-nitropropane-1, 3-diol, DMDM hydantoin, diazolidinyl urea, and imidazolidinyl urea. Positive reactions to formaldehyde are mainly related to the releasers, as, according to EU legislation, except for nail hardeners, which may contain up to a maximum of 5% formaldehyde, the maximum allowed concentration of formaldehyde in finished products is 0.2%, and any product that exceeds 0.05% has to include a warning that the product contains formaldehyde (8).

The materials used were Van der Bend patch test chambers (Van der Bend, Brielle, The Netherlands), applied on the back with Micropore™ (3M Health Care, Borken, Germany), and fixed with Mefix® (Mölnlycke Health Care, Göteborg, Sweden) as adhesive tape. The patch test readings were performed according to the international guidelines of the International Contact Dermatitis Research Group (9) after 2 days, 3 days (exceptionally), and 4 days, and occasionally later. Sometimes, repeated open application tests or usage tests were performed in

Table 1. Number of non-fragrance allergens present in the causal cosmetic product categories

Allergens	Skin care products		Hair care products		Body-cleansing products		Sun care products		Facial cleansers		Intimate hygiene products		Nail cosmetics		Deodorants		Make-up		Shaving products		Depilatory products		Total
	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	
Emulsifiers/surfactants																							
Arachidyl glucoside	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Cetearyl glucoside	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Cetyl alcohol	-	4	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
Cocamide DEA	-	-	-	1	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
Cocamidopropyl betaine	-	-	1	6	2	4	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	15
Coco-glucoside	-	-	-	1	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
Decyl glucoside	-	1	-	1	-	1	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8
Hydroxystearic acid	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1
Isononyl isononanoate	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Lauramine oxide	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Lauroyl collagen amino acids	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Lauryl alcohol	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
Lauryl glucoside	-	-	-	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
Sodium cocoamphoacetate	-	-	1	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	3
Sorbitan oleate	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Sorbitan sesquioleate	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
Conditioning agents																							
Bisabolol	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	4
Cocamidopropyl PG-dimonium chloride phosphate	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Ethylhexylglycerin	2	4	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-	8
Panthenol	2	2	-	3	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	8
Propolis extract	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Preservatives																							
Benzalkonium chloride	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Benzoic acid	-	1	-	2	-	-	-	-	-	3	-	1	-	-	-	-	-	-	-	-	-	-	7
2-Bromo-2-nitropropane-1,3-diol	2	7	2	4	1	18	-	1	1	1	1	1	-	-	-	-	-	-	-	1	-	-	40

Table 1. Continued

Allergens	Skin care products		Hair care products		Body-cleansing products		Sun care products		Facial cleansers		Intimate hygiene products		Nail cosmetics		Deodorants		Make-up		Shaving products		Depilatory products		Total
	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	
5-Bromo-5-nitro-1,3-dioxane	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Cetrimonium bromide	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Chlorphenesin	1	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
Diazolidinyl urea	2	12	-	3	-	-	-	4	-	6	-	-	-	-	-	-	-	2	-	-	-	-	29
Dichlorobenzyl alcohol	1	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
Didecylidimonium chloride	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
DMDM hydantoin	2	4	1	23	-	5	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	37
Farnesol	-	1	-	1	-	-	-	-	-	-	-	-	-	-	2	2	-	-	-	-	-	-	6
Formaldehyde	5	18	6	16	2	20	-	-	-	4	-	1	-	2	-	-	-	-	-	-	-	-	74
Imidazolidinyl urea	2	10	-	6	-	1	-	-	-	2	-	1	-	-	-	-	-	-	-	-	-	-	22
Iodopropenyl butylcarbamate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	2
Methyldibromoglutaronitrile	3	2	-	1	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	8
Methylchloroisothiazolinone and methylisothiazolinone	-	6	6	19	-	6	-	1	-	6	-	10	-	-	-	-	-	-	-	-	-	-	54
Methylisothiazolinone	-	2	-	6	-	1	-	-	-	3	-	8	-	-	-	2	-	-	-	1	-	-	23
Parabens	3	14	-	-	-	1	-	1	3	1	-	-	-	-	-	-	-	2	-	-	-	-	25
Phenoxyethanol	2	7	-	-	-	-	-	-	3	-	-	-	-	-	-	1	-	-	-	-	-	-	13
Potassium sorbate	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Quaternium-15	-	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	2
Triclosan	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Antioxidants																							
Ascorbyl tetraisopalmitate	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Propyl gallate	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Sodium metabisulfite	-	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
Tocopherol	-	2	-	-	-	-	-	2	-	-	-	-	-	-	1	-	-	-	1	-	-	-	6

Table 1. Continued

Allergens	Skin care products		Hair care products		Body-cleansing products		Sun care products		Facial cleansers		Intimate hygiene products		Nail cosmetics		Deodorants		Make-up		Shaving products		Depilatory products		Total
	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	
Plant extracts																							
<i>Achillea millefolium</i> extract	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
<i>Arnica montana</i> extract	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
<i>Calendula officinalis</i> extract	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	3
<i>Chamomilla recutita</i> extract	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Compositae mixture ^a	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
<i>Crysanthemum</i> extract	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
<i>Euphorbia</i> extract	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	2
<i>Melaleuca alternifolia</i> leaf oil	4	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
<i>Mentha piperita</i> oil	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
Vehicle components																							
<i>Butyrospermum parkii</i> butter	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
Colophonium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
Disodium EDTA	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Glyceryl rosinat	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
Isopropyl myristate	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	5
Lanolin alcohols	9	13	-	-	1	2	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	29
Maleated soybean oil	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Methoxy PEG-22/dodecyl glycol copolymer	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
Propylene glycol	3	4	-	1	-	-	-	5	-	4	-	-	-	-	-	1	-	-	-	-	-	-	18
Shellac	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	2
Tetrahydroxypropyl ethylenediamine	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5

Table 1. Continued

Allergens	Skin care products		Hair care products		Body-cleansing products		Sun care products		Facial cleansers		Intimate hygiene products		Nail cosmetics		Deodorants		Make-up		Shaving products		Depilatory products		Total
	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	1 ^b	2 ^c	
Triethylene glycol hydrogenated rosin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
VP/hexadecene copolymer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1
UV absorbers/filters	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzophenone-3	-	1	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
Benzophenone-4	-	-	6	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	7
Butyl methoxydibenzoyl-methane	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Drometrizole trisiloxane	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Ethylhexyl methoxycinnamate	1	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
Methylene bis-benzotriazolyl tetramethylbutyl-phenol	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Octocrylene	-	-	-	-	-	-	-	36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	36
Terephthalidene dicamphor sulfonic acid	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dihydroxyacetone	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Glycol	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	5
HEMA-methacrylate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HEMA	-	-	-	-	-	-	-	-	-	-	-	-	5	2	-	-	-	-	-	-	-	-	7
Hydroxyethyl acrylate	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Methyl methacrylate	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	4
Nickel sulfate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	3
Totals for each period	63	149	24	103	7	75	2	70	11	37	1	22	14	4	9	8	5	8	1	4	3	1	621
Totals for both periods	212		127		82		72		48		23		18		17		13		5		4		

PEG, poly(ethylene glycol); UV, ultraviolet.

Farnesol, which is also considered to be a fragrance allergen, was included because of its antimicrobial properties.

^aReactions were correlated with composite extracts present in the causal cosmetics.^b2000–2005.^c2006–2010.

cases where a cosmetic product that remained negative on patch testing was suspected of being responsible for the dermatitis that the patient had presented with.

Results

The presence of the allergenic ingredient(s) in a specific cosmetic product was confirmed according to the ingredient label in 959 of 1448 records; 621 of 959 concerned non-fragrance components, preservatives being responsible for 58% of them. Table 1 gives the total number of reactions to the many different allergens identified and their presence in the different types of causal cosmetic product, which belong to 11 different categories. Two periods were considered: from 2000 to 2005, and from 2006 to 2010.

The numbers of reactions to non-fragrance and fragrance allergens in each cosmetic category are shown in Table 2: allergic reactions were most often correlated with skin care products (34%), followed by hair care products (20%), body-cleansing products (14%), and sun care products (10%), facial cleansers together with deodorants (6%), and intimate hygiene products (3%).

The relative frequencies of allergens in the main categories of causal cosmetic product are shown in Fig. 2. The non-fragrance allergens, in decreasing order of frequency,

Table 2. Total number of positive reactions to fragrance and non-fragrance allergens in the different cosmetic categories

Cosmetic categories	Number of reactions to non-fragrance allergens	Number of reactions to fragrance allergens	Totals
Skin care	212	117	329
Hair care products	127	66	193
Body-cleansing products	82	55	137
Sun care products	72	26	98
Facial cleansers	48	11	59
Deodorants	17	42	59
Intimate hygiene products	23	8	31
Nail cosmetics	18	0	18
Make-up	13	1	14
Shaving products	5	8	13
Depilatory products	4	4	8
Totals	621	338	959

were: preservatives (58%), vehicle components (12%), emulsifiers/surfactants together with ultraviolet (UV) absorbers/filters (nearly 9%), conditioning agents (4%), plant extracts (3%), and antioxidants (2%).

The relative frequencies of the preservatives that were responsible for at least 10% of the positive reactions in the main cosmetic categories are shown

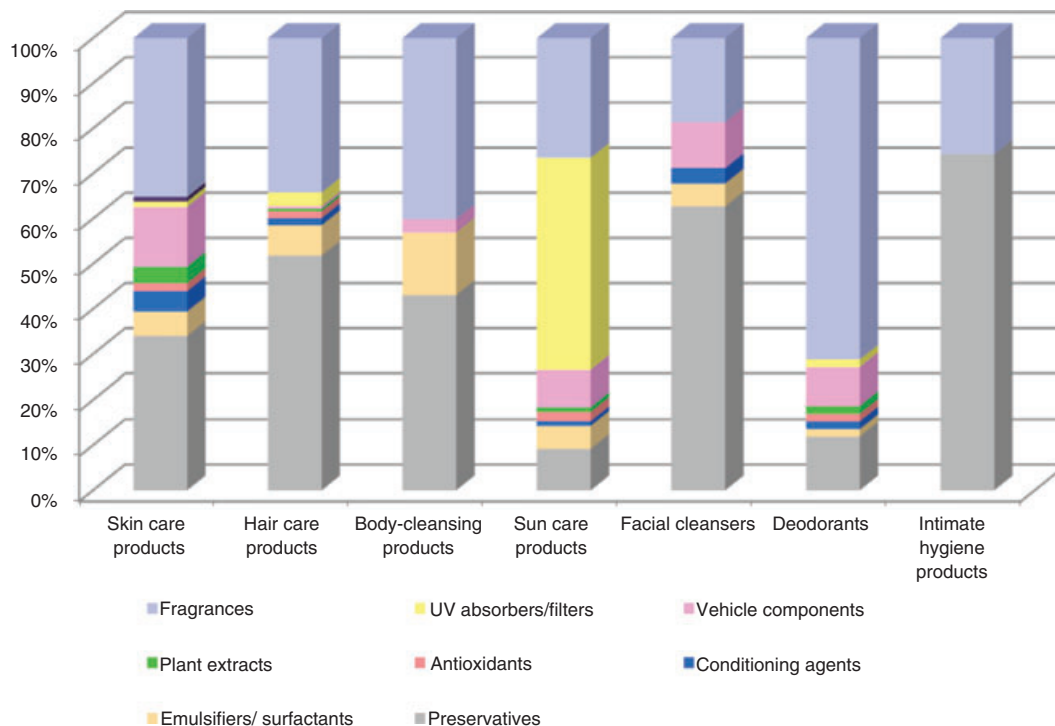


Fig. 2. Relative frequencies (%) of allergens in the main cosmetic categories. UV, ultraviolet.

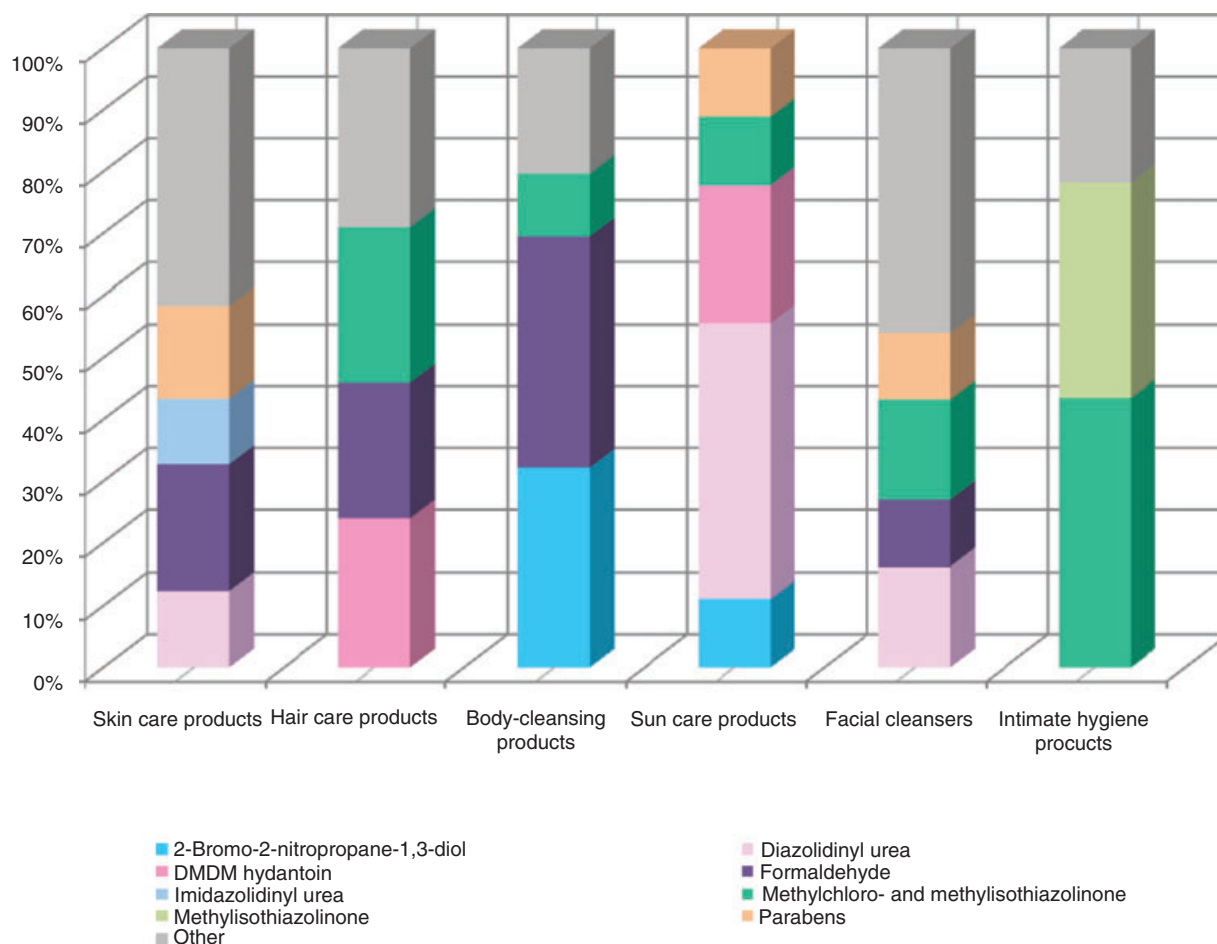


Fig. 3. Relative frequencies (%) of the preservatives (only those that produced at least 10% of the positive reactions) in the main cosmetic categories.

in Fig. 3. Formaldehyde and formaldehyde-releasers were the most important allergens among the preservatives (58%). They were most often related to body-cleansing products, particularly 2-bromo-2-nitropropane-1,3-diol, whereas diazolidinyl urea was most often related to sun care and skin care products. Then came the methylchloroisothiazolinone (MCI)/MI mixture (15%), which was most frequently found in hair care and intimate hygiene products, and facial cleansers (in the last category together with diazolidinyl urea). MI (6.4%) was especially related to intimate hygiene products, whereas parabens (7%) and phenoxyethanol (4%), which are considered to be rare allergens among preservatives, were especially related to skin care products. Among the 130 reactions to formaldehyde-releasers, 40 concerned 2-bromo-2-nitropropane-1,3-diol, 37 DMDM hydantoin, 29 diazolidinyl urea, 22 imidazolidinyl urea, and two quaternium-15.

Among UV absorbers/filters, 54% concerned photoallergic reactions. Octocrylene was by far the most frequent cause of reactions to sunscreens (63%), 72% of which were photoallergic in nature.

Fragrance allergens accounted for most of the reactions to deodorants (71%).

Finally, (meth)acrylates and nickel were relevant allergens in the few nail cosmetics and make-up products retrieved, respectively.

Discussion

Skin care products represent a broad category of leave-on products, including massage oils and, for example, hydrating tissues used together with epilatory wax; the latter are potentially more likely to cause allergic contact dermatitis, because they are applied on damaged skin. In this way, even rare allergens, such as methoxy

poly(ethylene glycol)-22/dodecyl glycol copolymer and lauryl alcohol, may be found (10).

Fragrances and preservatives were the most frequent allergens, and formaldehyde and formaldehyde-releasers in particular. Methylidibromo glutaronitrile was infrequently responsible, as would be expected after being banned from cosmetic products in the EU in 2007 (1, 7, 11). Among vehicle components, lanolin alcohols were the most frequent.

The hair care products included were waxes, conditioners, gels, and shampoos, in which the majority of the reactions were related to preservatives, particularly MCI/MI and the formaldehyde-releaser DMDM hydantoin, followed by fragrances. Indeed, DMDM hydantoin was the most common preservative agent in shampoos commercialized in an American pharmacy network (12); it was also the most common agent in cosmetic products (17%) in Sweden (13) and the second most common in the United States (5.4%), according to the Food and Drug Administration Voluntary Cosmetic Registration Program Database 2009 (14). We did not consider hair dyes here, because of missing information for this category (only a few patients actually brought the package leaflets or the products that they had reacted to), which would render the figures unrepresentative.

Among the cleansing products, wipes for facial cleansing and particularly for intimate hygiene (also for babies), which are not rinse-off, were found to be an important sensitization source for MCI/MI and also MI; the use of such products in non-keratinized and occluded areas must be responsible for this (15).

With regard to sun care products, roughly one-quarter of the reactions were caused by fragrances, and almost half by UV absorbers/filters. Contact and photocontact allergy to octocrylene was increasingly observed, which is in agreement with the literature (16). This sunscreen agent is often included in skin care and sun care formulations, also for use in children (16).

Most photoallergic cases occurred in patients previously photosensitized by ketoprofen; this is probably attributable to cross-reactivity (17).

In agreement with a recent Danish study (18), the majority of the allergens in deodorants were fragrances.

It seems that a lower concentration threshold is needed for sensitization in the axillae, which could be explained by the presence of a moist and occluded environment together with the presence of hair follicles that may facilitate penetration of the allergens.

Methacrylate allergens, that is, HEMA, glycol HEMA-methacrylate and methyl methacrylate, highlight the popularity of artificial nails and gels as causes of allergic contact dermatitis in clients, but particularly in manicurists (1).

Finally, we identified three cases of nickel allergy related to make-up products, with, in one case, even a positive reaction to an eye pencil in which the presence of nickel could be chemically identified (19). According to a recent cross-sectional general population study in Danish women, no association could be observed between nickel allergy and cosmetic dermatitis caused by mascara or eye shadow; however, a causal relationship in selected cases could not be excluded (20).

Conclusions

Among 11 different categories of causal cosmetic products, skin care products, followed by hair care products and body-cleansing products, were most often involved.

With regard to non-fragrance allergens, many different ingredients could be identified as causes of allergic contact dermatitis resulting from specific cosmetic products; however, preservatives were by far the most important ones, particularly formaldehyde as linked to formaldehyde-releasers, MCI/MI, and, more recently, MI alone.

Octocrylene was responsible for the majority of allergic and particularly photoallergic reactions to sun care products, the latter being most often related to ketoprofen photosensitization.

Notwithstanding the limitations of the data, owing to bias in information and selection, this study provides information on current exposure to and trends in the actual use of allergens in specific cosmetic products, and hence valuable information for further routine testing and preventive measures.

References

- Goossens A. Contact-allergic reactions to cosmetics. *J Allergy* 2011; 467071. doi: 10.1155/2011/467071.
- Wetter D A, Yiannias J A, Prakash A V, Davis M D, Farmer S A, el-Azhary R A. Results of patch testing to personal care product allergens in a standard series and a supplemental cosmetic series: an analysis of 945 patients from the Mayo Clinic Contact Dermatitis Group, 2000–2007. *J Am Acad Dermatol* 2010; 63: 789–798.
- Nardelli A, Drieghe J, Claes L, Boey L, Goossens A. Fragrance allergens in 'specific' cosmetic products. *Contact Dermatitis* 2011; 64: 212–219.
- Goossens A, Drieghe J. Computer applications in contact allergy. *Contact Dermatitis* 1998; 38: 51–52.
- Ackermann L, Aalto-Korte K, Alanko K et al. Contact sensitization to methylisothiazolinone in Finland – a multicentre study. *Contact Dermatitis* 2010; 64: 49–53.

- 6 Lundov M, Thyssen J, Zachariae C, Johansen J. Prevalence and cause of methylisothiazolinone contact allergy. *Contact Dermatitis* 2010; **63**: 164–167.
- 7 Schnuch A, Lessmann H, Geier J, Uter W. Contact allergy to preservatives. Analysis of IVDK data 1996–2009. *Br J Dermatol* 2011; **164**: 1316–1325.
- 8 De Groot A, Flyvholm M A, Lensen G, Menné T, Coenraads P J. Formaldehyde-releasers: relationship to formaldehyde contact allergy. Contact allergy to formaldehyde and inventory of formaldehyde-releasers. *Contact Dermatitis* 2009; **61**: 63–85.
- 9 Wahlberg J E. Patch testing. In: *Textbook of Contact Dermatitis*, 3rd edition, Rycroft R J, Menné T, Frosch P J, Lepoittevin J P (eds): Heidelberg, Berlin, Springer, 2001: pp. 435–468.
- 10 Goossens A, Armingaud P, Avenel-Audran M et al. An epidemic of allergic contact dermatitis due to epilating products. *Contact Dermatitis* 2002; **47**: 67–70.
- 11 Commission of the European Communities. Commission directive 2007/17/EC of 22 March 2007. *Off J Eur Union* 2007; **L82**: 27–30.
- 12 Zirwas M, Moennich J. Shampoos. *Dermatitis* 2009; **20**: 106–110.
- 13 Yazar K, Johnsson S, Lind M L, Boman A, Lidén C. Preservatives and fragrances in selected consumer-available cosmetics and detergents. *Contact Dermatitis* 2011; **64**: 265–272.
- 14 de Groot A C, White I R, Flyvholm M A, Lensen G, Coenraads P J. Formaldehyde-releasers in cosmetics: relationship to formaldehyde contact allergy. Part 1. Characterization, frequency and relevance of sensitization, and frequency of use in cosmetics. *Contact Dermatitis* 2010; **62**: 2–17.
- 15 García-Gavín J, Vansina S, Kerre S, Naert A, Goossens A. Methylisothiazolinone, an emerging allergen in cosmetics? *Contact Dermatitis* 2010; **63**: 96–101.
- 16 Avenel-Audran M, Dutartre H, Goossens A et al. Octocrylene, an emerging photoallergen. *Arch Dermatol* 2010; **146**: 753–757.
- 17 Karlsson I, Vanden Broecke K, Mårtensson J, Goossens A, Börje A. Clinical and experimental studies of octocrylene's allergenic potency. *Contact Dermatitis* 2011; **65**: 343–352.
- 18 Heisterberg M V, Menné T, Andersen K E et al. Deodorants are the leading cause of allergic contact dermatitis to fragrance ingredients. *Contact Dermatitis* 2011; **64**: 258–264.
- 19 Travassos A R, Bruze M, Dahlin J, Goossens A. Allergic contact dermatitis from nickel in a green eye pencil. *Contact Dermatitis*, in press.
- 20 Thyssen J P, Linneberg A, Menné T, Nielsen N H, Johansen J D. No association between nickel allergy and reporting cosmetic dermatitis from mascara or eye shadow: a cross-sectional general population study. *J Eur Acad Dermatol Venereol* 2010; **24**: 722–725.