

Allergic contact dermatitis caused by cocamide diethanolamine

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Summary

Background. Cocamide DEA (CAS no. 68603-42-9) is a non-ionic surfactant frequently used in industrial, household and cosmetic products for its foam-producing and stabilizing properties. Contact allergy has been reported quite rarely in the past, but recently several cases were published, raising the question of an increase in the frequency of allergic dermatitis caused by this substance.

Objectives. To describe cocamide DEA-allergic patients and their characteristics observed in our department.

Methods. Medical charts of patients, investigated between 1990 and December 2015, were retrospectively reviewed for cocamide DEA-allergy. Demographic characteristics and patch test results were analyzed.

Results. Out of 1767 patients tested, 18 (1%) presented with an allergic reaction to cocamide DEA, all of them at least with hand dermatitis. Twelve patients had (past) occupational exposure to cocamide DEA. Out of the 18 patients, 15 showed (most often) multiple positive reactions and 7 also suffered from atopic dermatitis.

Conclusions. Cocamide DEA allergy is relatively rare, despite frequent use, and an increasing trend was not observed. Reactions to cocamidopropyl betaine and cocamide MEA only occurred in some of the subjects tested. Shampoos and liquid hand soaps/cleansers dominated as sources of exposure. All patients presented with an impaired skin barrier due to atopic and/or previous contact dermatitis.

Key words: allergic contact dermatitis; atopy; CAS no. 68603-42-9; cleansing; cocamide DEA; cocamide MEA; cocamidopropyl betaine; cosmetics; hand dermatitis; skin barrier; surfactant.

Coconut fatty acids diethanolamide (syn. cocamide diethanolamine, cocamide DEA, coconut DEA, CAS no. 68603-42-9) is a water-soluble mixture of ethanolamides of coconut acid (1). It is a non-ionic emulsifier or surfactant, foam booster, and viscosity-enhancing agent, and is used in industrial, household and cosmetic products, such as industrial hand cleansers, liquid hand

soaps, hair shampoos, protective creams, cutting fluids, waxes, and wax removers (1–9). In the cosmetics database from our department (10), which contains ingredient information on ~1300 cosmetic products distributed in pharmacies, we found cocamide DEA to be present in nine bath, shower or hand wash oils, in one anti-dandruff shampoo, and in one bar soap. Occupational, but also non-occupational, contact dermatitis caused by cocamide DEA has been reported quite rarely in the past, whereas, recently, several dozen cases were published, raising the question of a possible increase in contact allergies to cocamide DEA (2, 3, 11). Here, we present an analysis of cocamide DEA-allergic patients in our department.

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Patients and Methods

The medical charts of patients, investigated between 1990 and December 2015, were retrospectively reviewed for cocamide DEA allergy. The patients were patch tested with Van der Bend® chambers (Van der Bend, Brielle, The Netherlands), and later with IQ Ultra® chambers (Chemotechnique Diagnostics, Vellinge, Sweden), covered with Mefix® (Mölnlycke Health Care, Göteborg, Sweden); readings were performed on day (D) 2, D4, and sometimes D7, according to European Society of Contact Dermatitis criteria (12). All patients were tested with the baseline series, and in some cases with other test series, such as the hairdresser series containing cocamide DEA 0.5% pet. and cocamidopropyl betaine 1% aq. (CAS no. 61789-40-0) (both from Chemotechnique Diagnostics), and allergens tested on a case-by-case basis, when on the label of a product used, including cocamide DEA 0.5% pet. and cocamide monoethanolamine (cocamide MEA) 0.5% aq. (CAS no. 68140-00-1, prepared in-house). The clinical files of the patients with positive reactions to cocamide DEA were analysed in detail, with regard to occupations, symptoms, atopy, positive patch test results, and concomitant allergic reactions. Information about the ingredients of products used by our patients was obtained from the product labels.

Results and Discussion

During the study period, a total of 15 478 patients were tested. On the basis of the patient history and clinical signs, and the label of the cosmetic products used, cocamide DEA was tested in 1767 patients. Of these, 1551 were also tested with cocamidopropyl betaine, and 22 were positive; and 90 were also tested with cocamide MEA, and 1 was positive.

Of the 1767 patients, 18 (1%) showed a mostly weak but clearly allergic positive response to cocamide DEA (data shown in Table 1), the last case of contact allergy being observed in 2012; this percentage is similar to that reported by other authors (2, 11). Several of the patients had multiple positive test reactions.

All patients suffered from hand dermatitis, a typical feature of cocamide DEA-allergic subjects (2); some also had dermatitis on other body parts, such as the arms, chest, legs, and feet. Of the 18 patients with positive patch test reactions to cocamide DEA, 11 (nos. 1, 3–6, 8, 10, 11, 14, 16, and 18) were occupationally exposed. In 1 case (no. 12), there was no current exposure to cocamide DEA, but past occupational contact was shown. The 12 patients with (past) occupational exposure were 6 hairdressers, 3 healthcare workers (2 nurses; 1 laboratory assistant), 2 car mechanics, and 1 workman in the rubber industry.

The most common sources of occupational cocamide DEA exposure were shampoos for the hairdressers and hand cleansers/liquid soaps for the other patients. In a recent report, healthcare workers were more likely to have occupationally relevant reactions to cocamide DEA than non-healthcare workers, with hand soaps constituting the main source of sensitization (13).

In 6 cases (nos. 2, 7, 9, 13, 15, and 17), no occupational exposure to cocamide DEA could be detected. Three of the patients had been exposed to (liquid) hand soap at home; for 1 patient, a paediatrician, the products used that contained cocamide DEA had not been specified in the medical chart, and in 2 cases no current exposure could be identified. Sources of sensitization previously reported by other authors included hand cleansers (2, 6, 8), shampoos (9, 14), barrier creams (2, 8), hydraulic mining oil (5), a protective hand gel (7), metalworking fluids (2, 8), dishwashing liquids (2), an antifungal cream, and a foaming antiseptic solution (3).

Analysis of the patient's medical charts showed that they all presented with impaired skin barrier function caused by atopic and/or previous (irritant or allergic) contact dermatitis. Detergents, soaps and shampoos are known to compromise the skin barrier. Only 3 patients reacted only to cocamide DEA; the majority had other, most often multiple, contact allergies. Polysensitization is defined as contact allergy to three or more allergens (15). Among our positive cases, 13 of the 18 patients fulfilled these criteria, which were also reported by other authors (2, 4). Nine of 18 patients had an atopic constitution, 7 with current concomitant atopic dermatitis, including those with an isolated reaction to cocamide DEA. In a previous study, no significant difference in the prevalence of cocamide DEA allergy between atopic and non-atopic patients could be found (11).

Of the 15 patients tested with it, only 2 (nos. 1 and 11) also showed positive patch test reactions to cocamidopropyl betaine, another coconut oil-derived sensitizer, although it is not structurally related to cocamide DEA (2, 11, 14); contact allergy to cocamidopropyl betaine has been attributed to impurities in it (16, 17). We only considered the clear positive responses, as it is also recognized as an irritant substance under patch test conditions. Seven of the 18 patients who reacted to cocamide DEA had also been tested with cocamide MEA, and only 1 (no. 13) showed a positive patch test reaction.

Conclusions

Cocamide DEA allergy is relatively rare, despite its frequent use in industrial, household and cosmetic products. In our series of 18 cocamide DEA-allergic

Table 1. Overview of cocamide DEA-allergic patients: demographic data, patch test results, and sensitization sources

Patient no. (year)	Sex/age (years)	Atopy	Occupation	Lesion locations	Tests performed (besides baseline)	Patch test			Relevance	Concomitant positive reactions
						reaction to Cocamide DEA D2	reaction to Cocamide DEA D4	reaction to Cocamide DEA D7		
1 (1992)	F/16	Atopic dermatitis	Hairdresser	Hands	Hairdresser and corticosteroid series	–	+	NR	Shampoos at work	Formaldehyde, fragrances, nickel, <i>Myroxylon pereirae</i> , MCI/MI, PPD, PTD, cocamidopropyl betaine, ammonium persulfate, glyceryl thioglycolate, diazolidinyl urea
2 (1992)	F/28	Hay fever	Paediatrician	Hands and soles	Antiseptic and shoe series, and own products	–	+	NR	Unknown	Formaldehyde, nickel, mercapto mix, mercaptobenzothiazole, <i>p</i> -tert-butylcatechol, thiocyanomethylbenzothiazole Euxyl® K400
3 (1995)	F/49	–	Hairdresser	Hands and forearms	Hairdresser series and own products	+	+	NR	Shampoos at work	
4 (1996)	F/29	–	Hairdresser/beautician	Hands	Hairdresser and rubber series, and own products	+	+	NR	Shampoos at work	Nickel, cobalt, parabens, o-nitro-PPD, PTD, ammonium persulfate, ammonium thioglycolate, glyceryl thioglycolate, ethylene thiourea, diaminodiphenylmethane
5 (1997)	F/25	Hay fever	Laboratory assistant	Hands	Rubber series and own products	+	+	NR	Liquid soap at work	Laurel alcohols
6 (1998)	F/20	–	Hairdresser	Hands	Hairdresser series and own products	+++	++	NR	Shampoos at work	o-Nitro-PPD, PTD, ammonium persulfate, ammonium thioglycolate, <i>p</i> -aminophenol, diazolidinyl urea, chromate, benzocaine, Euxyl® K400, thiomersal
7 (1998)	F/23	–	Nurse's aide	Hands	Own products	+	+	NR	Soap at home	Nickel, cobalt
8 (2002)	F/28	Atopic dermatitis	Nurse	Hands and feet	Shoe series and own products	+	+	NR	Liquid soap at work	Ranitidine, colophonium, propylene glycol, Disperse Blue 106
9 (2002)	M/17	Hay fever	Car mechanic	Hands	Plastics and glues series, and own products	+	+	NR	Soap at home	–
10 (2002)	M/48	Asthma	Workman in the rubber industry	Hands and forearms	Industrial oils, plastics and glues series, and own products	+	+	NR	Hand cleanser at work	Euxyl® K 400, imidazolidinyl and diazolidinyl urea, nonoxynol, methylidibromo glutaronitrile, octylisothiazolinone
11 (2003)	M/27	Hay fever	Car mechanic	Hands	Own products	–	+	NR	Hand cleanser at work	<i>Myroxylon pereirae</i> , benzalkonium chloride, cocamidopropyl betaine
12 (2006)	M/34	Atopic dermatitis	Car mechanic	Hands	Industrial oil series and own products	+	+	NR	Past exposure to a hand cleanser at work	–

Table 1. Continued

Patient no. (year)	Sex/age (years)	Atopy	Occupation	Lesion locations	Tests performed (besides: baseline)	Patch test			Relevance	Concomitant positive reactions
						Cocamide DEA D2	Cocamide DEA D4	Cocamide DEA D7		
13 (2007)	M/36	Hay fever Atopic dermatitis	Chauffeur	Hands, dorsum of feet, legs, chest, and neck	Fragrance series and own products	+	++	NR	Liquid hand soap at home	Cocamide MEA, colophonium, cobalt
14 (2008)	F/22	Hay fever Atopic dermatitis	Nurse	Hands and forearms	Rubber series and own products	++	+	NR	Liquid soap at work and shower gel at home	–
15 (2008)	M/45	Atopic dermatitis	Unemployed	Hands, lower legs, and feet	Hair dyes, food additives, and own products	–	+	+?	Unknown	<i>Myroxylon pereirae</i> , cetrimide, chlorhexidine digluconate, chloramine, cobalt, nickel, PPD, disperse mix, isopropyl alcohol, povidone iodine
16 (2009)	F/19	Hay fever –	Hairdresser	Hands and forearms	Hairdresser and textile dye series, and own products	+	+	+	Shampoos and hair conditioners at work	PPD, PTD, ammonium persulfate, propylene glycol, formaldehyde
17 (2010)	M/24	–	Laboratory assistant	Hands and eyelids	Rubber series and own products	+	+	NR	Unknown	Lanolin alcohols, benzalkonium chloride, tetrahydroxypropyl ethylenediamine
18 (2012)	F/15	–	Hairdresser assistant	Hands	Hairdresser and rubber series, and own products	+?	+	NR	Shampoo at work	PPD, PTD, ammonium persulfate, disperse mix, decyl and coco glucoside, <i>p</i> -aminophenol

F, female; M, male; MCI, methylchloroisothiazolinone; MEA, monoethanolamine; MI, methylisothiazolinone; NR, not read; PPD, *p*-phenylenediamine; PTD, toluene-2,5-diamine.

patients, all with impaired skin barrier function caused by atopic and/or contact dermatitis, shampoos and hand cleansers/liquid soaps dominated as sources of exposure. Hairdressers, healthcare workers and car mechanics were

particularly affected. The majority of our patients had (most often) multiple other contact allergies. In contrast to recent reports, we did not find an increasing trend for cocamide DEA sensitivity.

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