

Allergen of the Year: Alkyl Glucosides

Maisa Alfalah, MD,* Camille Loranger, MD,† and Denis Sasseville, MD, FRCPC†

Alkyl glucosides are surfactants synthesized through the condensation of long-chain fatty alcohols and glucose, extracted from vegetal, renewable sources. Although available for more than 4 decades, they have been rediscovered in recent years because of their eco-friendly character. They are used in various leave-on and rinse-off cosmetics and are considered of low irritancy and allergenicity. However, since the early 2000s, cases of allergic contact dermatitis to this family of molecules have been repeatedly reported. Decyl glucoside was found to be a “hidden” allergen in the sunscreen ingredient Tinosorb M and is likely responsible for most allergic contact dermatitis reported to this compound. Members of the North American Contact Dermatitis Group have seen a steady increase of the rate of sensitization to decyl glucoside. Cross-reactions with other glucosides are common but not automatic; thus, patch testing multiple compounds is recommended.

Considered eco-friendly because of their complete biodegradation, alkyl glucosides are plant-derived, nonionic surfactants. They are produced by the reaction of glucose with fatty alcohols, mainly extracted from palm or coconut oil.^{1,2} Glucosides have emulsifying, cleansing, and foaming properties. Alkyl glucosides include a number of chemically related compounds, such as decyl, lauryl, cetearyl and, coco glucoside, and are closely related to other surfactants, such as methyl glucose dioleate.³ They are widely used in a variety of household products including cosmetic, skin care, hair dyes, cleansing, fragrance, and tanning formulations.¹ They have been used for more than 4 decades in rinse-off products such as shampoos. However, they were eventually replaced by other surfactants before making a comeback in the 1990s. Because they are considered nonirritant or weakly irritant compounds,⁴ they are extensively used nowadays in both rinse-off and leave-on cosmetics.^{3,5}

GLUCOSIDES AS UNEXPECTED ALLERGENS

The allergenic properties of glucosides have only been identified since 2003, when Goossens et al⁶ described 2 cases of contact allergy to lauryl glucoside and coco glucoside. Their observation was soon followed by 2 reports describing 5 patients with contact allergy to decyl glucoside.^{3,5} Several additional case reports and series have since clearly established the allergenicity of glucosides

in various cosmetic and cleansing products.^{2,7–13} Some of these reports have revealed the “hidden” presence of decyl glucoside as a stabilizing agent for the microparticles of the sunscreen ingredient Tinosorb M.^{3,6,8–12} A comparative study using the murine local lymph node assay assessed the skin-sensitizing potential of 8 glucosides of different alkyl chain length and branching and showed that 3 of the 8 tested glucosides may be classified as potential sensitizers.⁴ However, in the same study, the repeated insult patch test protocol failed to demonstrate a sensitizing potential for all tested glucosides.⁴

EPIDEMIOLOGY AND CLINICAL PICTURE

The prevalence of glucoside-induced allergic contact dermatitis is probably underestimated,⁹ because of the lack of large well-designed studies and lack of multiple glucosides in most cosmetic patch test series. Members of the North American Contact Dermatitis Group patch test approximately 2400 patients per year. They added decyl glucoside 5% in petrolatum to their standard series in 2009 and have since noted a small but constant increase in the rate of positive reactions to this surfactant, from 1.5% in 2019–2010 to 1.7% in 2013–2014.¹⁴

During the last 12 years, approximately 20 patients with allergic contact dermatitis from different glucosides have been described in 10 case reports and case series.^{2,3,5–12} In addition, another 30 patients with allergic contact dermatitis from 1 or more alkyl glucosides were recently described in a retrospective study that reviewed records for 19 years.¹³ Of 50 patients, 37 (74%) were females, probably because of their higher use of cosmetics. The patients' ages ranged from 7 to 86 years, with the average age of 49.6 years. The most frequently implicated cosmetic products were sunscreens (n = 16, 32%), shampoos (n = 16, 32%), skin-cleansing products (n = 15, 30%), facial and body lotions and creams (n = 5, 10%), and hair care products such as dyes and mousses (n = 4, 8%). At least 20 patients (40%) had a history of atopy, and 6 patients

From the *Division of Dermatology, National Guard Hospital, Riyadh, Saudi Arabia; and †Division of Dermatology, McGill University Health Centre, Montreal, Quebec, Canada.

Address reprint requests to: Denis Sasseville, MD, McGill University Health Centre, Montreal General Hospital, Room L8.210, 1650 Cedar Ave, Montreal, QC H3G 1A4, Canada. E-mail: denis.sasseville@mcgill.ca.

D.S. receives royalties from UpToDate (Wolters Kluwer Health). The other authors have no funding or conflicts of interest to declare.

DOI: 10.1097/DER.0000000000000234

© 2016 American Contact Dermatitis Society. All Rights Reserved.

(12%) had occupational exposure to implicated products. It is believed that impaired skin barrier enhances the penetration of rinse-off products that contain glucosides.^{2,3}

The clinical picture varied according to the area targeted by the responsible products. For sunscreens, eczema was largely distributed on the face and to a lesser extent on the neck, arms, and upper chest. With shampoos, dermatitis was mostly localized on the scalp, more obviously along the frontal hairline and occipitotemporal area, and less so on the face and trunk. In occupational exposures, eczematous plaques affected mainly the hands because of contact with shampoos or hair care products by hairdressers and application of antiseptic agents or creams by nurses. Patients had positive reactions to 1 or more alkyl glucoside (decyl, lauryl, coco, and cetearyl glucosides). However, because of testing inconsistency between published reports, it is difficult to determine which glucoside is most often associated with contact allergy.

CROSS-REACTIONS OF GLUCOSIDES

Most patients simultaneously tested to several glucosides had multiple positive reactions.^{3,6,8,13} Glucosides often present as mixtures of various alkyl chain lengths, some of them being impurities that persist during their industrial production.⁹ Therefore, the simultaneous positive patch test reactions to several derivatives may represent concomitant reactions instead of cross-reactions.^{8,10} In addition, most patients who reacted to 1 or more glucoside derivatives also had positive reactions to other surfactants and nonrelated chemicals.^{3,13} This polysensitization may be explained by increased transcutaneous penetration facilitated by barrier disruption and inflammation.¹³

PATCH TESTING

Currently, glucosides are rarely included in cosmetic patch test series.⁹ The European photopatch test baseline series recommends testing decyl glucoside when investigating reactions to methylenebisbenzotriazolyl tetramethylbutylphenol (Tinosorb M).¹⁵ The optimal concentration and vehicle for glucosides as patch test allergens are not yet established. However, it was suggested that decyl glucoside in a 10% aqueous solution would detect definite allergic reactions without inducing irritation.^{3,5} Because these surfactants rarely exist in a pure form, it would be interesting to know the exact chemical composition of the commercially available glucoside allergens.³ In addition, patch testing should ideally be performed not only with the suspected products but also with their separate ingredients.¹¹

CONCLUSIONS AND RECOMMENDATIONS

Glucoside-induced allergic contact dermatitis is not an infrequent problem and is probably underestimated. The increasing number of reported cases may represent more awareness of a situation that has long been missed but may also be due to the increased use of these mild surfactants in a variety of household products. They should be recognized as emergent allergens, and we strongly urge patch testers to include various glucosides in their cosmetic series.

REFERENCES

1. *International Cosmetic Ingredient Dictionary and Handbook*. 8th ed. Vol 1. Washington, DC: The Cosmetic, Toiletry, and Fragrance Association; 2000: 242, 342, 777.
2. Krehic M, Avenel-Audran M. Allergic contact dermatitis from decyl glucoside in an antiseptic lotion. *Contact Dermatitis* 2009;61(6):349–350.
3. Blondeel A. Contact allergy to the mild surfactant decylglucoside. *Contact Dermatitis* 2003;49(6):304–305.
4. Garcia C, Ball N, Cagen S, et al. Comparative testing for the identification of skin-sensitizing potentials of nonionic sugar lipid surfactants. *Regul Toxicol Pharmacol* 2010;58(2):301–307.
5. Le Coz CJ, Meyer MT. Contact allergy to decyl glucoside in antiseptic after body piercing. *Contact Dermatitis* 2003;48(5):279–280.
6. Goossens A, Decraene T, Platteaux N, et al. Glucosides as unexpected allergens in cosmetics. *Contact Dermatitis* 2003;48(3):164–166.
7. Horn HM, Murray C, Aldridge RD. Contact allergy to decyl glucoside. *Contact Dermatitis* 2005;52(4):227.
8. Andersen KE, Goossens A. Decyl glucoside contact allergy from a sunscreen product. *Contact Dermatitis* 2006;54(6):349–350.
9. Andrade P, Gonçalves M, Figueiredo A. Allergic contact dermatitis to decyl glucoside in Tinosorb M. *Contact Dermatitis* 2010;62(2):119–120.
10. Pereira N, Coutinho I, Andrade P, et al. The UV filter tinosorb M, containing decyl glucoside, is a frequent cause of allergic contact dermatitis. *Dermatitis* 2013;24(1):41–43.
11. Borrego L, Liuti F, Morales H. Contact dermatitis to methylenebisbenzotriazolyl-tetramethyl butylphenol and decyl glucoside contained in Tinosorb M. *Contact Dermatitis* 2014;70(Suppl 1):98.
12. de Groot AC, van Zuuren EJ, Hissink D. Contact allergy to Tinosorb® M: recommendations for diagnostic improvement. *Contact Dermatitis* 2014;70(4):251–254.
13. Gijbels D, Timmermans A, Serrano P, et al. Allergic contact dermatitis caused by alkyl glucosides. *Contact Dermatitis* 2014;70(3):175–182.
14. DeKoven JG, Warshaw EM, Belsito DV, et al. North American Contact Dermatitis Group patch test results: 2013–2014. In press.
15. Gonçalves M, Ferguson J, Boneville A, et al. Photopatch testing: recommendations for a European photopatch test baseline series. *Contact Dermatitis* 2013;68(4):239–243.