

Gallate Contact Dermatitis: Systematic Review and Product Update

Zachary E. Holcomb, BS,^{*} Megan G. Van Noord, MSIS,[†] and Amber Reck Atwater, MD[‡]

Allergic contact dermatitis related to cosmetic use can result from allergens not routinely evaluated by standard patch test protocols. Propyl, octyl, and dodecyl gallates are commonly used as antioxidant preservatives with reports of associated allergic contact dermatitis in the literature. The objectives of this review were to investigate the role of gallates in allergic contact dermatitis and to explore products containing these preservatives. A systematic review of the literature through April 2016 was performed to explore cases of reported gallate allergy. Food and cosmetic product databases were searched for products containing gallates. Seventy-four cases of gallate contact allergy have been reported. In addition, a variety of commercially available cosmetic products and foods contain gallate chemicals. Propyl gallate is the most commonly reported gallate contact allergen and often causes facial and/or hand dermatitis.

Gallates are antioxidant chemicals that are commonly used as preservatives in food products and cosmetics. Although many gallic acid esters exist and have been used industrially, the term *gallates* usually refers to the following 3 most common esters of gallic acid used as preservatives: propyl gallate, octyl gallate, and dodecyl gallate (also known as “lauryl gallate”). The structures of these 3 chemicals, which differ only by length of their side chain, are shown in Figure 1.¹

The gallates have been used as food preservatives since 1948 to prevent formation of peroxides (which lead to rancidity) in oils, fats, and fat-containing foods.² In 1976, the Joint Food and Agriculture Organization of the United Nations/World Health Organization Expert Committee on Food Additives established an acceptable daily total gallate intake at 0.02 mg/kg of body weight (as a sum of propyl, octyl, and dodecyl gallates).³ These chemicals are also used in cosmetics and emulsions to prevent alterations in color and odor. The use of gallates in cosmetics has increased since 1947, prompting the US Food and Drug Administration to limit the concentration of gallates in cosmetics and topical medications from 0.001% to 0.01%.⁴ As it turns out, for the past 4 decades, there have been multiple reports in the literature of allergic contact dermatitis (ACD) resulting from exposure to gallates.

Previous experimentation using guinea pigs has shown that all 3 gallates are moderate to strong contact sensitizers.⁵ In fact, a correlation between side chain length and sensitizing capacity

was observed in this experiment, with maximum sensitization occurring with a side chain length of 12 carbon atoms (corresponding to dodecyl gallate). Clinically, sensitization occurs to all 3 gallates. However, propyl gallate is the most commonly used preservative of the 3 gallates in both food and cosmetics and thus has the most reported cases of ACD in the literature. In addition, a large multicenter study revealed that octyl gallate has the greatest clinical sensitizing capacity of the gallates, as determined by the percentage of patients patch testing positive to the chemical, followed by dodecyl gallate and propyl gallate.⁶

Despite that gallates have been used as preservatives in food products and cosmetics for the better part of a century, only recently have a significant number of reports started to surface within the literature of adverse allergic reactions to these chemicals. One possible theory for this observation is that oral consumption of gallates can induce tolerance that is protective against the development of ACD. In 1 study, guinea pigs that were fed propyl gallate and then immunized intradermally against both propyl gallate and dinitrochlorobenzene only had positive patch test results for dinitrochlorobenzene, suggesting that orally induced tolerance may have prevented cutaneous sensitization to propyl gallate.⁷ However, an increasing prevalence of gallate use in the cosmetic industry, coupled with regulation and decreased use of gallates in foods, could explain why the incidence of ACD to the gallate chemicals seems to be increasing.⁸

Although gallates have a strong sensitizing capacity and are frequently used as preservatives, most reports of contact dermatitis due to gallate allergy only focus on 1 or a few patients. This makes the tasks of observing trends and determining sensitizing products difficult. To further elucidate the relationship between gallates and ACD, we conducted a systematic review of published data regarding reports of allergy to propyl, octyl, and dodecyl gallates. Furthermore, we have searched multiple databases containing food items and cosmetic products to provide an updated picture of items containing these gallate preservatives. Throughout this

From the ^{*}Duke University School of Medicine, Duke University; [†]Duke University Medical Center Library; and [‡]Department of Dermatology, Duke University Medical Center, Durham, NC.

Address reprint requests to: Amber Reck Atwater, MD, Duke University Medical Center, DUMC 3643, Durham, NC 27710. E-mail: amber.atwater@duke.edu.

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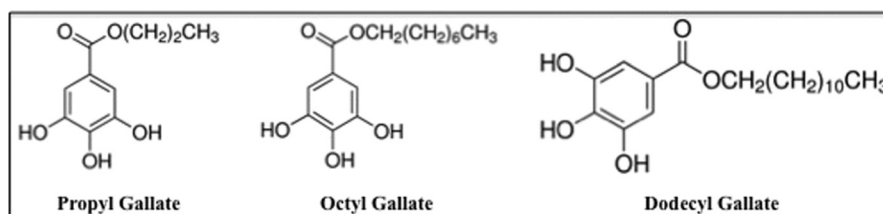


Figure 1. Chemical structure of propyl, octyl, and dodecyl gallates.

article, the International Nomenclature of Cosmetic Ingredients is used, when possible.

METHODS

A systematic review of the scientific literature up to April 2016 was conducted to identify all case reports and case series describing positive patch test results to propyl gallate, octyl gallate, and/or dodecyl gallate. PubMed/MEDLINE, Embase, Web of Science, and Cochrane Library databases were searched with an English-language filter for human studies using the following terms: (*skin diseases or allergy and immunology or skin tests or allergy or dermatitis or patch test or adverse reaction*) and (*octyl gallate or octylgallate or 3,4,5-trihydroxybenzoic acid octyl ester or propyl gallate or propylgallate or gallic acid propyl ester or lauryl gallate or dodecyl gallate or dodecylgallate or gallate esters or E-312 antioxidant or antioxidant E-312*). The references of all included articles were searched to identify additional cases. The first author reviewed each of the articles. Criteria for inclusion were articles that contained confirmed positive patch test results for propyl gallate, octyl gallate, and/or dodecyl gallate. Articles in languages other than English and articles that did not include human studies were excluded. Given the limited number of reported cases of gallate allergy in the literature, articles were not excluded on the basis of relevance of the patch test or timing of patch test reading.

The online food product database established and maintained by Label Insight was queried to determine food items that contain gallates as ingredients.⁹ Label Insight contains ingredient and nutritional information for more than 22,000 items sold in American grocery stores. Most data involve food products, but other items are included as well. The search was performed in August 2016 by searching for the terms *propyl gallate*, *octyl gallate*, *dodecyl gallate*, and *lauryl gallate* within the *Raw Ingredients* filter of the Label Insight database. Duplicate products that differed only in serving size were excluded from the search results.

To determine which personal care products contain gallates, 2 separate databases were used. The online Contact Allergen Management Program (CAMP) database, provided by the American Contact Dermatitis Society, details the ingredients in personal care products with the intent of helping patients avoid products that elicit allergic reactions.¹⁰ This database was queried in June 2016 using the search terms *propyl gallate*, *octyl gallate*, and *dodecyl gallate* to determine product categories and the number of products within

each category containing gallates. A second online database, the Skin Deep online cosmetic database maintained by the Environmental Working Group (EWG)¹¹ was queried in August 2016 to examine specific personal care products containing the gallate chemicals. Again, the search terms *propyl gallate*, *octyl gallate*, *dodecyl gallate*, and *lauryl gallate* were used. Duplicate products that differed only in size were excluded from the EWG search results. Because the CAMP database only reported “product categories” whereas the EWG database reported specific product names, we cannot be sure of the number of products that were “double counted” between the 2 database queries. Direct comparison of the 2 databases is therefore difficult, and the information has been tabulated here in the specific format provided by each database.

GALLATE ALLERGY IN THE LITERATURE

We searched the literature for reports of allergy to propyl, octyl, and dodecyl gallates. All reports with positive patch tests to 1 of these 3 chemicals, regardless of relevance, were collected. There were 74 individual cases of ACD to the gallate chemicals reported in the literature. The results are summarized in Table 1.

There is variability in the concentration, vehicle, and reading time for the patch testing, likely due to variations in clinical practice between centers. Several important trends are noticeable within the collected data. Propyl gallate was the most commonly reported gallate allergen of the three, demonstrating positive patch tests in 64% (47/74) of the patients with a gallate allergy. Octyl gallate showed a positive patch test rate of 26% (19/74), whereas dodecyl gallate demonstrated a positive patch test rate of 30% (22/74). Several of the authors did not comment on relevance or whether the allergens could be irritants, but 2 publications, both involving dodecyl gallate, reported the reaction as an irritant. The authors therefore felt that it was not responsible for the observed ACD in those 2 patients.

Excluding workers with cutaneous exposure to food products, only 4 (5%) of the 74 reported cases were thought to be due at least in part to ingestion of food items (3 cases of margarine and 1 case of peanut butter).^{12,15,34,53} These patients reported swelling of the tongue and dermatitis of the lips, and 1 patient reported hand dermatitis after peanut butter ingestion. All of the other cases were due to cutaneous exposure to a gallate-containing product, either a cosmetic product or a topical medicament. Although a variety of products were reported as the causative agent, the majority of

TABLE 1. Case Reports of Positive Patch Test Results to Propyl, Octyl, and Dodecyl Gallates

Year	Age	Sex	Clinical Symptoms	Positive Patch Test Results	Relevance	Patch Test (Chemical %/Vehicle)	Reading Time	Source
1975 ¹²	26	Female	Unspecified contact dermatitis	Dodecyl gallate	—	0.25%	—	Margarine
				Octyl gallate		0.25%		
1975 ¹²	60	Female	Stasis dermatitis	Dodecyl gallate	—	0.25%	—	Unspecified ointment
				Octyl gallate		0.25%		
1975 ¹³	50	Male	Itchy, diffuse papular erythema with excoriations	Propyl gallate	Relevant	0.1% pet	72 h	Alphosyl cream
1976 ¹⁴	37	Female	Diffuse erythroderma with vesicular eruptions of the dorsal hands	Dodecyl gallate	Unknown	2% oo	—	Cosmea Lanoline Cream
1978 ¹⁵	46	Male	Dermatitis of the hands and face	Octyl gallate	Relevant	0.1% oo and 1% oo	—	Peanut butter
1980 ¹⁶	58	Female	Cheilitis	Propyl gallate	Relevant	2% pet	—	Lipstick
1984 ¹⁷	59	Female	Hyperkeratotic eczema	Propyl gallate	Relevant	1% eth	—	Unspecified ointment
1987 ¹⁸	60	Female	Itchy eczematous eruption of the hands, forearms, face, neck, legs, and buttocks	Propyl gallate	Relevant	0.01%, 0.1%, 1% pet	72 h	"Idomin Fukt" moisturizing cream
				Octyl gallate	Unknown	0.001%, 0.01%, 0.1%, 1% pet		
				Dodecyl gallate	Unknown	0.05%, 0.1%, 1% pet		
1987 ¹⁹	68	Female	Eczematous dermatitis of the leg	Propyl gallate (++)	Relevant	1% in eth, 0.1% pet	—	Dermoangiopan gel
1987 ²⁰	23	Female	—	Dodecyl gallate (++/+++)	Relevant	0.1 oo	48 h, 72 h	Washing powder
1987 ²⁰	40	Female	—	Dodecyl gallate (−/+)	Relevant	0.1% oo	48 h, 72 h	Washing powder
1987 ²⁰	31	Female	—	Dodecyl gallate (+/+)	Relevant	0.1% oo	48 h, 72 h	Washing powder
1987 ²⁰	21	Male	—	Dodecyl gallate (+/++)	Relevant	0.1% oo	48 h, 72 h	Washing powder
1988 ²¹	—	Female	Dermatitis of the arms and thoracoacromial region	Propyl gallate	Relevant	1% pet	—	Unspecified lotion containing propyl gallate
1988 ²¹	—	Female	Dermatitis of the arms and thoracoacromial region	Propyl gallate	Relevant	1% pet	—	Unspecified lotion
1988 ²¹	—	Female	Dermatitis of the arms and thoracoacromial region	Propyl gallate	Relevant	1% pet	—	Unspecified lotion
1988 ²¹	—	Female	Dermatitis of the arms and thoracoacromial region	Propyl gallate	Relevant	1% pet	—	Unspecified lotion
1988 ²¹	—	Female	Dermatitis of the arms, neck, face, and thoracoacromial region	Propyl gallate	Relevant	1% pet	—	Unspecified lotion
1988 ²¹	—	Female	Dermatitis of the arms, neck, face, and thoracoacromial region	Propyl gallate	Relevant	1% pet	—	Unspecified lotion
1988 ²²	24	Male	Itchy, erythematous, papular, edematous, vesicular eruption	Propyl gallate	Relevant	1% pet	—	Traumatociclina topical medication
1988 ²²	34	Female	Eczematous eruption of the vulvar region spreading to the legs and trunk	Propyl gallate	Relevant	1% pet	—	Traumatociclina topical medication
1988 ²³	43	Female	Eyelid dermatitis	Propyl gallate	Relevant	0.1% pet	—	D-Base Gentili cosmetic cream
1989 ²⁴	58	Female	Cheilitis, tingling of lips, edematous upper lip	Propyl gallate	Relevant	2% pet	48 h, 96 h	Lip Balm (Nature's Sunshine Products)
1989 ²⁵	19	Female	Itchy swollen hands, face and legs, eyelid edema, nausea	Octyl gallate (+/+)	Relevant	0.1% pet	48 h, 72 h	Octyl gallate powder in the food industry
				Octyl gallate (+/+)	Irritant	1% alc		

(Continued on next page)

TABLE 1. (Continued)

Year	Age	Sex	Clinical Symptoms	Positive Patch Test Results	Relevance	Patch Test (Chemical %/Vehicle)	Reading Time	Source
1990 ²⁶	—	—	Axillary dermatitis	Propyl gallate	Relevant	0.5% in 25:75 eth:water	48 h	Deodorant
1992 ²⁷	53	Female	Puffy eyelids and dermatitis of the neck	Propyl gallate (++)	Relevant	1% pet	4 d	Liposomal cream
1992 ²⁷	61	Female	Itchy patches on the face and neck	Propyl gallate (++)	Relevant	1% pet	2 d, 4 d	Liposomal cream
1992 ²⁷	27	Female	Facial dermatitis	Propyl gallate (++)	Relevant	1% pet	—	Liposomal moisturizer
1992 ²⁷	61	Female	Eyelid edema, facial rash	Propyl gallate (++)	Relevant	1% pet	2 d, 4 d	Liposomal cream
1992 ²⁷	54	Female	Eyelid swelling, itchy eruption of the face and neck	Propyl gallate (++)	Relevant	1% pet	2 d, 4 d	Liposomal cream
1992 ²⁷	34	Female	Facial dermatitis	Propyl gallate (++)	Relevant	1% pet	4 d	Liposomal moisturizer
1992 ²⁷	55	Female	Periorbital edema, rash of the face and neck	Propyl gallate (++)	Relevant	1% pet	4 d	Liposomal cream
1992 ²⁷	65	Female	Facial swelling	Propyl gallate (++)	Relevant	1% pet	4 d	Liposomal moisturizer
1992 ²⁷	59	Female	Erythematous upper eyelids, rash of the face and neck	Propyl gallate (++)	Relevant	1% pet	2 d, 4 d	Liposomal cream
1992 ²⁷	44	Female	Dermatitis of the face and neck	Propyl gallate	Relevant	1% pet	—	Liposomal cream, margarine
1992 ²⁸	35	Male	Swelling and erythema of the genitals	Propyl gallate (++)	Relevant	1% pet	2 d, 4 d	Timodine cream
1993 ²⁹	49	Female	Stomatitis, burning sensation of oral mucosa, tongue erythema, and swelling	Octyl gallate	Relevant	0.1% pet	2 d, 4 d	Unknown
1993 ³⁰	19	Female	Cheilitis of the lips and corners of the mouth	Propyl gallate (++)	Relevant	1% pet	48 h, 96 h	Lipstick
1993 ³⁰	21	Female	Pruritis, erythema, and burning sensation of the lips	Propyl gallate (++)	Relevant	1% pet	48 h, 96 h	Lipstick Vera 87
1993 ³⁰	26	Female	Cheilitis, erythema, and peribuccal scaling	Propyl gallate (++)	Relevant	1% pet	48 h, 96 h	Lipstick
1993 ³⁰	26	Female	Cheilitis	Propyl gallate (++)	Relevant	1% pet	48 h, 96 h	Lipstick Sophie Noell
1993 ³⁰	34	Female	Pruritic, erythematous plaques of the face, neck, and upper chest	Propyl gallate (++) Octyl gallate (++) Dodecyl gallate (++)	Relevant Relevant Relevant	1% pet 0.25% pet 0.25% pet	—	Liposomal cream
1994 ³¹	23	Female	Darkening, scaling, and slight swelling of the lower lip	Propyl gallate Octyl gallate	Relevant Unknown	1% pet 0.25% pet	—	Lakme Primrose 315 lipstick
1994 ³²	42	Female	Eczema in the hand and arm	Propyl gallate (++) Propyl gallate (++)	Relevant Relevant	2% pet 0.5% pet and 1% pet	2 d, 3 d	Traumatocycline ointment
1995 ³³	44	Male	Lip desquamation, erythema, and soreness	Octyl gallate (++)	Relevant	0.25%	4 d	Lip preparation
1995 ³³	30	Female	Lip desquamation, erythema, and soreness	Dodecyl gallate (++)	Relevant	0.25%	4 d	Lip preparation
1995 ³³	31	Female	Lip desquamation, erythema, and soreness	Octyl gallate (++)	Relevant	0.25%	4 d	Lip preparation
1995 ³³	35	Female	Lip desquamation, erythema, and soreness	Dodecyl gallate (++)	Relevant	0.25%	4 d	Lip preparation
1995 ³³	32	Female	Lip desquamation, erythema, and soreness	Propyl gallate (++)	Relevant	1%	4 d	Lip preparation
1995 ³³	39	Female	Lip desquamation, erythema, and soreness	Octyl gallate (++)	Relevant	0.25%	4 d	Lip preparation

TABLE 1. (Continued)

Year	Age	Sex	Clinical Symptoms	Positive Patch Test Results	Relevance	Patch Test (Chemical %/Vehicle)	Reading Time	Source
1995 ³³	69	Female	Lip desquamation, erythema, and soreness	Octyl gallate (++)	Relevant	0.25%	4 d	Lip preparation
1995 ³⁴	6	Male	Episodic swelling of the lower lip	Dodecyl gallate	Relevant	0.2% pet	—	Margarine
1996 ³⁵	54	Female	Facial dermatitis, followed by recurrent oral inflammation	Propyl gallate (+++/+++) Propyl gallate (++/+++) Octyl gallate (++/+++) Octyl gallate (++/+++) Dodecyl gallate (++/+++) Dodecyl gallate (+/+++)	—	0.3% pet 0.1% pet 0.3% pet 0.1% pet 0.3% pet 0.1% pet	2 d, 4 d	Facial cosmetic
1997 ³⁶	23	Female	Itchy, painful dermatitis of the fingertips, dorsal hands, and fingers, accompanied by crusts, fissures, and exudate	Dodecyl gallate	Relevant	0.1% pet	—	Exposed as a cheese counter assistant
1997 ³⁷	59	Male	Swelling, erythema, and edema of penile lesion	Propyl gallate (+++/+++)	Relevant	—	2 d, 4 d	Locapred cream
1998 ³⁸	—	Female	Lip dermatitis	Propyl gallate (++) Octyl gallate (+++)	—	0.25% pet 0.25% pet	2 d, 4 d	Lipstick
1999 ³⁹	25	Female	Dryness, scaling, and burning sensation over the lips	Propyl gallate Octyl gallate	—	—	2 d, 3 d	—
2000 ⁴⁰	37	Female	Cheilitis and perioral dermatitis	Octyl gallate	Relevant	0.3% pet	2 d, 3 d	Amylab lipstick
2001 ⁴¹	23	Female	Rash starting on the left ventral wrist, spread to involve the dorsal hands	Dodecyl gallate	—	0.25% pet	2 d, 5 d	Exposed as a baker
2002 ⁴²	41	Male	Erythema and edema around the eyes	Propyl gallate (+/+)	Relevant	1% pet	2 d, 4 d	Exposed in a textile manufacturing plant
2003 ⁴³	54	Female	Melkersson-Rosenthal syndrome	Octyl gallate (++) Dodecyl gallate (++)	Relevant Relevant	0.3% pet 0.3% pet	3 d	Unknown
2006 ⁴⁴	48	Female	Itching, pigmentation and erythema of the forehead	Gallate mix (+)	Relevant	1.5% pet	2 d, 3 d	Bindi material
2006 ⁴⁵	38	Male	Recurrent pruritic erythema and scaling of the scalp and mustache area	Dodecyl gallate (+/+)	Relevant	—	2 d, 3 d	Corticosteroid cream
2007 ⁴⁶	29	Female	Recurrent erythema and vesiculation of the lips	Propyl gallate (++/+++)	Relevant Relevant Relevant	0.5% pet	48 h, 72 h, 96 h	Lipstick and Zovirax cream
2010 ⁴⁷	30	Female	Itchy and painful rash of the lips	Propyl gallate (++) Octyl gallate (+)	Relevant Unknown	—	72 h	Crabtree & Evelyn Aloe Vera Lip Balm
2010 ⁴⁸	44	Female	Dermatitis of the upper eyelids, face, earlobes, postauricular area, forearms, legs, and right dorsal hand	Dodecyl gallate	Irritant	(Not specified)	—	Unknown
2010 ⁴⁹	62	Male	Worsening of facial seborrheic dermatitis	Propyl gallate (++/++)	Relevant	1% pet	2 d, 3 d	Sebclair cream
2010 ⁵⁰	19	Female	Perioral cheilitis and dermatitis	Propyl gallate (++/++) Octyl gallate (++/++) Dodecyl gallate (-/+)	—	—	48 h, 96 h	Halibut lip balm
2010 ⁵¹	50	Female	Atopic eczema	Propyl gallate (++++)	Unknown	—	2 d/3 d, 4 d/5 d	—
2011 ⁵²	41	Female	Contact depigmentation of center of the forehead and dorsal feet	Propyl gallate (+++/+++)	Relevant	—	2 d, 3 d	Liquid kumkum, lipstick, plastic and rubber flip-flops

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TABLE 1. (Continued)

Year	Age	Sex	Clinical Symptoms	Positive Patch Test Results	Relevance	Patch Test (Chemical %/Vehicle)	Reading Time	Source
2013 ⁵³	42	Female	Swollen tongue	Dodecyl gallate	Unknown	0.25% pet	2 d, 4 d	Edible oils and margarine
2013 ⁵⁴	—	—	—	Propyl gallate (–/–/+)	—	1%	48 h, 96 h, 168 h	—
2014 ⁵⁵	55	Female	Urticaria, cheilitis, facial dermatitis	Dodecyl gallate (+)	Not relevant	—	96 h	Stannous fluoride in toothpaste
2014 ⁵⁶	54	Female	Recalcitrant eyelid and upper face dermatitis with burning sensation	Dodecyl gallate	Irritant	—	—	Alcaftadine 0.25% ophthalmic solution

Entries with “—” represent unreported data points. If no vehicle listed, information was not provided.

Alc indicates alcohol; eth, ethanol; oo, olive oil; pet, petrolatum.

responsible products were cosmetics. Furthermore, lip products were reported as the source in 20 patients (27%).

Not surprisingly, most reactions were confined to the regions of topical application of a gallate-containing product. They most commonly consisted of erythema, pruritus, a burning sensation, and occasional edema. Less commonly, the patients reported systemic symptoms such as nausea. Even in cases where a food source was suspected, the dermatitis was localized, either to the tongue and lips (suggesting topical exposure) or to other areas such as the hands and fingers. Because systemic contact dermatitis can include a localized cutaneous presentation, particularly involving the hands,⁵⁷ we cannot definitively determine from our data whether topical exposure alone is responsible for observed gallate ACD or whether ingestion can also present with a similar clinical picture.

In addition to the data reported previously, there have also been studies of patch test databases to look at overall incidence of positivity to gallates. Garcia-Melgares et al¹ retrospectively reviewed patch test data in their department from 1985 to 2006 and determined that 3.9% (46/1173) of patients with suspected ACD had positive patch tests to at least 1 of the 3 gallates. Of these patients, 2.6% (30/1173) reacted to propyl gallate, 2.3% (27/1173) reacted to octyl gallate, and 0.5% (6/1173) reacted to dodecyl gallate. Similarly, Perez et al⁸ examined patch test data from 1988 to 2005 and found that 0.6% (55/9529) of patients had positive patch test results to propyl gallate. In 2014, Kumar and Paulose⁵⁸ reported on 50 patients with suspected ACD to cosmetics and found that 20 (40%) of them tested positive for gallate mix (containing propyl, octyl, and dodecyl gallates). These reports looking at large volumes of patients across many years support the findings from our literature review, including propyl gallate as the most commonly reported source of ACD and the prevalence of gallate allergy in patients with ACD due to a cosmetic product.

FOODS CONTAINING GALLATES

To educate and provide successful avoidance strategies to patients with sensitivity to gallates, it is crucial to know which products contain these ingredients. Classically, gallates are described as preservatives in fatty and oily foods. There have been reports of

gallates used as preservatives in margarine and peanut butter, and our literature review revealed patients sensitized by both of these foods. However, there are many other foods that contain gallates, usually propyl gallate.

The Label Insight online food product database was queried as described previously.⁹ When searching for items with propyl gallate as an ingredient, Label Insight found 352 unique items (after removing duplicates that only differed by serving amount). These data are shown in Table 2.

Because recommending hundreds of foods on an ever-changing list for each patient with propyl gallate allergy to avoid is not practical, it may be easier to look at brands that most commonly contain propyl gallate. Label Insight was again used to compile a list of brand names for items containing propyl gallate as an ingredient. The 10 brands with the most items are shown in Figure 2.

A similar search was performed for food items containing octyl gallate in the Label Insight database. This search yielded only 5 unique food items, thus confirming that propyl gallate is the more commonly used preservative. The foods containing octyl gallate are shown in Table 3. A similar search was also performed for dodecyl gallate, but no food items within the Label Insight database contained this ingredient.

COSMETICS CONTAINING GALLATES

Gallates are used in a variety of cosmetics because of their ability to stabilize products and prevent free radical-associated oxidation. This oxidation is undesirable because it results in rancidity, color changes, viscosity changes, and active ingredient deterioration within the product. However, inclusion of gallates as antioxidant additives in cosmetic products has led to several cases of ACD, as described previously. Similar to the trend observed in foods, the water-soluble propyl gallate is the most commonly used gallate preservative in cosmetics.⁵⁹

The online CAMP database was queried to determine the number and types of personal care products containing propyl, octyl, or dodecyl gallates, as shown in Table 4.¹⁰ Of the 4679 products listed in the CAMP database, 25 (0.53%) contained propyl gallate, whereas none of the products listed octyl gallate or dodecyl gallate as

TABLE 2. Food Items From the Label Insight Database Reported to Contain Propyl Gallate as an Ingredient

Label Insight Food Items Containing Propyl Gallate		
67th Street BBQ Original Sauce Pork	Johnsonville Hot Italian Sausage	Odom's Sausage Gravy
Advil Allergy & Congestion Relief	Johnsonville Italian Sausage Slices	Odom's Sausage Links Whole Hog Breakfast
Advil Pain Reliever & Fever Reducer	Johnsonville Luck of the Irish Garlic Sausage	Odom's Sausage, Egg, & Cheese Biscuit
Align 24/7 Digestive Support	Johnsonville Mild Italian Sausage	Odom's Skinless Cooked Pork Sausage Links
Align <i>B. Infantis</i> Probiotic Supplement	Johnsonville Mild Italian Sausage Patties	Odom's Snack-sized Sausage Biscuits
America's Choice Instant Mashed Potatoes	Johnsonville Original Bratwurst	Odom's Turkey Sausage Biscuits
Archer Farms Mild Italian Sausage	Johnsonville Original Breakfast Sausage	Odom's Turkey Sausage Links
Archer Farms Peanut Butter Trail Mix	Johnsonville Pork & Chicken Maple Sausage	Odom's Turkey Sausage Patties
Armour Lard	Johnsonville Premium Mexican Sausage	Odom's Whole Hog Sausage Links
Armour Lard and Hydrogenated Lard	Johnsonville Steakhouse Onion Patties	Odom's Snack-sized Sausage Biscuits
Armour Manteca	Johnsonville Steakhouse Seasoned Grillers	Odom's Turkey Sausage Biscuits
Armour Sausage & Pancake on a Stick	Johnsonville Sweet Italian Sausage	Odom's Turkey Sausage Patties
Aunt Jemima Biscuit Sandwiches	Johnsonville Swiss Cheese/Mushroom Patties	Odom's Whole Hog Sausage Links
Aunt Jemima Croissant Sandwiches	Johnsonville Vermont Maple Syrup Sausage	Orajel Fast-Acting Gel
Aunt Jemima Griddlecake Sandwiches	Key Food Noodle Soup Mix	Orajel Instant Pain Relief
Baker's Corner Vanilla Pudding	Key Food Red Velvet Raisin Muffin	P'MOS Italian Sausage & Pepperoni Pizza
Banquet Beef Pot Pie	Kirby & Holloway Old-Fashioned Sausage	P'MOS Supreme Pizza
Banquet Chicken Fried Chicken Meal	Kraft Cranberry Stuffing Mix	Palermo's Italian Sausage Pizza
Banquet Morning Bakes	Kraft Chicken Stuffing Mix	Palermo's Meat Lovers Pizza
Banquet Sausage & Croissant Sandwiches	Kraft Cornbread Stuffing Mix	Palermo's Supreme Pizza
Banquet Sausage & Gravy Deep Dish	Kraft Everyday Stuffing Mix	Papa Carmignani's Italian Sausage
Banquet Sausage & Pancake Minis	Kraft Mixed Savory Herbs Stuffing Mix	Pedia Care Multi-Symptom Cold Relief
Banquet Sausage Biscuit Sandwiches	Kraft Savory Stuffing Mix	Pioneer Gravy Mix
Banquet Sausage, Egg, Buttermilk Biscuit	Kraft Stuffing Mix	Pop-Secret Double Butter Microwave Popcorn
Banquet Sausage Gravy	Kraft Traditional Sage Stuffing Mix	Pop-Secret Homestyle Premium Popcorn
Banquet Sausage Snack Size Sandwiches	Kraft Turkey Stuffing Mix	Pop-Secret Jumbo Pop Movie Theater Butter
Bob Evans Six Cheese Pasta	Kraft Whole Wheat Chicken Stuffing Mix	Pop-Secret Jumbo Pop Premium Butter
Botto's Italian Sausage (Broccoli, Cheese)	Krasdale Noodle Soup Mix	Pop-Secret Jumbo Pop Premium Popcorn
Botto's Italian Veal Sausage	Kroger Country Gravy Mix	Pop-Secret Old Fashioned Kettle Corn
Botto's Low Sodium Sweet Italian Sausage	Kroger Mexican Flavored Rice & Sauce	Pop-Secret Premium Buttered Popcorn
Botto's Sweet Italian Sausage	Kroger Mexican Seasoned Refried Beans	Pop-Secret Premium Cheddar Popcorn
Brew Pub Bacon Cheeseburger Pizza	Kroger Pork Flavored Gravy Mix	Pop-Secret Premium Double Butter Popcorn
Brew Pub Lotzza Motzza 4-meat Pizza	Kroger Pork Sausage Links	Pop-Secret Premium Movie Theater Butter
Brew Pub Lotzza Motzza Cheese Pizza	Kroger Sausage & Blueberry Pancake	Pop-Secret Premium Popcorn
Brew Pub Lotzza Motzza Pepperoni Pizza	Kroger Sausage & Pancake	Praters Broccoli & Rice Casserole
Brew Pub Lotzza Motzza Sausage Pizza	Kroger Sausage & Pancake on a Stick	Praters Potatoes
Brew Pub Lotzza Motzza Supreme Pizza	Kroger Traditional Refried Beans	Praters Supreme Green Bean
Brew Pub Sausage & Mushroom Pizza	Kroger Turkey Flavored Gravy Mix	Praters Turkey Gibley Gravy
Brew Pub Sausage & Pepperoni Pizza	Kroger Turkey Sausage Links	Ralph's Noodle Soup Mix
Caesar's Italian Sausage Ravioli	Kroger Turkey Sausage Patties	Ralph's Onion & Garlic Refried Black Beans
Children's Mucinex	L. B. Jamison's Soup Base (beef)	Ralph's Refried Beans
Clear Value Pre-creamed Shortening	L. B. Jamison's Soup Base (chicken)	Randolph Apple/Cinnamon Breakfast Sausage
Clear Value Refried Beans	La Preferida Lard and Hydrogenated Lard	Randolph Bratwurst (cheddar/jalapeno)
Cold-Eeze Children's Daytime (cherry)	Libby's Country Sausage Gravy	Randolph Bratwurst (mushroom/provolone)
Cold-Eeze Children's Nighttime (berry)	Lip Smacker Cotton Candy Lip Gloss	Randolph Brown Sugar Breakfast Sausage
Day 'n Night Bites (sausage, egg, cheese)	Lip Smacker Party Pack Lip Gloss	Randolph Chipotle & Cheddar Sausage
Day 'n Night Bites (sausage biscuit)	Lip Smacker Strawberry Lip Balm	Randolph Market Bratwurst
Denmark Foods Fresh Bratwurst	Lip Smacker Vanilla Lipstick	Randolph Market Hot Italian Sausage
Denmark Foods Hot Italian Sausage	Lip Smacker Watermelon Lip Balm	Randolph Market Mild Italian Sausage
Denmark Foods Sweet Italian Sausage	M&M Chocolate Candies	Reser's Fine Foods Main St. Bistro
Desert Essence Lip Rescue	M&M Peanut Butter Chocolate Bars	Richardson Butter Mints Confections
Desert Essence Lip Rescue (w/ tea tree oil)	M&M Peanut Butter Chocolate Candies	Robitussin Maximum Strength Cold + Flu
Digiorno Cheese Stuffed 3-meat Pizza	M&M Peanut Butter Chocolate Confection	Roundy's Beer 'n Bratwurst

TABLE 2. (Continued)

Label Insight Food Items Containing Propyl Gallate		
Digiorno Cheese Stuffed Crust Pizza	M&M Peanut Butter Chocolate Cups	Roundy's Breakfast Maple Sausage
Digiorno Cheese Stuffed Sausage Pizza	M&M Peanut Butter Chocolate Eggs	Roundy's Bratwurst
Digiorno Cheese Stuffed Supreme Pizza	M&M Peanut Butter Chocolate Variety Pk	Roundy's Fresh Polish Sausage
Digiorno Garlic Bread Pizza	Maglio Company Hot Italian Sausage	Roundy's Hot Italian Sausage
Digiorno Original 3-Meat Pizza	Maglio Company Mild Italian Sausage	Roundy's Mild Italian Sausage
Digiorno Original Sausage/Pepperoni Pizza	Marie Callender's 3-Meat, 4-Cheese Lasagna	Roundy's Original Breakfast Sausage
Digiorno Rising Crust 3-Meat Pizza	Marie Callender's Cheesy Egg & Sausage	Roundy's Original Sausage Patties
Digiorno Rising Crust Supreme Pizza	Marie Callender's Comfort Bakes Lasagna	Roundy's Pasta & Sauce
Digiorno Thin Crust 4-Meat Pizza	Marie Callender's Flaky Croissant	Safeway Chicken Gravy Mix
Dimetapp Children's Cold Relief (grape)	Marie Callender's Freshly Made Pasta	Safeway Microwave Popcorn
Dimetapp Nighttime Cold & Congestion	Marie Callender's Sausage Cheddar Biscuit	Safeway Vegetarian Refried Beans
Disney Lip Smacker Lipstick	Marie Callender's Sausage/Cheddar Sandwich	Santa Barbara Five Layer Party Dip
Disney Princess Lip Gloss 438	Marie Callender's Sausage/Gravy/Egg Pot Pie	Sauer's Roast Turkey Breast Seasoning Mix
Ed Hipp's Beef Breakfast Sausage	Market Pantry Black Refried Beans	Schnucks Breakfast Sandwiches
El Milagro Tortillas	Markey Pantry Mild Italian Sausage	Screamin' Sicilian Boss Hog Pizza
Emil's Thin Crust Sausage/Pepperoni Pizza	Meijer Fresh Polish Sausage	Screamin' Sicilian Supremus Maximus Pizza
Essential Everyday Croissant Sandwiches	Meijer Ground Chorizo Sausage	Shoppers Value Sausage & Cheese Biscuit
Essential Everyday Biscuit Sandwiches	Meijer Hemorrhoidal Cream	Shoprite Chicken Stuffing Mix
Eucerin Skin Calming Body Wash	Meijer Hot Italian Sausage	Shoprite Turkey Stuffing Mix
Excedrin Extra Strength Pain Reliever	Meijer Mashed Potatoes (creamy butter)	Shur Saving Shortening
Farmland Pork Sausage (original)	Meijer Mild Italian Sausage	Shurfine Noodle Soup Mix
Farmland Pork Sausage Links	Meijer Mucus Relief	Signature Kitchens Refried Beans
Farmland Pork & Sausage Links (hot)	Milk-Bone 4-Meat Flavored Dog Snacks	Skittles Lip Balm
Farmland Sausage Biscuit	Morning Delight Hash Browns & Sausage	Smart Ones Smart Delights
Farmland Sausage Croissant (w/cheese)	Morning Delight Sausage Biscuits	Spartan Chicken Pasta & Sauce
Food Club Shoestring Potato Sticks	Mucinex Children's Cold Relief	Spartan Creamy Butter Mashed Potatoes
Goya Beef Empanadas	Mucinex Children's Cough Suppressant	Spartan Instant Pudding
Goya Refined Lard	Mucinex Children's Multi-Symptom Relief	Special Value Whipped Shortening
Goya Spanish Style Arroz Amarillo	Mucinex Children's Nighttime Pain Relief	Stove Top Stuffing Mix for Chicken
Grandma Frey's Strawberry Rhubarb Pie	Mucinex Fast-Max Cold & Sinus	Swaggerty's Farm Premium Sausage
Great Value 4-Cheese Mashed Potatoes	Mucinex Fast-Max Cold, Flu, & Sore Throat	Tennessee Pride Real Country Sausage
Great Value Butter/Herb Mashed Potatoes	Murad Advanced Acne & Wrinkle Reducer	Tennessee Pride Sausage Buttermilk Biscuits
Great Value Creamy Butter Mashed Potatoes	Murad Essential-C Daily Renewal	The Balm Concealer
Great Value Fettuccini Alfredo	Murad Essential-C Night Moisture	The Balm Medium/Dark Concealer
Great Value Instant Mashed Potatoes	Murad Essential-C Toner	The Onion Crock Minestrone Soup
Great Value Maple Pork Sausage Patties	Murad Facial Cleanser	Tio Franco Refried Beans
Great Value Mashed Potatoes (w/butter)	Murad Rejuvenating Lift	Twix Chocolate/Peanut Butter Candy Bars
Great Value Original Beef Breakfast Patties	Murad T-Zone Pore Refining Serum	Tyson Grilled & Ready Pulled Pork Loin
Great Value Original Pork Sausage Links	Murry's Sunrise Beef Patties	Tyson Sausage, Egg, & Cheese Biscuits
Great Value Original Pork Sausage Patties	Neutrogena T/Gel Dandruff Shampoo	Wei-Chuan Spring Roll Shells
Great Value Original Turkey Breakfast Patties	(No brand) Boned Hog Sausage Patties	Weis Italian Wedding Cake Slices
Great Value Pancakes & Sausage on a Stick	(No brand) Cooked Turkey Sausage Links	Weis Original Breakfast Sausage
Great Value Spicy Pork Sausage Patties	(No brand) Cooked Turkey Sausage Patties	White Rose Noodle Soup Mix
Great Value Roasted Garlic Mashed Potatoes	Odom's 6 Sausage Patties	White Rose Potato Sticks
Hargis House Sausage Gravy	Odom's Biscuit-Sized Sausage Patties	Winco Foods Banana Cream Instant Pudding
Harry's Fresh Foods Dirty Rice (Cajun-style)	Odom's Cooked Pork Sausage Patties	Winco Foods Pistachio Pudding Filling
Hempler's Mild Italian Sausage	Odom's Cooked Sausage Patties	Winco Foods Vanilla Cream Instant Pudding
Howe Coconut Crunch	Odom's Cooked Turkey Sausage Links	Wyler's Chicken Noodle Hearty Soup Mix
Jennie-O Turkey Bratwurst	Odom's Croissant Egg & Cheese Sandwich	Wyler's Extra Noodles Soup Mix
Jimmy Dean Breakfast Bowl Sausage/Gravy	Odom's Croissant Sausage, Egg, & Cheese	Wyler's Hearty Soup Mix
John Morrell Pork Sausage	Odom's Fully Cooked Sausage Patties	Wyler's Homestyle Beef Vegetable Mix
Johnsonville Beer 'n Bratwurst	Odom's Hot Sausage Patties	Wyler's Homestyle Chicken Noodle Mix
Johnsonville Bratwurst w/Pork & Chicken	Odom's Jumbo Sausage & Buttermilk Biscuit	Wyler's Homestyle Vegetable Noodle Mix

TABLE 2. (Continued)

Label Insight Food Items Containing Propyl Gallate		
Johnsonville Breakfast Sausage Turkey	Odom's Mild Sausage Patties	Wyler's Instant Beef Bouillon Granules
Johnsonville Brown Sugar & Honey Sausage	Odom's Original Sausage Patties	Wyler's Instant Bouillon
Johnsonville Cheddar Brats Bratwurst	Odom's Pork Sausage Links	Wyler's Instant Bouillon Granules
Johnsonville Chorizo Mexican Sausage	Odom's Pork Sausage Patties	Wyler's Instant Chicken Bouillon Cubes
Johnsonville Classic Italian Style Meatballs	Odom's Pork Sausage Tubes	Wyler's Instant Chicken Bouillon Powder
Johnsonville Grillers Bratwurst Patties	Odom's Sausage & Buttermilk Biscuits	Wyler's Instant Flavored Chicken Broth
Johnsonville Grillers Cheddar Bratwurst	Odom's Sausage & Egg Buttermilk Biscuits	Wyler's Noodle Mix with Chicken Broth
Johnsonville Grillers Cheddar Cheese/Bacon	Odom's Sausage & Maple Pancakes	Wyler's Reduced-Sodium Beef Bouillon
Johnsonville Grillers Pork w/Cheddar Cheese	Odom's Sausage Balls	Wyler's Sodium-Free Chicken Bouillon
Johnsonville Grillers Sweet Italian Sausage	Odom's Sausage Biscuits	YoCrunch Candies
Johnsonville Homestyle Meatballs	Odom's Sausage Croissants	Zatarain's Red Beans & Rice with Sausage
Johnsonville Hot n Spicy Bratwurst		

ingredients. Most cosmetic products containing propyl gallate (13/25) fell into the “makeup” category, predominantly including lipsticks, lip gloss, and other products applied to the lips. There were also “medications” (7/25) that contained propyl gallate, including corticosteroids and depigmenting agents. Finally, only a couple of products fell into the “skin care” category, including an antiaging cream and a type of soap.

The lack of products within the CAMP database reported to contain octyl and dodecyl gallates does not necessarily imply that these ingredients are not present in cosmetic products. The database is not exhaustive. Furthermore, concentrations of octyl and dodecyl gallate may be small enough to omit from the ingredient list but still significant enough to elicit an allergic reaction. Finally, errors and omissions in product labeling occasionally occur.

To determine some of the specific products containing gallates, the EWG Skin Deep online cosmetic database was queried.¹¹ The results from this search are shown in Table 5. Briefly, of more than 62,000 cosmetic products listed in the database, 45 unique products were found containing propyl gallate. Again, none were found to contain octyl or dodecyl gallate. Most propyl gallate-containing products (30/45) were lipstick, lip gloss, or lip balm.

DISCUSSION

Propyl, octyl, and dodecyl gallates are preservatives used in foods and cosmetic products. To further understand the relationship

between the gallates and ACD, we conducted a systematic review to search for reported cases of gallate allergy. Seventy-four individual cases have been reported, along with occasional reports of database analysis to examine the incidence of gallate reactivity. Our search revealed that among those with gallate allergy, propyl gallate is the most commonly reported, followed by dodecyl gallate and then octyl gallate. These findings differ from previous reports that dodecyl gallate has the greatest sensitizing capacity⁵ and that octyl gallate is clinically observed to sensitize the most patients as measured by the greatest frequency of positive patch test results.⁶

Classically, the gallates have been associated with oily and fatty foods, especially foods such as peanut butter and margarine.^{53,60} Although this association remains true, we found many additional foods that contained gallates. Propyl gallate was the most prevalent gallate preservative in food, with rare presence of octyl gallate and no identified dodecyl gallate. Cosmetic items contain gallates as well, and the trend is similar to food products. Propyl gallate is the most commonly used of the gallate chemicals as a preservative in cosmetics. Many of these products were lip preparations, which aligned with the literature reports of multiple cases of lipstick- and lip balm-induced ACD.

On the basis of the results of this systematic review, we do not recommend routine screening for gallate allergy, but we do recommend patch testing for propyl gallate in patients with hand or facial dermatitis and a suspicion for ACD related to personal care products. In addition, we recommend patch testing for

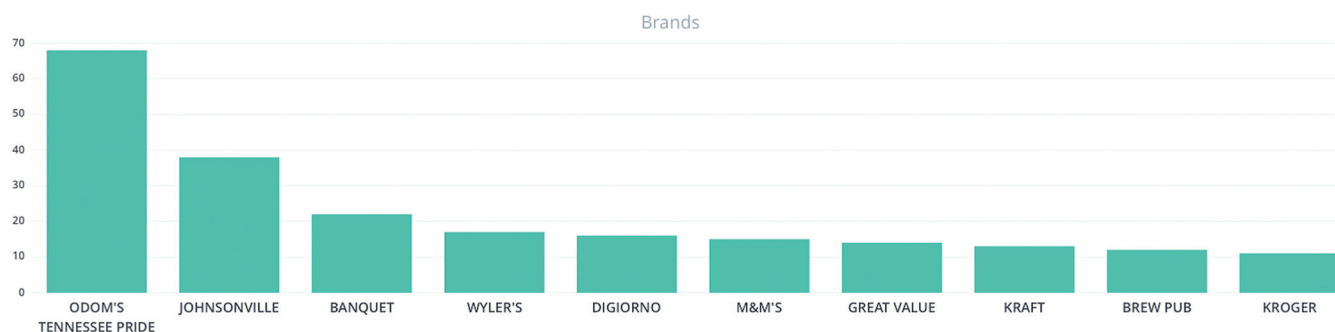


Figure 2. Ten brands with the most items containing the ingredient “propyl gallate.”

TABLE 3. Food Items From the Label Insight Database Reported to Contain Octyl Gallate as an Ingredient

Label Insight Food Items Containing Octyl Gallate		
Forrelli Strawberry Flavored Wafers	Manamit Vanilla Flavored Wafers	Osem Wafers
Gefen Coated Wafers	Manamit Chocolate Flavored Wafers	

propyl gallate in patients with cosmetic or medicament use and an undetermined cause of ACD.

Cross-reactivity to gallates has been observed, whereby a patient sensitized to one of the gallate chemicals becomes sensitive to others.^{30,35} Hemmer et al³⁵ even suggested that gallates may be involved with cross-reactions with other chemicals, including catechol, protocatechuic acid, and 4-*tert*-butylcatechol. It is difficult to determine the rate of cross-reactivity with the data from our review. Therefore, we currently cannot make a recommendation regarding avoidance of all 3 gallates in a patient who is reactive to 1 gallate chemical.

In this systematic review, we identified only 4 cases thought to be due at least in part to ingested gallate-containing food items.^{12,15,34,53} Consequently, it is difficult to comment on the indication for gallate avoidance in foods when a gallate-positive patch test occurs. Further work is necessary to determine the prevalence of systemic contact dermatitis due to gallate ingestion and indications for patient avoidance of gallates in foods.

There are inherent limitations to the conclusions that can be drawn from this systematic review. First and foremost, the cases here are skewed by selective reporting bias. Although it is useful to examine the cases of gallate allergy and the presentation of the associated dermatitis, no information can be ascertained regarding

similar presentations in patients with negative patch test results to the gallate chemicals. Therefore, future studies are necessary to more accurately describe the prevalence of gallate allergy in patients presenting with ACD.

In terms of the database reviews of food and personal care products, although updated lists of gallate-containing foods and cosmetic items are useful to patients and providers, lists of this nature are constantly evolving and therefore only represent a “snapshot” in time. In the setting of changing regulations, evolving market conditions, and product reformulations, information provided by database searches is only accurate for a limited time. Therefore, these lists will need constant updating to remain useful and informative to patients. However, we hope that the sources of information referenced in this review will provide a starting point for clinicians to obtain similar information in the future.

In this systematic review of gallate-positive patch tests, the most commonly reported allergen was propyl gallate. In addition, database review confirmed that propyl gallate is the most common gallate chemical present in both foods and personal care products. Propyl gallate is a potential allergen in the setting of facial and/or hand dermatitis for patients whose reactions could be related to personal care products, and it should be tested for this group of patients. Further research is necessary to better understand the relationship between gallate ingestion and systemic contact dermatitis as well as gallate cross-reactivity.

ACKNOWLEDGMENTS

The authors thank Label Insight for providing free access to their food product database of more than 200,000 items through their Open Data Initiative. For providing information on cosmetic products, we acknowledge assistance from the American Contact

TABLE 4. CAMP Database Product Types Containing Gallates

CAMP Database Product Type	Product Count	Propyl Gallate		Octyl Gallate		Dodecyl Gallate	
		Count	%	Count	%	Count	%
Makeup: face, blusher	39	1	2.56	0	0.00	0	0.00
Makeup: face, concealer	43	1	2.33	0	0.00	0	0.00
Makeup: lip, gloss	27	2	7.41	0	0.00	0	0.00
Makeup: lip, lipstick	38	7	18.42	0	0.00	0	0.00
Makeup: lip, other	19	2	10.53	0	0.00	0	0.00
Medications: corticosteroid, over the counter	13	1	7.69	0	0.00	0	0.00
Medications: corticosteroid, Rx	102	3	2.94	0	0.00	0	0.00
Medications: corticosteroid, generic, Rx	161	2	1.24	0	0.00	0	0.00
Medications: depigmenting agents, Rx	11	1	9.09	0	0.00	0	0.00
Medications: perianal	16	1	6.25	0	0.00	0	0.00
Medications: seborrhea, Rx	6	1	16.67	0	0.00	0	0.00
Nail care: basecoat/topcoat	16	1	6.25	0	0.00	0	0.00
Skin care: antiaging\antiwrinkle\skin firming	202	1	0.50	0	0.00	0	0.00
Skin care: soaps\cleansers	395	1	0.25	0	0.00	0	0.00
Total products	4679	25	0.53	0	0.00	0	0.00

TABLE 5. The EWG Skin Deep Cosmetic Database Results for Products Containing Propyl Gallate

EWG Skin Deep Cosmetic Product	Product Category
Eucerin Skin Calming Body Wash	Body wash/cleanser
Mustela Stelaker for Cradle Cap (fragrance free)	Cradle cap treatment
Preparation H Anti-Itch Cream with hydrocortisone 1%	Hemorrhoid cream
Walgreens Hemorrhoidal Pain Relief Cream	Hemorrhoid cream
Preparation H Hemorrhoidal Cream, Maximum Strength Pain Relief	Hemorrhoid cream
Desert Essence Lip Rescue with Shea Butter	Lip balm
Lip Smacker Lip Balm, Honey Pot	Lip balm
Bonne Bell Lip Smacker	Lip balm
Owens & Minor Medichoice Lip Balm, SPF 15	Lip balm
CoverGirl Outlast All Day Lip Color, Beaming Berry 720	Lipstick/lip gloss
CoverGirl Outlast All Day Lip Color, Berry Delicious 595	Lipstick/lip gloss
CoverGirl Outlast All Day Lip Color, Blossom Berry 555	Lipstick/lip gloss
CoverGirl Outlast All Day Lip Color, Brazen Raisin 542	Lipstick/lip gloss
CoverGirl Outlast All Day Lip Color, Celestial Coral	Lipstick/lip gloss
CoverGirl Outlast All Day Lip Color, Cherry Cordial 575	Lipstick/lip gloss
CoverGirl Outlast All Day Lip Color, Cinnamon Stick	Lipstick/lip gloss
CoverGirl Outlast All Day Lip Color, Coral Sunset	Lipstick/lip gloss
CoverGirl Outlast All Day Lip Color, Eternal Flame	Lipstick/lip gloss
CoverGirl Outlast All Day Lip Color, Fuchsia Forever 574	Lipstick/lip gloss
CoverGirl Outlast All Day Lip Color, Honeyed 540	Lipstick/lip gloss
CoverGirl Outlast All Day Lip Color, Hottie 548	Lipstick/lip gloss
CoverGirl Outlast All Day Lip Color, Lingering Spice	Lipstick/lip gloss
CoverGirl Outlast All Day Lip Color, Luminous Lilac 750	Lipstick/lip gloss
CoverGirl Outlast All Day Lip Color, Mauve Muse 585	Lipstick/lip gloss
CoverGirl Outlast All Day Lip Color, Moonlight Mauve	Lipstick/lip gloss
CoverGirl Outlast All Day Lip Color, Natural Blush	Lipstick/lip gloss
CoverGirl Outlast All Day Lip Color, Naturalist	Lipstick/lip gloss
CoverGirl Outlast All Day Lip Color, Nude Flush	Lipstick/lip gloss
CoverGirl Outlast All Day Lip Color, Pink Pearl	Lipstick/lip gloss
CoverGirl Outlast All Day Lip Color, Plum Berry	Lipstick/lip gloss
CoverGirl Outlast All Day Lip Color, Radiant Red	Lipstick/lip gloss
CoverGirl Outlast All Day Lip Color, Red Hot 517	Lipstick/lip gloss
CoverGirl Outlast All Day Lip Color, Rose Pearl	Lipstick/lip gloss
CoverGirl Outlast All Day Lip Color, Tickled Pink	Lipstick/lip gloss
CoverGirl Outlast All Day Lip Color, Wine to Five	Lipstick/lip gloss
Alpha Hydrox Retinol ResQ	Moisturizer
CVS Accelerated Wrinkle Repair Moisturizer, SPF 30 (2015 formulation)	Moisturizer
Skin + Pharmacy Advanced Anti-Aging Therapy Retinol Day Moisturizer, SPF 30	Moisturizer
Razor MD Rx Post-Shave Lotion, Sandalwood	Shaving cream
Razor MD Rx Post-Shave Lotion, Unscentedz	Shaving cream
Glycolix Elite Sunscreen, SPF 30 (2015 formulation)	Sunscreen
Citrix Vitamin C Antioxidant Sunscreen, SPF 40	Sunscreen
DDF Protect and Correct UV Moisturizer, SPF 15 (2015 formulation)	Sunscreen/moisturizer
L'Oreal Age Perfect Hydra-Nutrition Facial Oil, SPF 30	Sunscreen/moisturizer
La Prairie Advanced Marine Biology Day Cream Sunscreen, SPF 20	Sunscreen/moisturizer

Dermatitis Society's Contact Allergen Management Program database and the Environmental Working Group Skin Deep database.

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