

Benzoate Allergy in Children—From Foods to Personal Hygiene Products

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Abstract: Benzoate allergy may be an overlooked allergen in children and one that may be of increasing importance with its increasing role as a preservative in pediatric personal hygiene formulations. The cases herein report an association with cola and benzoate allergy and discusses the implications of replacement of formaldehyde by benzoates in personal hygiene products.

A 12-year-old boy with recalcitrant pruritic cheilitis presented for evaluation. He had central sparing correlating with the protective contact point of his soda bottle with his lip (Fig. 1). He reportedly consumed a minimum of 4 L of cola a day, packaged in plastic bottles. Patch testing with the North American Contact Dermatitis Group screening series and the Balsam Series demonstrated a [++] reaction to balsam of Peru 25%, [++] to cinnamic alcohol 5%, [+] to cinnamic aldehyde 1%, [++] to sodium benzoate 5%, and [+] to benzoic acid 2%. Based on these findings, an avoidance regimen was implemented (including cessation of cola intake and implementation of fragrance-free precautions in his personal hygiene products), which resulted in full clearance of his dermatitis.

Later, the patient ate canned baked beans in tomato sauce and experienced a full flare of the cheilitis, supporting the potential role of benzoates in

this dermatitis, because beans and tomato sauce naturally contain benzoates. Since this initial case in 2007, the authors have noted five similar cases of children with confirmed benzoate allergy and associated flares related to soft drinks, one of which has been published (1). In the subsequent patients, benzoate was confirmed as a preservative in a current hygiene product (unpublished data).



Figure 1. Dry, cracked lips consistent with cheilitis, with central sparing where the plastic soda bottle made protective contact.

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DISCUSSION

Coincidentally, 1 year after evaluation of the first case, Coca Cola (Atlanta, GA) removed sodium benzoate from the diet Coke formulation sold in Britain in response to public concern over soda's potential for formation of the carcinogen benzene (2). Because benzoate and ascorbic acid are known to form benzene in the presence of transition metals (an environment inherent to many nonalcoholic carbonated beverages), there is international monitoring of the levels of benzene in current soda formulations (3,4). Reformulations of several sodas have aimed at maintaining the benzene level below the maximum allowed in drinking water, 5 µg/kg (parts per billion) (5). One study by Van Poucke et al (4) in 2008 demonstrated that soda sold in plastic bottles contained significantly more benzene than that in glass or aluminum containers. Despite reformulations, many sodas still contain benzoate salts as preservatives, including sodium benzoate and potassium benzoate (Table 1).

On a historical note, early evidence of toxicity induced by benzoates prompted H.J. Heinz, between 1900 and 1905, to seek a preservative-free ketchup formulation through sanitation and produce improvements, to make obsolete the need for sodium benzoate. The Heinz Co. advertising campaign announced the novel ketchup products "free of benzoate of soda" while simultaneously informing the public of the harm wrought by ingesting "poisonous substances." This led to lobbying for the passage of the Pure Food Act in

1906, which mandated ingredient labeling and regulated distribution of items with preservatives (6), marking a pivotal step toward the development of the U.S. Food and Drug Administration (7). Although sodium benzoate was later allowed in limited amounts, this legislation also led to the exclusion of salicylate and formaldehyde from use in food products (6).

In addition to its use as a preservative, benzoic acid is found naturally in several food types, one being red beans (8). It is likely that this, in combination with the tomato-based sauces used for baked beans, known to be high in cinnamic alcohol and benzoate, both components of balsam of Peru, led to the second flare in our patient (9). Given the cross-reactivity of the balsam of Peru constituents, it is challenging to determine whether patients are also cosensitized and reacting to a chemically similar flavoring agent. Although the amount of benzoic acid in foods is significantly less than the amount in preservatives (with the exception of certain berries and fruits), benzoate-sensitive patients may benefit greatly from a benzoate-restricted diet (10).

In 1997, Dillarstone described a recurring pattern of behavior with regard to preservative use. The effect is such that an infrequently used preservative is introduced into the market and adopted by manufacturing companies and then becomes widely used until a tipping point occurs with a rise in contact allergy reports. This leads to concern and awareness, followed by a manufacturing shift to decrease use of the preservative in question, with a subsequent decline in the incidence of the contact allergy. Another preser-

TABLE 1. *Examples of Sodas Containing Benzoate Salts*

Product	Manufacturer (Location)	Product information found at (accessed May 2015)
Fanta	Coca Cola (Atlanta, GA)	http://coca-colaproductfacts.com
Sprite		
Seagram's ginger ale		
Barq's root beer		
Diet Barq's		
Fresca		
Coca Cola Zero		
Diet Coke		
Diet Coke with lime		
Pepsi Max	PepsiCo (Purchase, NY)	http://www.pepsicobeveragefacts.com/home/find#/
Diet Pepsi		
Caffeine-free diet Pepsi		
Diet Sierra Mist		
Mountain Dew		
Diet Mountain Dew		
Sunkist	Dr. Pepper Snapple (Plano, TX)	http://www.sunkistsoda.com/product.php
Diet Sunkist		
Dr. Pepper		
Diet Dr. Pepper	Nestle (Vevey, Switzerland)	http://www.drpepper.com/products/
Nestea with lemon		
Diet Nestea with lemon		

vative substance then replaces that preservative, and the pattern is repeated (11).

In 2013, major manufacturers of children's personal hygiene products announced that they were shifting away from formaldehyde-releasing preservatives in pediatric personal care products (12). They subsequently transitioned to the use of benzoates, thus increasing exposure and potential risk of sensitization to benzoates. An epidemiologically significant increase in sodium benzoate allergy was reported from 1996 to 2009 in a study done by the International Network of Departments of Dermatology (Germany, Switzerland, and Austria) (13). Few centers in the United States test sodium benzoate on the standard tray and even fewer test children's reaction to the substance. Furthermore, although published data are limited in regard to a temporal trend of sensitization to benzoates in North America, the authors have observed that the increased incorporation of this preservative into pediatric personal care products has correlated with an emerging increase in detected sensitization.

The authors believe that attention should be given to benzoate as an allergen of increasing importance, given the continued exposure of the general population to benzoates in food and beverage items, as well as an increase in incorporation into hygiene products. This case demonstrates the ubiquitous nature of this allergen in various consumer products and highlights the need for more published data on the rates of sensitization to benzoates and their derivatives.

CONFLICT OF INTEREST

Sharon E. Jacob, M.D., has served as a consultant for Johnson & Johnson and an independent investigator on the Smartpractice Clinical Safety and Efficacy Evaluations of T.R.U.E. TEST Panels 1, 2, and 3.2 in Children and Adolescents (PREA I/II) studies.

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