



Contents lists available at ScienceDirect

Environmental Research

journal homepage: [www.elsevier.com/locate/envres](http://www.elsevier.com/locate/envres)

## Measurement of endocrine disrupting and asthma-associated chemicals in hair products used by Black women

Jessica S. Helm<sup>a,\*</sup>, Marcia Nishioka<sup>b,1</sup>, Julia Green Brody<sup>a</sup>, Ruthann A. Rudel<sup>a</sup>, Robin E. Dodson<sup>a</sup>

<sup>a</sup> Silent Spring Institute, Newton, Massachusetts, USA

<sup>b</sup> Battelle Memorial Institute, Columbus, Ohio, USA

### ARTICLE INFO

#### Keywords:

Consumer product  
Hair product  
Endocrine disruptor  
Fragrance  
Paraben

### ABSTRACT

**Background:** Personal care products are a source of exposure to endocrine disrupting and asthma-associated chemicals. Because use of hair products differs by race/ethnicity, these products may contribute to exposure and disease disparities.

**Objective:** This preliminary study investigates the endocrine disrupting and asthma-associated chemical content of hair products used by U.S. Black women.

**Methods:** We used gas chromatography/mass spectrometry (GC/MS) to test 18 hair products in 6 categories used by Black women: hot oil treatment, anti-frizz/polish, leave-in conditioner, root stimulator, hair lotion, and relaxer. We tested for 66 chemicals belonging to 10 chemical classes: ultraviolet (UV) filters, cyclosiloxanes, glycol ethers, fragrances, alkylphenols, ethanolamines, antimicrobials, bisphenol A, phthalates, and parabens.

**Results:** The hair products tested contained 45 endocrine disrupting or asthma-associated chemicals, including every targeted chemical class. We found cyclosiloxanes, parabens, and the fragrance marker diethyl phthalate (DEP) at the highest levels, and DEP most frequently. Root stimulators, hair lotions, and relaxers frequently contained nonylphenols, parabens, and fragrances; anti-frizz products contained cyclosiloxanes. Hair relaxers for children contained five chemicals regulated by California's Proposition 65 or prohibited by EU cosmetics regulation. Targeted chemicals were generally not listed on the product label.

**Conclusions:** Hair products used by Black women and children contained multiple chemicals associated with endocrine disruption and asthma. The prevalence of parabens and DEP is consistent with higher levels of these compounds in biomonitoring samples from Black women compared with White women. These results indicate the need for more information about the contribution of consumer products to exposure disparities. A precautionary approach would reduce the use of endocrine disrupting chemicals in personal care products and improve labeling so women can select products consistent with their values.

### 1. Introduction

People are exposed to a wide range of endocrine disrupting chemicals (EDCs) and asthma-related chemicals from consumer products (Dodson et al., 2012; Rudel et al., 2010). Personal care products are a significant source of exposure to phthalates, phenols, and parabens (Berger et al., 2018; Branch et al., 2015; Braun et al., 2014; Fisher et al., 2017; Guo and Kannan, 2013; Harley et al., 2016; Meeker et al., 2013; Parlett et al., 2013;

Philippat et al., 2015a). Exposure to chemicals from personal care products is thought to occur primarily via absorption through skin and inhalation (Ernstoff et al., 2016). Urinary levels of these chemicals vary by race/ethnicity, with higher urinary levels of some phthalates and parabens in U.S. Black women compared to U.S. White women (Branch et al., 2015; Calafat et al., 2010; James-Todd et al., 2017; Varshavsky et al., 2016). Racial/ethnic differences in the use of personal care products may contribute to observed exposure disparities.

**Abbreviations:** BBP, benzylbutyl phthalate; BP-3, benzophenone-3; BPA, bisphenol A; DEP, diethyl phthalate; D4, octamethylcyclotetrasiloxane; D5, decamethylcyclopentasiloxane; D6, dodecamethylcyclohexylsiloxane; DEHP, bis(2-ethylhexyl) phthalate; DPP, di-n-propyl phthalate; EDCs, endocrine disrupting chemicals; FDA, US Food and Drug Administration; GC/MS, gas chromatography/mass spectrometry; HHCB, 1,3,4,6,7,8-hexahydro-4,6,6,7,8,8-hexamethylcyclopenta[g]-2-benzopyran; IARC, International Agency for Research on Cancer; IVF, in vitro fertilization; LOD, level of detection; MRL, method reporting limit; NHANES, National Health and Nutrition Examination Survey; Prop 65, California's Proposition 65; UV, ultraviolet

\* Correspondence to: Silent Spring Institute, 320 Nevada Street, Suite 302, Newton, MA 02460, USA.

E-mail address: [helm@silentspring.org](mailto:helm@silentspring.org) (J.S. Helm).

<sup>1</sup> Present address: Ohio State University, Columbus, Ohio, USA.

<https://doi.org/10.1016/j.envres.2018.03.030>

Received 1 November 2017; Received in revised form 9 February 2018; Accepted 18 March 2018

0013-9351/© 2018 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Please cite this article as: Helm, J.S., Environmental Research (2018), <https://doi.org/10.1016/j.envres.2018.03.030>

Assessing exposures to EDCs and asthma-associated chemicals for Black<sup>2</sup> women is important given the higher incidence of hormone-mediated diseases (James-Todd et al., 2016a) and higher prevalence of asthma (CDC, 2015) in Black women and children. When considering conditions potentially impacted by EDCs, U. S. Black women have higher rates of obesity (May et al., 2013), diabetes (Beckles and Chou, 2013), and pre-term birth (Martin and Osterman, 2013) than U.S. White women. In addition, Black women experience earlier menarche (Cabrera et al., 2014), and more prevalent fibroids (Jacoby et al., 2010) and infertility (Chandra et al., 2013), including poor in vitro fertilization (IVF) outcomes (McQueen et al., 2015). The incidence of breast and endometrial cancers in Black women is increasing, and Black women experience more aggressive forms of these cancers (Cote et al., 2015; DeSantis et al., 2016).

Recent research suggests that EDCs in common consumer products, including hair products, contribute to these hormone-mediated diseases. For example, use of hair oil and hair relaxers is associated with earlier menarche (James-Todd et al., 2011; McDonald et al., 2018), higher incidence of fibroids (Wise et al., 2012), and increased risk of breast cancer (Brinton et al., 2018; Heikkinen et al., 2015; Llanos et al., 2017). Higher urinary concentrations of phthalate metabolites have been associated with fibroids (Huang et al., 2014; Kim et al., 2017, 2016), earlier indicators of puberty (Watkins et al., 2014), less successful IVF outcomes (Hauser et al., 2016) and preterm birth (Ferguson et al., 2017, 2014). However, other studies have not found some of these associations (Mendelsohn et al., 2009; Pollack et al., 2015; Weuve et al., 2010).

Market and exposure research suggest that differences in personal care product use may contribute to higher observed levels of associated consumer product chemicals in Black women (James-Todd et al., 2017). African-American women spend more money on fragrances, feminine hygiene, and deodorizing products than other US women (Nielson, 2013), potentially resulting in greater product use and exposures. Use of fragrances was positively associated with urinary metabolite levels of diethyl phthalate (DEP) in a study of pregnant African-American and Dominican women in New York City (Just et al., 2010), and data from the National Health and Nutrition Examination Survey (NHANES) showed that reported use of vaginal douches, which are heavily marketed to Black women as aesthetic products (Ferranti, 2011), was associated with higher urinary metabolite levels of DEP in Black women (Branch et al., 2015).

Hair products are of particular interest as a potential source of exposure and health disparities (Stiel et al., 2016). Certain hair products are more commonly used by Black women, including straightening and moisturizing hair products (James-Todd et al., 2012; Nielson, 2013; Taylor et al., 2017) that are often used to meet social beauty norms (Zota and Shamasunder, 2017). Black women and children use hormone-containing hair and skin products more often than White women and children (Donovan et al., 2007; Li et al., 2002; Tiwary and Ward, 2003) and some professional hair straightening products contain and release substantial amounts of formaldehyde (Pierce et al., 2011). Testing of Black women's hair products has been limited to one study that tested four products for estradiol, estriol, and estrone (Tiwary and Ward, 2003), and another that measured estrogenic and anti-estrogenic activity (Myers et al., 2015). Consumer product chemicals have not previously been measured in Black women's hair products.

To learn whether hair products used by Black women differ from products tested previously (Dodson et al., 2012; Guo and Kannan, 2013; Hori and Kannan, 2008; Liao and Kannan, 2014), we characterized the concentrations of 66 EDCs and asthma-associated chemicals in six types of hair products commonly used by Black women. We present results by

chemical class, for comparison to previous work, and by product category. To determine whether product ingredient labels provide sufficient information to avoid chemicals of concern in hair products, we evaluated the concordance between the labeled ingredients and the measured concentrations. We also compare detected chemicals with regulated restrictions on ingredients. This study provides some of the first data on measured concentrations of chemicals in products used by Black women.

## 2. Methods

### 2.1. Product selection

We tested 18 products in six hair product categories: hot oil treatment, anti-frizz/polish, leave-in conditioner, root stimulator, hair lotion, and relaxer. Hot oil treatments are used periodically before shampooing to make hair smoother and stronger, whereas anti-frizz products are used anytime to smooth hair and give it shine. Leave-in conditioner and hair lotions are used after showering or as needed to condition and moisturize hair, and root stimulators advertise increased hair growth and strength. The root stimulator products we tested range from a “treatment” serum to products that are used like hair lotions. These product types are most often used one to seven times a week, while hair relaxers are used several times a year to permanently straighten hair (James-Todd et al., 2012). We purchased products in 2008 as part of a larger product study and focus in this analysis on one leave-in conditioner, one hot oil treatment, and multiple products for anti-frizz, root stimulators, hair lotions, and hair relaxers. A higher percentage of Black women report using these six types of hair products compared with White and Hispanic women (James-Todd, 2008).

We selected specific products for testing based on surveys of product use. We relied primarily on results from a 2004–2005 convenience sample of 301 women in New York City, 54% of whom were Black (non-Hispanic African-American or African-Caribbean) (James-Todd et al., 2012). We selected the 12 most frequently used products (at least five percent of survey respondents reported using these products) and 6 products that were frequently used by Black women, but not others, in this survey (James-Todd, 2008). A 2007 survey of pregnant women in the National Collaborative Perinatal Project (James-Todd, 2008) included nine of the tested products and confirmed that each was predominantly and/or commonly used by Black women (James-Todd, 2008). We obtained product names through personal communication (James-Todd T). Product names and manufacturers are in [Supplemental Material Table 1](#).

### 2.2. Chemical analysis

We targeted 66 chemicals for analysis based on evidence of their association with endocrine disruption or asthma, their expected presence in consumer products, and analytical capacity. Chemical analysis details were described in (Dodson et al., 2012), and health evidence is provided in [Supplemental Table 2](#). In brief, samples were extracted with 3:1 dichloromethane: methanol and analyzed using gas chromatography/mass spectrometry (GC/MS) with the internal standard method of quantification. A separate aliquot of the extract was derivatized and analyzed for phenolic compounds via GC/MS. We aimed to detect chemicals present at  $> = 0.0001\%$  (1  $\mu\text{g/g}$ ) in the products. The 6-point calibration curve (0.15–25  $\mu\text{g/mL}$ ) spanned an equivalent product concentration range of 0.003–0.5% (0.03–5  $\text{mg/g}$ ); extract concentrations that exceeded this range were diluted and reanalyzed. Samples were extracted and detected as part of the second analytical round of this prior analysis (Dodson et al., 2012).

To control against potential false positives, we only reported samples over the Method Reporting Limit (MRL). We defined the MRL as the maximum of the analytical level of detection (LOD) and the 90th percentile of the method blank ( $n = 5$ ) concentrations. When there was

<sup>2</sup> “Black” is a racial or ethnic term encompassing individuals of African descent, including African-Americans and individuals from the Caribbean and Africa. It is considered to be a social rather than biological construct (Yudell et al., 2016).

Download English Version:

<https://daneshyari.com/en/article/8868933>

Download Persian Version:

<https://daneshyari.com/article/8868933>

[Daneshyari.com](https://daneshyari.com)