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Potential health consequences of applying mercury-containing skin-lightening creams during pregnancy and lactation periods

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ABSTRACT

Many studies have highlighted the widespread use of skin-lightening creams containing mercury by women during and after pregnancy to remove dark spots. Women, especially pregnant and lactating mothers using these products are at risk of mercury poisoning because sometimes it has no clinical symptoms, particularly during early exposure. Studies have shown that prenatal and postnatal mercury exposure can cause permanent neurological damage in children. Furthermore, mercury can cause women infertility and birth defects. Even though several studies have examined the reproductive and/or developmental consequences of gestational and lactational mercury exposure from fish consumption and/or dental amalgam, no studies have assessed the possible effects of the long-term use of mercury-containing skin-lightening products by women of childbearing age on their pregnancy outcome and children's health. This commentary aims to collate information on the popular use of mercury-containing skin-lightening creams and sheds the light to the readers about the limitations of the available data on its impact during a prenatal and/or postnatal period. There is an urgent need to assess the adverse health effects of applying these products during pregnancy or lactation on child growth and development through birth cohort studies. Until data from these studies are available, women should be advised not to use topical skin-lightening creams during pregnancy and lactation.

1. Introduction

Skin-lightening products are sold in different forms, including soaps and creams; the soap is usually marketed as "antiseptic soap" (Glahder et al., 1999; UNEP, 2008). The use of skin-lightening creams has become a common practice among women for cosmetics purposes (Olumide et al., 2008; Adawe and Oberg, 2013). The creams are extensively promoted online, by the media, and sometimes even by dermatologic clinics. Their use has been popular for decades among women throughout the world, mainly in Africa and Asia. Having a light skin or fair complexion has become an aspiration for many people around the world, and the use of skin-lightening creams has become an increasingly popular cosmetic practice in other parts of the world (Blay, 2011; Ladizinski et al., 2011; Dlova et al., 2015) despite several published studies on their adverse health effects after extended application. According to a 2015 report by global industry analysts covering major geographic regions such as the USA, Japan, Europe, Asia-Pacific (China, India, and "Rest of Asia-Pacific"), and "Rest of World" (http://www.researchandmarkets.com/reports/1056077/), the market for skin-lightening creams is projected to reach US$23.0 billion by 2020.

Mercury is added to creams because of its ability to inhibit the pigment melanin (Engler, 2005). The hypothesis is that mercury may replace the copper required for tyrosinase activity and thereby inactivate the enzyme, leading to the whitening action (Denton et al., 1952). Inorganic mercury is used in these creams because the skin easily absorbs it (Palmer et al., 2000). Organic forms such as phenyl mercuric acetate are sometimes used as cosmetic preservatives, and inorganic forms, such as ammoniated mercury, are the active ingredients in skin-lightening creams (Marzulli and Brown, 1972).

2. Worldwide legislation

The US Food and Drug Administration (US FDA) recently stated that skin-lightening creams should contain no more than a trace amount of mercury, less than 1 ppm, as unavoidable impurities under the conditions of good manufacturing practice (US FDA, 2011). Washam (2011) pointed out that the creams are still crossing the USA border despite FDA recalls prohibiting skin-lightening creams containing mercury. Health Canada's draft guidance on heavy-metal impurities in cosmetics specifies a limit of 3 ppm

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Table 1
Mercury contents in skin-lightening creams reported from various countries.

Study	Location	Found/total	Mercury content (ppm)
Murphy et al. (2015)	Cambodia	13/60 (21.7%)	2022, higest 6305
Maneli et al. (2016)	South Africa	12/29 (41.4%)	30–2300
Wang and Zhang (2015)	China	143/146 (97.9%)	Highest 0.045
Travasso (2014)	India	14/32 (43.8%)	0.1–1.97
Hamann et al. (2014)	USA	33/549 (6%)	>1000–45,622
Amponsah et al. (2014)	Ghana	0/50	0.001–0.549
Adawe and Oberg (2013)	Somali	11/27 (40.7%)	>1 (1.07 to 33,000)
Cristaudo et al. (2013)	Italy	1/6 (16.7%)	0.039
Alqadami et al. (2013)	Saudi Arabia	22/34 (64.7%)	>1 (1.289–2745)
Naser and Kirm (2012)	Sultanate Oman	25/40 (62.5%)	>1
Peregrino et al. (2011)	Mexico	6/16 (37.5%)	878–35,824
Al-Saleh et al. (2011a)	Saudi Arabia	2/23 (8.7%)	>1 (95.75 & 314,386.67)
McKelvey et al. (2011)	New York, USA	8/17 (47.1%)	3.37–41,600
Al-Ashban et al. (2006)	Saudi Arabia	30/88 (34.1%)	>1 (2.46–23,222)
EARTH (2003)	Thailand	10/47 (21.3%)	63.53 to 99,070
Al-Saleh and Al-Doush (1997)	Saudi Arabia	17/38 (45%)	>1 (1.18–5650)

for mercury as an impurity in cosmetic products (http://www.hc-sc.gc.ca/cps-spc/pubs/indust/heavy_metals-metaux_lourds/index-eng.php). Kenya, Mexico, and Brazil have instituted labeling systems to inform the public about the limits of mercury in skin-lightening products, and Russia has banned their sale (Uram et al., 2010). The Philippines Food and Drug Administration (FDA) has banned 70 skin-lightening creams containing more than the allowable limit of 1 ppm mercury since January 2010 (http://www.cosmeticsdesign-europe.com/Regulation-Safety/Philippines-FDA-updates-list-of-banned-mercury-laden-cosmetics). A European Union Directive banned the use of mercury as an ingredient in cosmetics, including skin-lightening products (EC, 2009).

Despite governmental efforts in many countries to ban the sale of skin-lightening creams containing mercury, these products are available for sale over the Internet, providing unlimited access to potential customers. Hamann et al. (2014) reported that many skin-lightening creams available to US consumers either online or in stores contained mercury above the US FDA limit.

3. Mercury contents in skin-lightening creams and their global use

Many studies worldwide have reported the presence of high mercury contents in skin-lightening, including countries with strict legislation as shown in Table 1. For example, Hamann et al. (2014) found 6.0% of 549 tested products contained mercury above 1000 ppm. In all, 45% of the mercury-containing samples contained the metal more than 10 000 ppm. High mercury contents well above the US FDA limits were found in many products sold in Saudi markets for more than a decade (Al-Saleh and Al-Doush, 1997). The government later banned some of these products. However, some are still sold in the Saudi market despite warnings against their use, as shown by our study in 2011 (Al-Saleh et al., 2011a). A study by Alghamdi (2010) reported that skin-lightening was a common practice among Saudi women. The author found that 197 of 506 Saudi women (38.9%) used skin-lightening cream; only 26.7% used them for medical purposes, and 20.8% were willing to use any skin-lightening creams that gave the fastest results, even if the components were unknown. The authors also found that approximately 10 and 21% of the women applied skin-lightening creams during pregnancy and lactation, respectively. Naser and Kirm (2012) found that one-fourth of the skin-lightening creams sold in the Sultanate of Oman contained mercury above the FDA acceptable limit of 1 μg/g, and the highest was 25.7 μg/g. A recent study by Wang and Zhang (2015), however, reported that mercury detected in 91.8% of various cosmetic products, including skin-lightening creams sold in China, but levels in all the goods were lower than 1 μg/g, the Chinese acceptable limit. A recent study by Copan et al. (2015) showed that users of skin-lightening creams contaminated with mercurous chloride, or calomel for skin-lightening and acne treatments, led to a multi-pathway mercury exposure among family members. The authors found that calomel could change the valence form to elemental mercury and volatilize once exposed to the skin or indoor surfaces.

Furthermore, a few studies have reported that some mercury skin-lightening creams contain one or more toxic ingredients that in most cases were not listed on the packaging, such as metals, hydroquinone, titanium dioxide, and corticosteroids (Al-Saleh et al., 2011a; Cristaudo et al., 2013; Iwegbue et al., 2015). Many of these ingredients are very harmful and may pose a health risk if the frequency of application, the duration of treatment and the body surface area involved are taken into account and if they are used during pregnancy and lactation.

4. Exposure to mercury from skin-lightening creams and its health effects

Chan (2011) extensively searched the Medline (1950–2011) and reported 31 studies of mercury poisoning following the use of skin-lightening creams containing mercury mostly by women who were neither pregnant nor breastfeeding and concluded that the use of mercury in these products should be strictly prohibited. He further stated that the public should be warned not to use such products, because their use can result in the systemic absorption and accumulation of mercury, leading to renal, gastrointestinal, and central nervous system toxicity. Cases of mercury toxicity and dermatologic complications due to the use of skin-lightening creams have been reported since the 1970s (Barr et al., 1973; Summa, 1975; Luderschmidt and Plewig, 1979; Gras and Mondain, 1981; Dyall-Smith and Scurry, 1990; Mahé et al., 1993, 2003; Otto et al., 1994; Sin and Tsang, 2003; Soo et al., 2003; Özkaya et al., 2009). Al-Saleh and Shinwari (1997) observed an association between the use of skin-lightening creams and urinary mercury in healthy Saudi women between the ages of 17 and 58 years, and 23% of the women had mercury levels above the reference value of 4 μg/l proposed by the World Health Organization in 1991 for non-exposed populations (WHO, 1991). Mercury levels in urine can increase gradually with repeated application of skin-lightening creams (Barr et al., 1973). Interestingly, the Centers for Disease Control and Prevention (CDC, 2012) found high mercury contents in household air and the urine of both users and non-users of skin-lightening creams. Some studies have reported the frequent use of skin-lightening creams and its potential harmful effects (Luderschmidt and Plewig, 1979; Balluz et al., 1997; Garza-Ocanas et al., 1997; Jovanovic et al.,