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DERMATOLOGY | RESEARCH ARTICLE

Toxic content of certain commercially available fairness creams in Indian market

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Abstract: People of Asian countries are very much conscious about complexion. This desire is exploited with advertisements of fairness creams in both the print and visual media which allure youngsters with promises of desired results. Skin lightening products occupy 61% of dermatological market in India. Cosmetics are supposed to be safe and healthy, but research reports on their toxicities are available. Heavy metals are added intentionally or unintentionally to cosmetics, the presence of which, the consumers are mostly unaware of. Arsenic, lead and mercury are top among hazardous systemic toxicants, which induce toxicity even at low levels of exposure. In this connection a survey was conducted among college students and working women regarding the usage of fairness creams, which revealed that use of fairness creams, is common. As per the information gathered, four most commonly used brands of fairness creams in Kerala, India, were analysed for arsenic, lead and mercury by ICP-MS. Although not in high levels, these were present in varying amounts in the four most commonly used brands of fairness creams. Analysis revealed the importance in choosing cosmetics with caution and to minimize the usage as far as possible.

Subjects: Toxicology; Public Health Policy and Practice

Keywords: cosmetics; fairness-creams; toxic heavy metals; ICP-MS

1. Introduction

Skin-lightening or “fairness” creams are big business in India. Skin-whitening products are particularly popular in Asian countries like India, China, Japan, and Korea (Burger, Landreau, Azoulay, Michel, & Fernandez, 2016). Such products occupy 61% of dermatological market in India (World

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PUBLIC INTEREST STATEMENT

Mercury, arsenic, lead and other such heavy metals are highly toxic even at low doses. The presence of these three heavy metals, though much less than the permissible limits, in all the four commonly used fairness creams studied currently, must be viewed as a precaution, because the chronic impacts of such a small level over a long period of usage are not yet fully understood. Beauty perceptions and the prejudice that dark skin is inferior to fair skin ought to change in the society in order to reduce the indiscriminate use of fairness creams. Women should be more conscious in this regard, as the foetus and breast-fed babies could fall victims.

Health Organization, 2011). Many corporate companies are profiting on colourism, equating light coloured skin with beauty, success, and empowerment (Nadeem, 2014). In the European Union, skin lightening products are considered as cosmetics, whereas in the United States, over-the-counter (OTC) drugs, and in Japan, quasidrugs (Salvador & Chisvert, 2007). Repeated direct applications of cosmetics to human skin, mucous membranes, hair and nails are supposed to be safe and healthy (Borowska & Brzóška, 2015), provided there are no toxic components in them. The common ingredients in cosmetics consist of preservatives, fragrance and heavy metals (Siti Zulaikha, Sharifah Norkhadijah, & Praveena, 2015), but some of which, including the impurities may be toxic to the consumers. Among the toxic components, heavy metals are one of the major ingredients, which are used in them intentionally (Iwegbue et al., 2015; Siti Zulaikha et al., 2015). Among the heavy metal impurities, mercury, arsenic, lead, cobalt, antimony, cadmium, nickel and chromium are highly toxic and are banned in cosmetics to be added intentionally as ingredients in European Union and United States (Bocca, Pino, Alimonti, & Forte, 2014; Iwegbue et al., 2015). Mercury salts are commonly added ingredients as fairness agents in cosmetics, whereas lead acetate is common in hair dyes. Addition of toxic ingredients to cosmetics as well as presence of toxic ingredients in cosmetics without proper warning on the toxicity are unethical practices involved in the marketing of such products (Eagle, Dahl, & Low, 2014).

The common side-effects of skin lightening cosmetics include both cutaneous and extra cutaneous effects (De Groot, Nater, & Weyland, 1994). Damage to the skin is the most frequently identified negative health outcome associated with skin bleaching. Stunted Purkinje cell dendrite growth, disruption of normal DNA functioning, renal and neurological complications, cataracts, glaucoma, Cushing-syndrome and the like are also impacts of cosmetics, whereas skin bleaching can harm foetal development in pregnant skin bleachers (Street, Gaska, Lewis, & Wilson, 2014). An experimental study with bleaching creams revealed disruption of mitosis in onion root cells (Udengwu & Chukwujekwu, 2008). It means that the ingredients in such creams are mito-depressive in action and can induce chromosome abnormalities as well as endomitosis. Similar can be the effects of toxic creams on human skin when applied, which may transform normal skin cells to malignant cells.

Arsenic (As), lead (Pb) and mercury (Hg) are the most notorious among the hazardous substances (Wang, 2012). Lead, mercury, cadmium and arsenic cause human health problems worldwide and are systemic toxicants (Jan et al., 2015). Chronic arsenic exposure can affect almost all the systems of the body (Huang et al., 2009). Lead poisoning can occur even at low concentration and may cause neurological damage and adverse effects on other systems (Iwegbue et al., 2015). Mercury inhibits melanogenesis in melanocytes by inactivating tyrosinase, the important catalyst in melanin production (Engler, 2005), thus reducing pigmentation. Mercury is hazardous to health (World Health Organization, 2011) and has the potential to cause Central Nervous System, gastrointestinal and nephro toxicities (Chan, 2011). Usage of cosmetics is increasing in the society, especially among women and teenage girls, and now even among men. Therefore, it has become urgent to analyse the safety of cosmetic products available in the market. Information on the presence of heavy metals in cosmetics in India remains quite negligible. In this context, a study on the use of cosmetics by our people is assessed and the degree of contamination of mercury, arsenic and lead in certain commonly used fairness creams in Kerala State of India is analysed.

2. Materials and methods

In order to assess the use of fairness creams, in the population, a group of college students and working women ($N = 140$), was randomly selected for a mini survey. They completed a questionnaire comprising of questions related to usage of fairness creams. As per the information gathered, four most commonly used brands of fairness creams in Kerala, India, the “Fair & Lovely-Antimarks”, “Fair & Lovely-Ayurvedic care”, “Pond’s white beauty”, and “Olay Natural White” were chosen for heavy metal study.

Heavy metals such as mercury, arsenic and lead were analysed in three samples of each of the four brands which belonged to different batches. A total of twelve samples were purchased from

retail shops in Kerala. Batch number, manufacturing address and manufacturing date of each were recorded (Table 1). With a Teflon spatula, 15 gm of each sample was transferred into clean sample container for analysis. The di-acid digested samples were analysed for mercury, arsenic and lead by Inductively Coupled Plasma-Mass Spectrometry (ICP-MS), Agilent 7700 analyser, at the Chemical analytical facility of Ministry of Ayush, Government of India known as “CARE Keralam”, Koratty, Thrissur, Kerala, India. The detection limit was 0.5 µg/kg or µg/L (0.5 ppb). The results were collected and recorded as per laboratory norms. Data were analysed and the significance of difference was tested using analysis of variance technique. The critical difference (CD at $p = 0.05$) was calculated and compared using Excel.

3. Results

In the survey outcome, 41.4 p of women used fairness creams (Table 2). Among the users, 67.2% used them on a daily basis (Table 3), and 91.4% of the users found their creams effective (Table 4) and were satisfied with the product they used.

Table 1. Product information of Fairness creams analysed for mercury, arsenic and lead

S.No:	Name of Fairness cream	Manufactured by	Date of manufacture	Use before	Batch No:
1	Fair & Lovely-Antimarks(a)	Hindustan Unilever Ltd.	14 May 2015	24 months from pkd	B09
		Unit-8, Plot No.1-(1-H), Sec-1A,Sidcul, Ranipur, Haridwar-249403, Uttarakhand			
2	Fair & Lovely-Antimarks(b)	Hindustan Unilever Ltd.	23 October 2015	24 months from pkd	B16
		Unit-8, Plot No.1-(1-H), Sec-1A,Sidcul, Ranipur, Haridwar-249403, Uttarakhand			
3	Fair & Lovely-Antimarks(c)	Hindustan Unilever Ltd.	8 May2016	24 months from pkd	B01
		Unit-8, Plot No.1-(1-H), Sec-1A,Sidcul, Ranipur, Haridwar-249403, Uttarakhand			
4	Fair & Lovely-Ayurvedic care (a)	Hindustan Unilever Ltd.	26 December 2014	24 months from mfd	B34
		Unit-8, Plot No.1-(1-H), Sec-1A,Sidcul, Ranipur, Haridwar-249403, Uttarakhand			
5	Fair & Lovely-Ayurvedic care (b)	Hindustan Unilever Ltd.	20 June 2016	24 months from mfd	B14
		Unit-8, Plot No.1-(1-H), Sec-1A,Sidcul, Ranipur, Haridwar-249403, Uttarakhand			
6	Fair & Lovely-Ayurvedic care (c)	Hindustan Unilever Ltd.	16 July 2016	24 months from mfd	B17
		Unit-8, Plot No.1-(1-H), Sec-1A,Sidcul, Ranipur, Haridwar-249403, Uttarakhand			
7	Pond's white beauty (a)	Hindustan Unilever Ltd.,	22 July 2016	24 months from pkd	B082
		L.B.C.P.Unit-II, Haridwar-249403, Uttarakhand			
8	Pond's white beauty (b)	Hindustan Unilever Ltd.,	18 March 2016	24 months from pkd	B086
		L.B.C.P.Unit-II, Haridwar-249403, Uttarakhand			
9	Pond's white beauty c)	Hindustan Unilever Ltd.	29 July 2016	24 months from pkd	B219
		L.B.C.P.Unit-II, Haridwar 249403, Uttarakhand			
10	Olay Natural White (a)	Procter & Gamble Home Products Pvt. Ltd.	23 November 2015	36 months from mfd	B8711
		Plot No: 1, Industrial Area, Katha P.O.Baddi-173205. Solan, H.P.			
11	Olay Natural White (b)	Procter & Gamble Home Products Pvt. Ltd.	16 September 2016	36 months from mfd	B3351
		Plot No: 1, Industrial Area, Katha P.O.Baddi-173205. Solan, H.P.			
12	Olay Natural White (c)	Procter & Gamble Home Products Pvt. Ltd.	23 September 2016	36 months from mfd	B3551
		Plot No: 1, Industrial Area, Katha P.O.Baddi-173205. Solan, H.P.			

Table 2. Fairness cream use in the sample population

Fairness cream use	Frequency (N = 140)	%
Users	58	41.4
Non-users	82	58.6

Table 3. Frequency of fairness cream usage

Frequency of use	Frequency (N = 58)	%
Daily users	39	67.2
4–6 days/week	3	5.2
2–3 days/week	7	12.1
Once a week	9	15.5

Among the four most commonly used brands of fairness creams analysed for mercury, arsenic and lead, no significant difference in mercury was observed between the varieties from different brands. In the case of lead too, there was no significant difference among varieties. But, in the case of arsenic, Olay Natural white showed the highest content (8.783 ppb) and Fair & Lovely-Ayurvedic care showed the lowest (1.897 ppb). However, unlike mercury and lead, a significant difference in arsenic was observed between different varieties (Table 5). Lead was found highest among all the three heavy metals studied in all the four brands, followed by arsenic and mercury (Figures 1 and 2).

4. Discussion

The present mini-survey revealed that 41.4% of women used fairness creams and that 67.2% used them on a daily basis. 91% of the users found their creams effective and were satisfied with the product they used. Present outcomes of the mini survey were consistent with those reported by others. Glenn (2008) reports that in India 60–65% of women use skin lightening creams. In a South African study, these were used by a third of African and Indian women there, and 90% users were satisfied with the products (Dlova, Hamed, Tsoka-Gwegweni, & Grobler, 2015). Similar reports were obtained from studies at Jordan (Hamed, Ttayem, Nimer, & AlKhatib, 2010), Sub-Saharan African countries (Mahé, 2013) and Senegal (Del Giudice & Yves, 2002). Prevalence of use of skin lightening cosmetics was 77.3% in Lagos, Nigeria (Adebajo, 2002).

The largely unregulated chemical content of skin lightening products, especially in developing countries is alarming. The European Union Cosmetics Directive lists lead and their compounds as unacceptable constituents of cosmetic products (Salvador & Chisvert, 2007). Arsenic and lead are prohibited in cosmetics by European Union. In India cosmetic products are regulated under the drugs and cosmetics act 1940 and rules 1945 and labelling declarations are regulated by Bureau of Indian Standards (BIS) (Sahu, Saxena, & Johnson, 2014). Rule 134 of drugs and cosmetics rules specifies that cosmetics shall not contain more than 2 ppm (parts per million) of arsenic and 20 ppm of lead. The rule 145 of the drugs and cosmetics rules totally disallows the use of lead and arsenic in cosmetics for colouring purpose and the rule 135 prohibits import of such cosmetics. Manufacture and import of cosmetics containing mercury compounds are prohibited by rule 145 D and 135 A. Drugs and cosmetics act prohibits intentional use of mercury in fairness creams (Sahu et al., 2014).

Many studies on mercury content of skin lightening creams have been reported from different parts of the world. Mercury tested in 549 such products from 32 countries by Hamann et al. (2014), confirmed presence of mercury in skin lightening products as a global phenomenon, with very high levels in some. In 14 of 32 samples of skin-lightening creams from Delhi markets, in the CSE (Centre for Science and Environment) study by Sahu et al. (2014), mercury was detected in the range of 0.10–1.97 ppm, and three samples were found to exceed the FDA limit of 1 ppm. In the present study, the level of mercury estimated in Pond’s white beauty was 4.727 ppb, “Olay Natural White”,

Table 4. Effectiveness of fairness cream usage

Effectiveness	Frequency (N = 58)	%
Effective	53	91.4
Not effective	5	8.6

Table 5. Mercury, arsenic and lead levels in fairness creams in ppb (µg/kg)

S.No.	Fairness cream	Mercury	Arsenic	Lead
1	Fair & Lovely-Antimarks	2.213	2.737	23.317
2	Fair & Lovely-Ayurvedic care	2.813	1.897	19.873
3	Pond's white beauty	4.727	5.213	21.683
4	Olay Natural White	3.800	8.783	11.107
	CV	25.964	45.578	51.715
	CD ($p = 0.05$)	NS	4.241	NS

3.800 ppb, “Fair & Lovely-Ayurvedic care” 2.813 ppb and in Fair & Lovely-Antimarks 2.213 ppb. These were not significantly different between the brands. According to the Drugs and Cosmetics Act, mercury in fairness creams is prohibited. Therefore, mercury contained in the samples of the present study is violation of the Act. Concentration of metals may vary within different batches of the sample from the same manufacturer (Iwegbue et al., 2015; Nnorom, 2011). Mercury levels in the four fairness creams were lower than those of the CSE study (Sahu et al., 2014), which may be due to batch to batch inconsistency in manufacturing.

There are not many reports on arsenic and lead in fairness creams though many are there in other cosmetics such as lipsticks and eye shadows (Bocca et al., 2014; Borowska & Brzóška, 2015; Sainio, Jolanki, Hakala, & Kanerva, 2000; Volpe, Nazzaro, Coppola, Rapuano, & Aquino, 2012). Liu, Katharine Hammond, and Rojas-Cheatham (2013) reports about 75% of lip products tested containing lead and those too, in very high amounts in half of the samples. Lead levels though not very high (0.5–4.5 ppm) in skin lightening creams studied in Nigeria, was higher than that found in moisturising creams in the same study (Iwegbue et al., 2015).

Figure 1. Mercury, arsenic and lead levels in fairness creams in ppb (µg/kg).

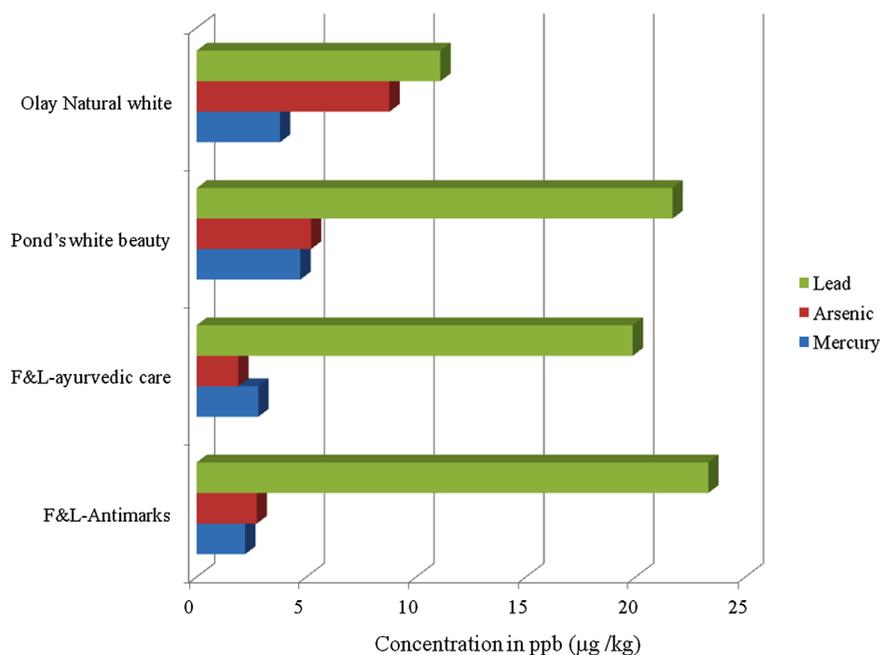
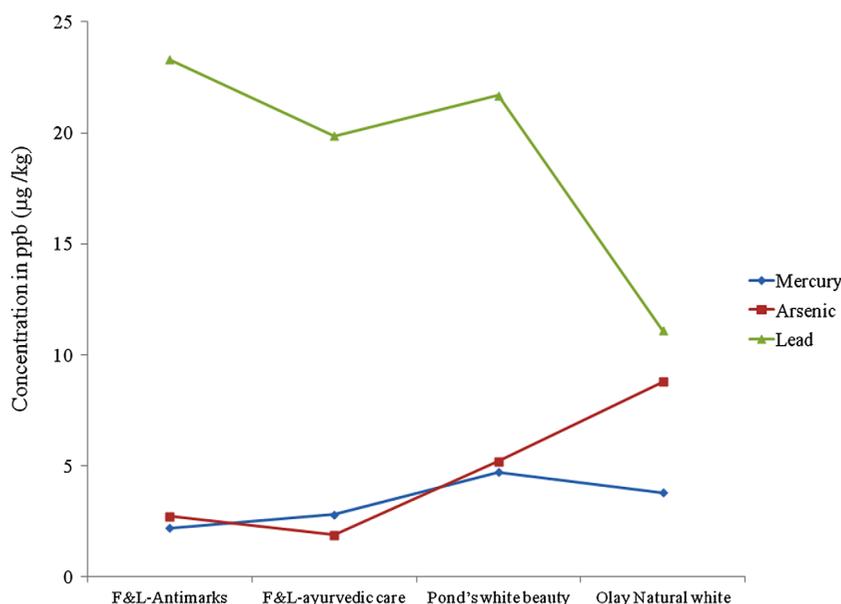


Figure 2. Comparative mean concentrations of mercury, arsenic and lead in fairness creams.



Arsenic and lead were also detected in all brands of fairness creams in the current study. For the arsenic content, Olay Natural white had highest (8.783 ppb) and Fair & Lovely-Ayurvedic care, the lowest (1.897 ppb). Fair & Lovely-Antimarks and “Pond’s white beauty” had 2.737 and 5.213 ppb of arsenic respectively. The lead levels were not significantly different between the brands, though lead was found highest among all the three heavy metals studied in all the four brands in the present study. The rule 134 of drugs and cosmetics rules specifies that cosmetics shall not contain more than 2 ppm (parts per million) of arsenic and 20 ppm of lead. Therefore, arsenic and lead levels cosmetics in India in the current study were much lower than the permissible limits.

5. Conclusion

Use of fairness creams was common. Although not in high levels, mercury, arsenic and lead were present in varying amounts in the four most commonly used brands of fairness creams in Kerala, the “Fair & Lovely-Antimarks”, “Fair & Lovely-Ayurvedic care”, “Pond’s white beauty”, and “Olay Natural White”. Although in amounts much less than the permissible limits, the presence of such toxic compounds in commonly used cosmetics must be viewed as a precaution, because the chronic impacts of such a small level over a long period of usage are not yet fully understood. Therefore, a change in the attitude of stakeholders in the usage of fairness creams and the prejudice that dark skin is inferior to fair skin is significant to avoid such environment impacts. Present findings necessitate further research on the adverse health effects, especially of chronic exposure to heavy metals in fairness creams.

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Competing interests

The authors declare no competing interest.

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