Determination of Lead and Cadmium in cosmetic products

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ABSTRACT

Heavy metal toxicity to the humans and animals is the result of long term low or high level exposure to pollutants common in our environment including in air we breathe, water, food etc. Apart from these, numerous consumer products like cosmetics and toiletries have been reported as a source of heavy metal exposure to human beings. Heavy metals like lead and cadmium were determined in different cosmetics products viz soap, face cream, shampoo, shaving cream etc from local market of Gwalior with atomic absorption spectrophotometer.   Lead was prominently detected in all of cosmetics products followed by cadmium. Among the different cosmetics products studied, the highest heavy metal contamination was found in bathing soap. Present study concludes that though in less amount but beauty cosmetic products are contaminate with heavy metals and hence may results in skin problems.

Key words: Lead, cadmium, cosmetic products.
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INTRODUCTION

Since the dawn of civilization cosmetics have constituted a part of routine body care not only by the upper strata of society but also by middle and low class people. Last few decades have shown a big boost in cosmetic in industries, by the production of the various types of the cosmetics which are needed for the care and beatification of the skin, hair, nails, teeth, body comprises of creams, beauty soaps, talcum and face powders, lotions, shampoos, hair oils, hair dyes, hair colors, perfumery items, lipsticks, sindoor, kajal, bindi, shaving creams, henna, rouge, body

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lotions, tooth paste etc. Although beauty consciousness of people has set the demand of cosmetics in market, the side effects as well as health consciousness of people has attracted the clinicians and researchers to find out the probable reason behind their side effects. Heavy metal contamination is one of the important reasons behind the same problem. Heavy metals like lead and cadmium are common contaminant in various cosmetic products [1, 2].

Lead poisoning has been a recognized health hazard for more than 2,000 years. Characteristic features of lead toxicity, including anemia, colic, neuropathy, nephropathy, sterility and coma. Exposure to low-levels of lead has also been associated with behavioral abnormalities, learning impairment, decreased hearing, and impaired cognitive functions in humans and in experimental animals [3]. There have been a number of reports in the media and on internet about the presence of lead in branded cosmetic products [2] Studies have revealed that many kohl eyeliners containing serious levels of lead are imported from India, Arabia and the Middle East. Long exposure to lead can bring on hypertension, caused through kidney damage. Some studies from Al-Saleh et al [4, 5] have revealed that lead from kohl can enter the body through skin absorption in children's as well as in their parents. Cadmium is a deep yellow to orange pigment and mostly present in lipsticks and face powders. The use of cadmium in cosmetics products are due to its color property as it has been used as a color pigment in many industries [6] Although many studies have been reported the presence of above metals in cosmetic products especially in lipsticks and nail polish, however data about their presence in soap, talcum powder, shaving cream etc is scanty. Present study thus planned to see if such cosmetics are contaminated with lead and cadmium.

EXPERIMENTAL SECTION

2.1 Collection of Samples
Samples of the most popular brands of cosmetics were collected from the various retail shops from local market of Gwalior. Total three different brands (coded A, B and C) of each product and total five samples of one brands of each samples were taken for study. In this way total 15 samples (5 samples for each brand A, B and C respectively) were collected for one cosmetic product. The information about test items and their quantities used in present study is summarized in table I. Five samples of different brands of each cosmetic viz. toilet soap, face cream, shampoo, shaving cream and talcum powder were collected separately in sterilized polythene bags.

2.2 Sample preparation
Sample preparation for heavy metal analysis was done under standard procedure. Briefly 1 gm of each sample was digested in approximately 5 ml mixture of concentrated acid (HNO_3 and Perchloric acid in 3:1 ratio) for 2-3 hrs on a hot plate. If black or brown color is appeared then again add 3.0 ml of mixture of concentrated acids to find out the white colored sample. The above digested samples were dissolved in 10 ml triple distilled water and filtered with the help of whatman number 1 filter paper. The clear solution was used for metal quantification.

2.3 Heavy metals quantification
Two metals i.e. lead and cadmium was analyzed through atomic absorption spectrophotometer (AAS PerkinElmer model AAnalyst 100).

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2.4 Statistics analysis

Total five samples of same product were analyzed for metal estimation and mean value was shown in results.

Table I Summarization of test items and their quantity used in the study

S.No	Brand Code	Sample name (code name)	Number of test items
1	Lower class (A)	Soap (SA)	5
		Face cream (FC-A)	5
		Shampoo (Sh-A)	5
		Shaving cream (SC-A)	5
		Talcum powder (TP-A)	5
2	Middle class (B)	Soap (SB)	5
		Face cream (FC-B)	5
		Shampoo (Sh-B)	5
		Shaving cream (SC-B)	5
		Talcum powder (TP-B)	5
3	Higher class (C)	Soap (SC)	5
		Face cream (FC-C)	5
		Shampoo (Sh-C)	5
		Shaving cream (SC-C)	5
		Talcum powder (TP-C)	5

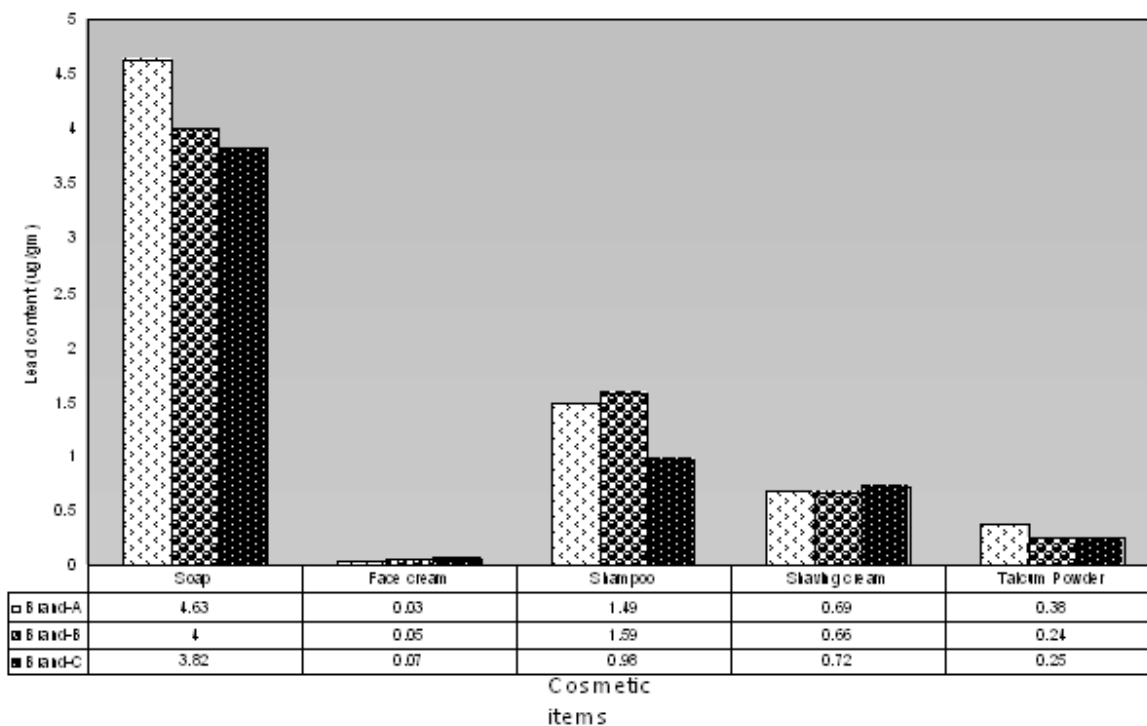|	Soap	Face cream	Shampoo	Shaving cream	Talcum Powder
Brand-A	4.63	0.03	1.49	0.69	0.38
Brand-B	4	0.05	1.59	0.66	0.24
Brand-C	3.82	0.07	0.98	0.72	0.25

Figure 1: Lead concentration in cosmetics (microgram/gram)

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RESULTS AND DISCUSSION

Cosmetics are one of the most important sources of releasing heavy metals in the environment. The possibility of skin allergy/ contact dermatitis may increase due to the presence of heavy metals in cosmetics. Since the heavy metals toxicity has been exemplified the problem of environment pollution, it is necessary to know about the all possible sources. In this context, we have tested the different cosmetic products for the presence of lead, cadmium. Total three brands of each cosmetic product were taken for study. These three brands were categorized according to their use by different society of people e.g. brand A was mostly used by lower class society, brand B was for middle class and brand C was for higher class society. The results of lead concentration in different cosmetic products has depicted in figure 1.
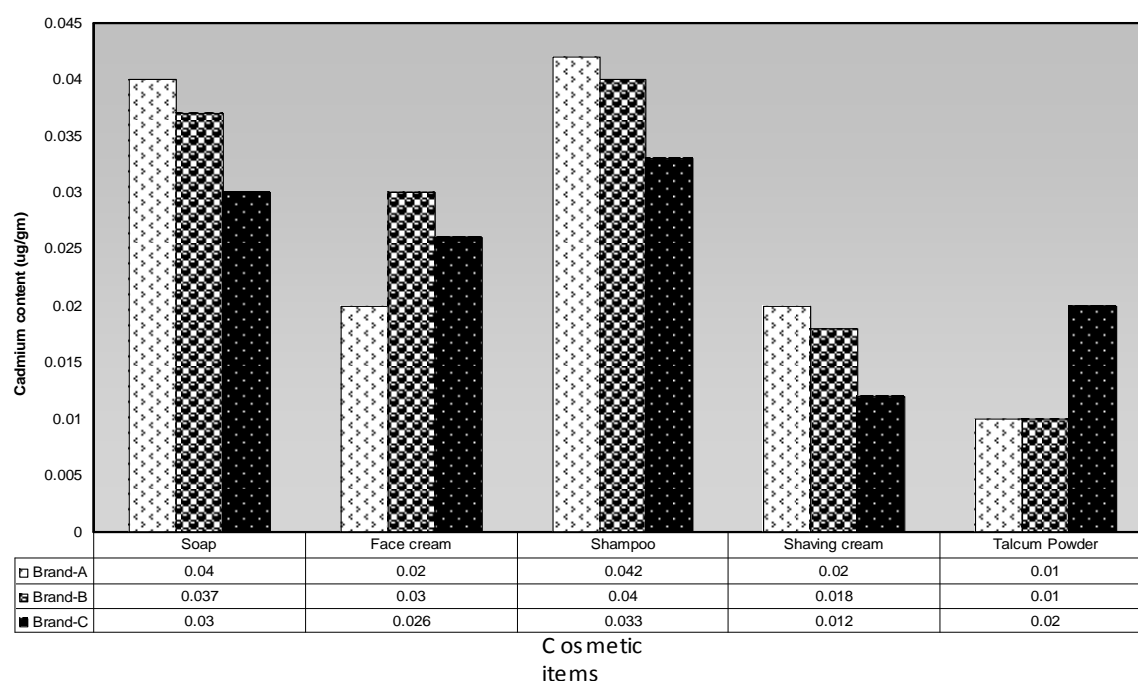
	Soap	Face cream	Shampoo	Shaving cream	Talcum Powder
□ Brand-A	0.04	0.02	0.042	0.02	0.01
▣ Brand-B	0.037	0.03	0.04	0.018	0.01
■ Brand-C	0.03	0.026	0.033	0.012	0.02

Cosmetic items

Figure 2: Cadmium concentration in cosmetics (microgram/gram)

Among the different samples analyzed, the highest concentration of lead was detected in Soap with brand code A (S-A) followed by shampoo with brand code B (Sh-B) while face cream (FC-C) and talcum powder (TP-B and C) showed lowest lead content. In compare between same products with different brand, mostly brand A showed the highest concentration followed by brand B. Lead is not essential element and is of no known biological value. Hardy et al [7] have analyzed total 23 kohl samples for heavy metal contamination, in results they concluded that lead was found to be the main constituent of almost half the kohl samples examined in this study. For the four Dubai city purchased kohls, one was based on galena, two on amorphous carbon and one sassolite. For the 18 Abu Dhabi city-purchased kohls, nine were based on galena, one on amorphous carbon, five on zincite, one on calcite/aragonite and two on sassolite. Recently heavy

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metals like lead, cadmium were determined in lipstick using laser induced breakdown spectroscopy where they found the concentrations of lead, cadmium and chromium was beyond their safe maximum permissible limit (MPS) i.e. 0.5ppm, 0.5ppm and 1ppm respectively [8]. The presence of lead in cosmetics has also been reported and thus the European Union (EU) law for cosmetic banned lead and lead compounds in cosmetics since 1976, [9] however trace amount of lead are unavoidable under conditions of good manufacturing practice [2].

The highest concentration of cadmium was detected in shampoo with brand code A (S-A) followed by soap with A and B brand (S-A and S-B). All brands of talcum powder showed the presence of cadmium in very trace amount. The result is described in figure 2.

Although the presence of cadmium in the samples were in trace amount but the slow release of cadmium with low amount may also cause harmful effects to the human body. The presence of cadmium has also reported in various lipsticks [8] it does not have to be present in abundance in products to produce hypertension. In fact, results from tests showed that it was minor exposure that caused high blood pressure. When cadmium was injected directly into the subject it caused blood pressure to drop. So the small amounts are not safe. It targets blood vessel and heart tissue, as well as, the kidneys, lungs and brain, and results in heart disease, hypertension, liver damage, suppressed immune system and other nasty symptoms [6, 10].

CONCLUSION

In the present study, we determined the lead, cadmium in various cosmetics of different brands. Based upon the results, we concluded that lead is one of most prominent toxic heavy metals in cosmetic products; however both cadmium and lead were under the permissible limit. The continued use of products contaminated with such heavy metals may cause slow release of these metals into the human body and thus show their harmful effects. So the extensive uses of such products should be avoided.

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