



Toxic Beauty. Are Cosmetics Harmful To Our Health?

KEYWORDS

Lead toxicity, Lipstick, Cosmetics

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ABSTRACT *The routes of entry of heavy metals like lead (Pb) includes some cosmetics, especially color cosmetics like lipsticks. Pb toxicity induced by lipsticks affect the women using them, the unborn fetus, if used in pregnancy, and infants, when used during lactation.*

This study aims to determine Pb content in lipstick brands sold across Indian markets, and attempts to quantify whether and how far they exceed the maximum permissible limit approved by FDA.

The samples were processed by wet digestion method and analysis was done by Flame Emission Spectrophotometry.

Study shows an alarmingly higher Pb level in all the samples tested. The lead concentrations in various lipstick colors, in decreasing order are- Brown> Pink> Purple> Maroon> Red.

Continuous use of these cosmetics could result in an increase in toxic metal levels beyond permissible limits. Therefore, effort should be made towards enlightening the users and the distributors of the health risks involved.

Introduction:

Heavy metal toxicity to the humans and animals is a result of optimum level exposure to pollutants common in our environment, including the air we breathe and water & food we consume. Apart from these, numerous consumer products like cosmetics and toiletries have been reported as a source of heavy metal exposure to human being. Although consumerism has set the demand of various brands of cosmetics in market, various side effects, as well as toxic effects have been attributed to it, so much so that clinicians and researchers have always been attracted to seek out the reasons behind these effects. It has been established that heavy metal like lead (Pb) is a common contaminant in various brands of cosmetics, mostly color cosmetics like lipsticks, and is responsible for a variety of toxic effects¹.

The health risks of Pb contamination include multiple systems involvement like hepatic, hematological and neural damage^{2,3}. Even the unborn fetus of pregnant mother can suffer the damages of inadvertent consumption of heavy metals present in cosmetics like lipstick, showing arrested growth and development⁴.

Studies have been conducted all over the world to determine the actual amount of heavy metals present in lipsticks^{1,2}. The campaign for safe cosmetics Centers for Disease Control and Prevention (CDC) in the United States (CSC2007) raised concern about the presence of lead in lipsticks⁵. Lead is mainly present in the pigments used to add color to the lipstick bar. The concentration of pure pigment can vary from 1% (in lip-gloss) to 10% (in darker shades of long-lasting formulae) depending on the type of product. Since the US Food and Drug administration (FDA) has not set a limit for lead in lipsticks, the CSC's results were evaluated based in the acceptable limit of lead in candy, assuming that lipstick can be swallowed like candy. They found that half of the 33 brand name red lipsticks contained detectable lead in the range of 0.03-0.65 µg/gm, and 1/3 of the tested lipsticks exceeded the acceptable FDA limit of lead in candy (0.1 µg/gm)⁶.

Many other studies have proven that cosmetic products are a possible source of heavy metal exposure to humans⁷. It not only causes multi organ complications like hepato-renal, cardiovascular, neurological and hematological effects in adults chronically exposed to it, but is also responsible for in utero complications resulting in preterm delivery and small for date babies, if used excessively by pregnant women. Also the lead accumulated in mother's body can substitute for calcium required for the skeletal development of fetus, if the mother's diet is calcium deficient⁴. However, no studies have been conducted in India to find out the amount of lead present in color cosmetics like lipstick, which is very commonly used by Indian women. The aim and objective of the present study is to assess the public health risk due to presence of toxic heavy metal like Pb in some commonly used brands of lipsticks and to determine whether and how far they exceed the maximum permissible limit approved by FDA.

Materials and Methods:

For the quantitative determination of lead, the local markets were surveyed for the most popular brands and 48 samples from 8 brands of lipstick were used. The brands were categorized as high end luxury brands (A), medium range commercially available and drugstore brands (B) and cheaper locally available imported brands (C) and coded accordingly. Lipsticks of the commonly used shades pink, red, brown, purple and maroon were chosen for this study. The manufacturing date and lot number was noted in all cases.

All glassware and plastic containers used were washed with liquid soap, rinsed with water and soaked in 10% nitric acid for 24 hrs, cleaned thoroughly with distilled water and dried avoiding contamination. All necessary precautions were taken throughout the study to avoid contamination as per the Association of Analytical Communities (AOAC) guidelines⁸. All chemicals used for the assessment were analytical grade (AR). 1gm of each sample was weighted on electric balance. The samples were analyzed according to standardized International protocol by wet

digestion method, using HNO_3 and HClO_4 in 3:1 ratio and H_2O_2 . The blanks were also processed and analyzed simultaneously. Analysis was done by a Flame Emission Spectrophotometer (Parkin-Elmer AAS, 2380) using an Air-acetylene flame for lead, using five standard solutions.

The method of standard addition which is used as a validation method was used to demonstrate the validity of our method⁹. Hence, a recovery test was performed using method of standard addition. Standard solutions containing Pb was prepared and spiked with digested samples, after dilution of the sample to 50 ml. batch precision and accuracy were successfully monitored with a 10% insertion rate of duplicates, blanks and spikes. Appropriate quality assurance procedures and precautions are carried out to ensure reliability of the results. Results from each batch were accepted if control samples were within 10% of the accepted value of these samples.

Results were analyzed for statistical significance by using statistical package software, version 9. Values in the text were shown in tabulated form as Mean+SD. Tests were performed in triplicate analysis.

Results:

A total of 48 samples of lipsticks from different brands were studied for the presence of lead. Besides, the presence of Pb across different colors of lipsticks from the same brand were also detected and analyzed. The brands were classified into 3 categories, A, B, and C.

The results are presented in the table below.

"Table 1 about here"

The lead concentrations in various lipstick colors in decreasing order are-

Brown > Pink > Purple > Maroon > Red.

Discussion:

The primary ingredients found in lipstick are wax, oil, alcohol and dye. Though lead is not an active ingredient of the lipsticks, it is present as impurities in the color additives. It is observed that the local cheaper brands have more quantity of lead in them as compared to the drug-store and high quality luxury brands. Also the long-lasting formulae contain more lead in them as compared to the normal ones, and the shimmer containing lipsticks have more of the toxic metal as compared to the color-only shades of the same brand.

Heavy metals become toxic when they are not metabolized by the body and accumulate in the soft tissue. It is said that a woman harmlessly but inadvertently consume about 4 pounds of lipstick in her lifetime. Unfortunately, no amount of lead is harmless for the body¹⁰. It has been realized very recently that even very low levels of lead exposure is hazardous, particularly for in utero babies & neonates. A pregnant woman with history of lead exposure may store it in her bones, which might get substituted for calcium needed by the growing fetus. It has also been documented that lead is excreted via breast milk as well⁴. Such observations should elicit concern, as studies have also reported that breastfeeding enhances the release of lead from the bones, being a biological analogue of calcium & getting accumulated in bone, in absence of calcium, in pregnant women. This lead freely crosses the placenta, and therefore, gestational lead poisoning is not only harmful for the women but also for the developing fetus, leading probably to congenital lead poisoning, pre-term labor, small for date deliveries and can also affect

fetal brain development. Epidemiological studies confirm association between lead exposure and prevalence of dental caries in school age children¹¹ who can also suffer from language development and behavior problems like low IQ, aggressive mood and attention deficit disorder. Lead is a biochemical analogue to calcium, and hence readily incorporated in tropic and metabolic pathways. Adults who are exposed to a dangerous amount of lead experience anemia, neurological dysfunction, weakness, hypertension, decreased fertility, and increased spontaneous abortion rates^{2, 3}.

In the present study one particular brand of local lipstick measured 60 times higher lead content than permissible limit, from all of 3 lots of same color studied. Other cheaper brands also showed 10-20 times higher level than allowable. These levels were seen to be dependent on the presence of shimmer in the cosmetic; the shimmery ones containing higher level. The medium and luxury range of lipsticks were studied under 2 categories: the normal moisturizing lipcolors and the long lasting matte range, which was seen to contain more lead.

Many studies have corroborated the presence of lead in lipsticks. Hepp et al have examined the lead content of 20 shades of different lipsticks brands sold in USA, and have shown detectable amount of lead in most of them, with values ranging from 0.02-5.92 $\mu\text{g}/\text{gm}$ ⁷. The Campaign for Safe Cosmetics (CSC2007) tested 33 brand name red lipsticks and found that more than 1/2 of them contained 0.03-0.06 $\mu\text{g}/\text{gm}$ of lead, and about 1/3 of the tested samples showed more levels of lead than the FDA permissible limit of 0.1 $\mu\text{g}/\text{gm}$ for candy⁶. Researches done at Canadian Environmental Defense (2011) on color cosmetics used by women also found lead in 96% of all samples of lipstick tested⁵. Adebajo et al surveyed heavy metal concentration in Nigerian cosmetics and found lead between 0.006-0.207 $\mu\text{g}/\text{gm}$ ¹². Mutaz A et al found alarming lead level in at least one of the lipstick samples procured from the local Palestinian market (15.9 $\mu\text{g}/\text{gm}$)¹³.

Lead, or any other heavy metal, is never tested as an ingredient in any of the cosmetics sold in the markets worldwide. Due to lack of manufacture testing and regulatory oversight, it is possible that the sellers are not even aware of the fact that products are contaminated. This is usually due to the use of poor quality ingredients, most likely forming the inorganic bases of such cosmetics. Since lead is found in the environment, in order to track the contamination source, manufacturers should test the raw ingredients before they are used for the processing of the final product. Also, India does not have any standards, guidelines and legislation regarding lead in any cosmetics products. Neither government agencies, nor private sectors monitor the heavy metal impurities in cosmetics imported, produced, marketed, distributed and used in the country. There is absolute lack of awareness among the users and consumers of such products.

Conclusion:

This study has revealed that the concentration of lead in the lipsticks under study is much higher than that specified by the USFDA for candy. Also, continuous use of these cosmetics could result in an increase in the toxic metal levels of body beyond permissible limits. Most common and widely used lipsticks found in Indian market contain level of lead ranging from 2 to 8 $\mu\text{g}/\text{gm}$ that is 20-80 times higher than the USFDA guideline value of 0.1 $\mu\text{g}/\text{gm}$ for lead in candy. Lead content also varies across brands and

presence of shimmer. There is no labeling of lead content in any of the cosmetics, nor are there legal frameworks to monitor the chemicals used in these products. Therefore, effort should be made towards enlightening the users and the distributors of the health risks involved. Removal of lead from personal care products after their manufacture is not possible; however, careful selection of raw material, keeping in mind the heavy metals involved, can improve the quality of the products and make the endeavors towards beauty toxic-free.

Tables-

Table 1- Level of lead ($\mu\text{g}/\text{gm}$) in various brands and shades of lipsticks in Indian markets

Brand Code	Color of lipstick	Lead (in $\mu\text{g}/\text{gm}$)
		Mean \pm SD
Brand A High end luxury brands	Pink	6.61 \pm 0.57
	Red	2.23 \pm 0.21
	Brown	8.72 \pm 0.12
	Purple	8.11 \pm 0.39
	Maroon	4.62 \pm 0.26
Brand B Medium range commercially available and drugstore brands	Pink	3.96 \pm 0.32
	Red	4.12 \pm 0.11
	Brown	4.71 \pm 0.16
	Purple	3.99 \pm 0.27
	Maroon	3.21 \pm 0.12
Brand C Cheaper locally available imported brands	Pink	5.99 \pm 0.61
	Red	4.17 \pm 0.52
	Brown	6.14 \pm 0.12
	Purple	5.97 \pm 0.32
	Maroon	4.47 \pm 0.19

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