Risk Assessment of Heavy Metal Contents (Lead and Cadmium) in Lipsticks in Iran

Parisa Ziarati, Saba Moghimi, Sepideh Arbabi-Bidgoli, and Mahnaz Qomi

***Abstract*—The aim of this survey was to assess the public health risk from certain brands of lipsticks products sold at local markets in Tehran. To investigate claims that some brands of cosmetic products sold at Iranian stores were non-complaint with the cosmetic products Group Standard 2006 under the Hazardous Substances, we focused only on the presence of total and Leachable Lead and Cadmium in randomly selected lipsticks. 120 samples of 19 brands of lipsticks made from different countries were randomly purchased for analysis but a single brand may contain several colors which have been analyzed separately. The samples were analyzed according to standardized international protocols by wet digestion method, by a Flame Emission Spectrophotometer. The highest concentration of lead and Cadmium was detected in Chinese lipsticks .The mean content of lead in 95.91% 0f Chinese lipsticks are much higher than 20 µg/g and all of the Iranian lipsticks are lower than 10 µg/g . There is significant difference in the levels of Lead in the entire four main color group analyzed. The pink color has highest concentration of lead, while violet color has the lowest Lead content and the brown and orange color have the highest and lowest concentration of cadmium respectively. The safety assessment of cosmetic products such as lipsticks is a complex issue that is not only affected by scientific questions, but also by the responsible regulatory organizers as well as consumers, health ministry and governmental organizers, there is an urgent to halt importing unsafe cosmetics.**

***Index Terms*—Lipstick, lead, cadmium, color.**

I. Introduction

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 being (Amit *et al*, 2010). 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 (Nnorom, et *al*, 2005; Al-Saleh, *et al*, 2009). Iran, then Saudi Arabia has the highest consumption of cosmetics in the Middle East. Total consumption of cosmetics in the Middle East in 2008 at around 7/2 billion dollars that the average growth of around eight percent a year, after Eastern Europe has the highest growth and this is because the region's population under age 30.Still, 14 million Iranian women sphere of cosmetics consumption overtaking almost countries have seized the area so that approximately 29 percent of consumers make up the Middle East. In other words, Iranian women will pay about 2/1 billion dollars of cosmetics in the Middle East cosmetics market (http://www.8dey.ir/archives/5785).

Pigments used as ingredients in lipsticks are regulated as color additives by the FDA and must undergo pre-market approval by the agency before they may be used in any cosmetics (Wirat Ruengsitagoon, Sorravee Thanasakulpasert, Karnchanok Ngiamsombat *et al*, 2001). There are currently no international standards for impurities in cosmetics. FDA's legal authority over cosmetics is different from other products regulated by the agency, such as drugs, biologics and medical devices. Cosmetic products and ingredients are not subject to FDA premarket approval authority. Cosmetic firms are responsible for substantiating the safety of their products and ingredients before marketing.

Although major sources of lead (Pb) contamination from leaded gasoline, lead-based paints, lead in public water systems, and lead solder for sealing canned foods have been reduced through various regulatory actions, public concerns still exist over possible sources of lead contamination. Lead from gasoline and paint can remain in soil and dust for many years, and imported foods and cosmetics may contain unsafe levels of lead (Sainio *et al*, 2000). The colored base is formed by pigments and pearls. Pigments give lipstick its color and covering power. The concentration of pure pigment can vary from 1% to 10% depending on the type of product (lip gloss to a dark lipstick). The most widely used pigments are mineral (titanium and iron oxides) and organic pigments (true pigments, toners and lakes) (Amparo and Alberto, 2007).

The aim of this survey was to assess the public Health risk from certain brands of lipsticks products sold at local markets in Tehran. To investigate claims that some brands of cosmetic products sold at Iranian stores were non-complaint with the cosmetic products Group Standard 2006 under the Hazardous Substances, we focused only on the presence of total and Leachable Lead and Cadmium in randomly selected lipsticks. Our concern arises from the safety of cheap priced lipsticks that is sold widely in stored around Tehran and other cities in Iran. Most of these products are imported from countries which have weak regulatory inspection and screening as well as no standard conditions for manufacturing.

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II. Materials and Methods

A. Sampling Description

120 samples of 19 brands of lipsticks made from different countries were randomly purchased for analysis but a single brand may contain several colors which have been analyzed separately. They are very popular and most of them are imported mainly from developing countries where no quality control measures are applied. Lipsticks were imported from 8 different countries (USA, France, England, Korea, China, Turkey, Canada, Taiwan and Germany) and we compare them with Iranian lipsticks.

B. Estimation of Cd, Pb

All glassware and plastic containers used were washed with liquid soap, rinsed with water, soaked in 10% volume/volume nitric acid for 24hrs, cleaned thoroughly with distilled water and dried in such a manner to ensure that any contamination does not occur. Blanks and samples were also processed and analyzed simultaneously. All the chemicals used were of analytical grade (AR). For heavy metal analyses 1 gram of each sample was weighed on electronic balance (Shimadzu LIBROR AEX 200G). The samples were analyzed according to standardized international protocols by wet digestion method, (Using HNO_3 and $HClO_4$ (3:1) and H_2O_2), analyzed by a Flame Emission Spectrophotometer Model AA-6200 (Shimadzu, Japan) using an air-acetylene flame for heavy metals, using at least five standard solutions for each metal. All necessary precautions were taken to avoid any possible contamination of the sample as per the AOAC guidelines (AOAC, 1998).

III. Results

This research covered 20 colors of 19 brands, Lead and Cadmium detected in all the colors in wide range of concentrations**.** The concentrations of 2 metals (lead and Cadmium) were determined in 40 samples from 4 different brands of Iranian lipsticks. The levels of these metals observed were generally lower than those observed in 48 samples from Chinese brands. In the majority of the products, the lead content was lower than 20 mg/kg. Only cheap Chinese brands have Lead content higher than 20 mg/kg DW. The mean concentration of Cadmium in all samples was lower than 1.2 mg/kg.

The mean contents of Lead and Cadmium in Iranian and Chinese Lipsticks are shown in Fig. 1 and Fig. 2 respectively.

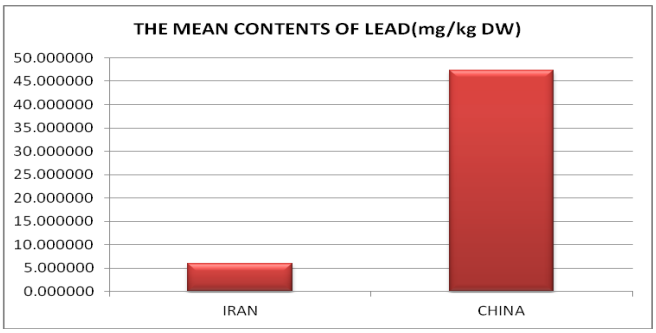

Fig. 1. The Mean contents of Lead (mg/kg DW) in Iranian and Chinese lipsticks.

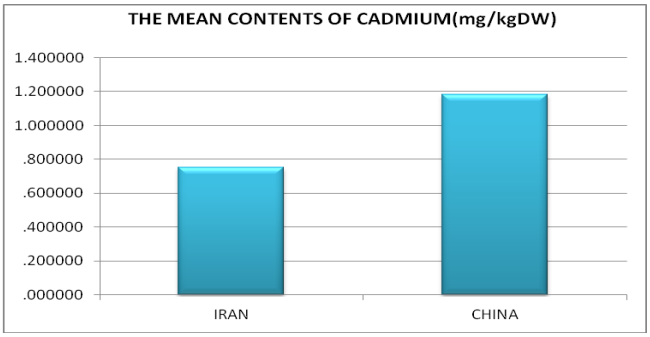

Fig. 2. The mean content of cadmium (mg/kg DW) in Iranian and Chinese lipsticks.

The highest concentration of lead and Cadmium was detected in Chinese lipsticks .The mean content of lead in 95.91% 0f Chinese lipsticks are much higher than 20 µg/g and all of the Iranian lipsticks are lower than 10 µg/g. The result of compare between lipsticks color for concentration of lead and Cadmium has depicted in Fig. 3 and Fig. 4. For health risk assessment loretz (Loretz *et al.*, 2005) [8] calculated the daily the daily usage of lipsticks by 360 women, ages 18-65 years usage 24 mg lipstick per day. In Iran it will be more as Iran, and then Saudi Arabia has the highest consumption of cosmetics in the Middle East (http://www.8dey.ir/archives/5785).

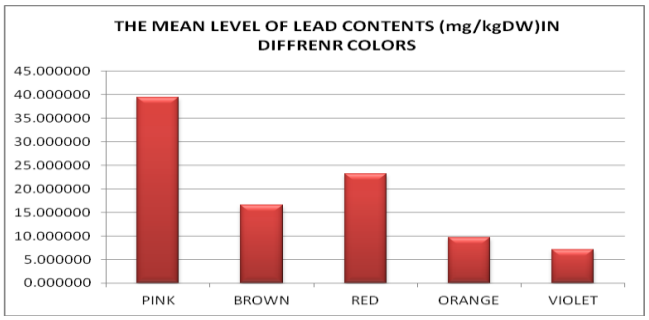

Fig. 3. The mean level of lead contents (mg/kg DW) in different colors of lipstick samples.

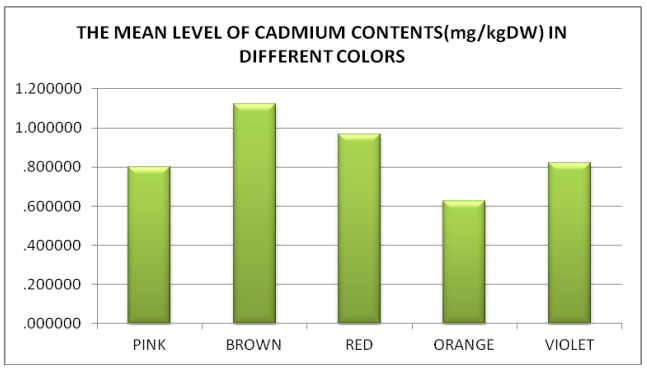

Fig. 4. The Mean level of cadmium contents (mg/kg DW) in different colors of lipstick samples.

The pink color has highest concentration of lead, while violet color has the lowest Lead content and the brown and orange color have the highest and lowest concentration of cadmium respectively.

Analysis of Variance (ANOVA) was done on each brand of the lipsticks to find out if there is significant variation in the concentrations of heavy metals in different colors of each brand. In Kiss & Beauty (Chinese Brand), there is significant

difference in the levels of Lead in the entire four main color group analyzed. This shows that the type of pigment used in lipsticks contributes to its heavy metal content. In Mero (Iranian Brand), four colors were also analyzed and the concentrations of Lead and Cadmium show significant differences of these metals in the colors ($P< 0.05$).

IV. Discussion

The primary ingredients found in lipstick are wax, oil, alcohol, and dye. Though, lead is not an ingredient of the lipsticks, it might be present as impurities in the color additives. According to Us FDA trace amount of lead in cosmetics is unavoidable under conditions of good manufacturing practice (Al-Saleh, *et al*, 2009).

The heavy metal contents in lipsticks and probably other cosmetics may cause harm to consumers. This research demonstrates that ingredients may contain or absorb heavy metals. For this reason, there is currently a potential global danger to the health and well-being of people. This risk can be reduced by international cooperation between toxicologists to investigate of the safety of cosmetic and personal care products and their ingredients on a daily basis.

In our study, China is a major manufacturer of the studied lipsticks and the samples were found to have dangerous high lead contents, therefore we suggest authorities to monitoring safety checks on cosmetic products before imported to other countries such as Iran.

In conclusion, the safety assessment of cosmetic products such as lipsticks and their ingredients is a complex issue that is not only affected by scientific questions, but also by the responsible regulatory organizers as well as consumers, health ministry and governmental organizers, there is an urgent to halt importing unsafe cosmetics as Lead in lipsticks might not cause an immediate health problem but its accumulative effects due to repeated application cannot be eliminated.

Acknowledgment

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