

Investigation of the Presence of Heavy Metals and Other Contaminants in Labor Cosmetics and their Health Risks in General

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Abstract

Introduction: Lipstick is one of the dermo-cosmetics most used by people around the world for a non-medicinal product that stays for a long time in direct contact with the lips, this industrialized product has compounds that when in excess, can accumulate in the organism, injure organs and can trigger malignant neoplasms, neuropathologies and other pathologies resulting from toxicities. In Brazil, the quality of these lip cosmetics is regulated by ANVISA (National Agency of Sanitary Surveillance), and the products made available in our national market, domestic or imported, must be evaluated and approved by INMETRO (National Institute of Metrology, Quality, and Technology) and IPEN (Institute of Energy and Nuclear Research). Lead, cadmium, chromium, arsenic, mercury, aluminum, manganese, titanium, and phthalates are heavy metals often used by the cosmetic industry to improve the structure, color, density, creosity and fixity of these products and depending on the concentration can be absorbed by the organism with systemic cumulative effects. Presumably, low-quality products can present some toxic elements in their composition, such as dyes, stabilizers, thickeners and fixatives that are often prohibited in our country and may represent a risk of systemic contamination and serious health problems.

Objective: It analyzed the safety of the use of lipsticks sold in the official Brazilian market, the concentration or not of these heavy metals.

Results: The concentration of heavy metals are the main contaminants of lipsticks but only a small group of products studied do not meet the specifications required by the agencies, but they were withdrawn from the market.

Conclusion: The use of lipsticks produced in Brazil sold in official stores and those officially imported by official channels do not pose a risk to Brazilian consumers, but the

same cannot be said of those imported illegally or produced by companies not registered with ANVISA.

Keywords: Contaminants; Heavy metals; Health

Introduction

US and European regulators in the early 2000s warned of the presence of hazardous substances in the industrialization of cosmetics causing great concern about the potential health risks [1]. As of 2010, the Brazilian population began to receive a type of current in social networks alerting about the presence of lead in its composition and its risk of triggering cancer [2]. Concomitant to this fact, INMETRO's ombudsman received many messages from concerned consumers and questioning the quality of products sold in Brazil and the authenticity of this information [3].

The lipstick had its solid formula developed early in the early 1930s, bringing an immense range of colors, on a greasy basis providing a uniform layer whose preparation formula is an industrial secret, but basically use petrolatum or vaseline, oil mineral wax, and mineral waxes [4].

In some cases, lead cadmium and chromium are often used as preservatives and thickeners and may present health risks due to their bioaccumulation in the body [5]. This problem can occur mainly in countries with high risks of contamination by pesticides in the soil, as in India, in addition to the heavy metals cited, there is great concern of the local authorities with the presence of arsenic and mercury in cosmetics, these toxic compounds are common in soil due to the use of fertilizers and agrochemicals [5].

The appearance, coverage, and durability are the main criteria for the number of components present in the lipstick, whether organic, inorganic pigments, dyes or both [6]. Because its application is directly on the lips, its constant use has the

potential for absorption by the oral mucosa and can potentially expose users to the absorption or ingestion of heavy metals that may be present in their composition [6].

Synthetic molecules such as phthalate, which are chemical substances in food packaging and are present as plasticizers and also as plastic resin softeners, found in low quality lipsticks and may have toxic effects on the reproductive system of animals being classified as toxic by European authorities because they are endocrine disrupters interfering with developmental processes and may also have effects on the human body [7].

Therefore, the objective of this study was to clarify whether petroleum-based lipsticks have a bioaccumulation in the body and can lead to predisposition to cancer and toxicity to continuous users, as well as to evaluate the possible concentration of harmful substances in different brands, prices, colors available in the Brazilian official market through the research conducted by the official regulatory agencies.

Methods

Eligibility and study design

Following literary search criteria with the use of the MeSH Terms that were cited in the item on "Search strategies", a total of 37 clinical studies that were submitted to the eligibility analysis were checked, and after that, 13 studies were selected, following the rules of review-PRISMA. Studies from 2008 to 2019 were analyzed.

Search strategy and information sources

The search strategy was performed in PubMed, Embase, Ovid and Cochrane Library, Web of Science, ScienceDirect Journals (Elsevier), Scopus (Elsevier), OneFile (Gale) followed the following steps: search for mesh terms: Contaminants, Heavy metals. Lipsticks and use of boolean "and" between mesh terms and "or" among historical findings. All references are registered in EndNote.

Major finding and discussion

The lip cosmetics industry has evolved over time, adhering to new formulations with different chemical compositions meeting the needs and criteria of user safety, that is, the industry is evolving and respecting the consumer (Table 1). Among the samples of manufacturers, the "A" to "O" marks were analyzed, all samples analyzed presented as required by national legislation [1-3].

In 73.3% the value of lead found ranged from 0 to 1 mg/kg in different brands (A, B, E, F, G, H, J, K, L, M, and N). 1 mg/kg and less than 2 mg/kg of the marks (C and I), one sample had the content of 2.3 mg/kg of the mark (D) and one sample had a 4.3 mg/kg (O) and none presented the content of 3 and 4 mg/kg [3] (Figure 1).

Thus, one of the main problems in the application of cosmetic products is the high content of heavy metals, such as Mercury, cadmium, lead and arsenic due to the industrial manufacturing

process [4,5]. Cosmetic products have been used by humans for thousands of years and many studies have explored the content of toxic elements in personal care and cosmetic products such as eyeliner, eyeliner, lipstick, skin whitening creams, mascara, body cream, face cream, powder, lacquer, liquid, perfume spray, liquid soap, shampoo and base [6-10].

Table 1 Amount of lead by various colors, lead diversified randomly.

Quantity of lead per color				
Quantity of lead	Red	Pink	Brown	Purple
0>1	5	3	1	2
1>2	1	0	0	1
2>3	0	0	1	0
3>4	0	0	0	0
4>5	0	1	0	0

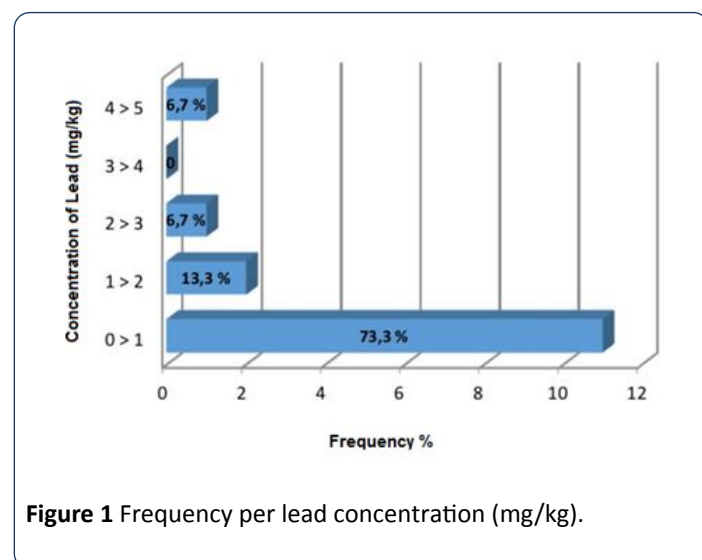


Figure 1 Frequency per lead concentration (mg/kg).

The heavy metals in cosmetic products applied to the skin can accumulate locally and some metals like mercury, lead, cadmium and aluminum are able to pass through the skin barrier and enter blood vessels [6]. Thus, a weight gain concentration of blood metals was reported in individuals who were exposed to these toxic metals via the application of cosmetic products. High levels of toxicity elements in the bloodstream can lead them to accumulate many parts of the human body and can result in dysfunction in vital organs such as the kidneys [6].

In this context, a study evaluated the contamination of lead, cadmium, arsenic and mercury in lipsticks, mascara, shade and eyebrow pencil, and compares the amounts of these toxic elements in legal and contraband products [4]. The data indicated that the lead content in the products did not exceed the acceptable limit of the German Federal Office for Consumer Protection and Food Safety (BVL) and that the values of cadmium in all products were significantly lower than the limit established by the BVL. The arsenic content of lipsticks, eyebrows and pencils was significantly higher than the BVL

standard, while the mercury content was well below the BVL standards, so there appears to be no concern associated with this toxic element. Legal cosmetics presented better results, with the exception of mascara, which presented higher amount of arsenic than contraband. The higher content of arsenic in smuggled eye shadows and eyebrow pencils is an issue that must be taken into account by the competent authorities [4].

However the mercury content was well below the limits of the BVL, meaning that there was no concern associated with this heavy metal. Legal cosmetics showed better results than contraband equivalents, except mascara, because official products showed higher amounts of arsenic than contraband. The higher content of arsenic in the contraband eye shadows and eyebrow pencil should be taken into consideration. The cosmetics analyzed in this study are applied to the skin and therefore in the long term. The use of these products can lead to an accumulation of heavy metals. Heavy metal contamination in cosmetic products can have adverse effects on consumer health, and this study has confirmed the importance of surveillance and quality control of smuggled and imported cosmetic products. In addition, it would be beneficial if consumers' knowledge of the potential risks of the frequent application of cosmetic products were to be improved [4].

Another study determined the concentration of heavy metals (lead, cadmium and chromium) in lipsticks of different price categories sold in the Malaysian market and to evaluate the potential health risks due to the daily intake of heavy metals in lipsticks [6]. A total of 374 questionnaires were distributed to female staff at a public university in Malaysia in order to obtain information such as brand and price of lipsticks, body weight and frequency and duration of lipstick use. This information was important for the calculation of the risk quotient (HQ) in the health risk assessment. Samples were extracted using a microwave digester and analyzed using inductively coupled plasma optical emission spectrometry. There was a significant difference in lead content in the lipsticks of different price categories. There was no significant non-carcinogenic health risk due to the exposure of these heavy metals to the consumption of lipsticks by prolonged 35-year exposure (HQ <1) [6].

In addition, another study observed that there was a significant difference in the concentrations of lead, cadmium and chromium between brands ($p < 0.05$) [7]. The concentrations of the elements measured in the marks did not exceed the values of the international standards laid down for lipstick [7].

Therefore, due to the simultaneous use of lipstick with other types of cosmetics and therefore the potential exposure of consumers to toxic elements in all cosmetics, it is necessary to continuously monitor the concentrations of these elements in these types of products in order to avoid potential health risks [8-13].

Conclusion

Based on the international findings of the concentration of heavy metals in lipsticks, INMETRO of Brazil did the analysis and all samples were in accordance with Resolution-RDC No. 44. No samples exceeded 20 ppm, all analyzes were with the lead content below recommended. It is important to look for products from companies that have registered with ANVISA for the safe consumption of the products.

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