



ASSESSMENT OF LEVEL OF TOXIC HEAVY METAL (Pb) IN LOCAL AND FOREIGN BRANDS OF LIPSTICKS IN FCT, ABUJA, NIGERIA

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ABSTRACT

This study determined toxic heavy metal concentration in Local and Foreign brands of lipsticks sold in FCT, Abuja Nigeria. The study analyzed twenty (20) samples of lipsticks comprising of ten (10) Local and ten (10) Foreign brands for Lead using flame atomic absorption spectrophotometric (FAAS) method. The mean concentration range of Lead in both the Local and the Foreign lipstick samples and their estimated daily intake by average users are 22-714.70 µg/g and 74.9-47927µg/g with the estimated daily intake by the average users as 1.056- 34.305 µg/g (Local samples) and 3.595 - 2300.496 µg/g. (Foreign), while the estimated daily intake by high users are 3.828 - 124.358 µg/g (Local) and 13.023 - 8339.298 µg/g (Foreign). The estimated concentration of Lead ingested daily intake in the Local and the Foreign samples indicated 20% and 70% of the samples were not safe for the average users. While the ingested daily intake in the Local and the Foreign samples indicated 50% and 90% of the samples were also not safe for high users as compared to WHO limit (20 µg/g) for Lead specified in cosmetic. Thus, continuous usage of these lipsticks can increase rate of exposure of the body system to Lead related disease conditions such as cancer which is known to be detrimental.

Keywords: Lipstick, Lead, AAS, Health hazard,

INTRODUCTION

Cosmetics have often been considered as more harmful by many dermatologists than good due to the complexity of the ingredients used in their formulation. Most of which are linked to many diseases conditions such as cancer, genetic aberration, developmental and reproductive problems (Gondal *et al.*, 2010). Lipstick is one of the most commonly used cosmetic products which are produced from a range of chemicals. For most women, the use of lipstick is not only for fashion statement but as a necessity for their everyday outdoor activity. Survey of women on the use of lipstick shows that about 75% of women make use of varying brands of lipsticks (Zhao *et al.*, 2013), it was also reported that about 90% of lipstick users cannot leave their homes without the application of lipstick, in other words, "it is a must for most of these women". However, the ingestion of these lipsticks on a daily base gives one a course of concern as it would be important to be aware of what is ingestible in these lipsticks. Generally, waxes and oils make the bulk of lipstick composition; a single stick of lipstick can contain several different chemical compounds with few

substances and compounds whose inclusion is essential. This involves careful choice of the ingredients in order to obtain the desired colour, glossiness, and indelibility (Iman and Sami, 2011). In recent years there has been concern over the very small amounts of heavy metals that can be found in some lipsticks. A recent study of 32 popular lipsticks found trace contaminant amounts of lead, cadmium, aluminum, chromium and manganese. The slow release of these metals into human system may be harmful to biological system if allowed to accumulate over time. The metals could accumulate in the body organs due to their long half life and interfere with essential nutrients of similar oxidation states such as calcium and zinc (Adepoju-Bello and Alabi, 2012). For instance, the toxicity of lead at high concentrations of exposure is well documented but a major concern in recent time is the possibility that continual exposure to even relatively low levels of this toxic metal in lipsticks products may pose potential health risks such as impaired renal, hemopoietin and nervous system with different reports linking to loss of cognitive function (Koller *et al.*, 2004; Ullah *et al.*, 2017).

The presence of lead in cosmetics has also been reported and thus the European union for cosmetic banned lead and lead compounds in cosmetics since 1976 and strict adherence to quality control is essential in ensuring that lead contamination in cosmetic product is prevented (Amit *et al*, 2010).

The growing concern about the physiological and behavioral effects of toxic metals on human health and population cannot be overlooked. This study was initiated due to several commonly reported cases of lead related disease conditions in women which could possibly be linked with use of cosmetic products such as lipstick. The aim was to evaluate the Local and Foreign brands of lipsticks commonly sold in FCT, Abuja Nigeria for Lead content in order to ascertain their level of safety.

MATERIALS AND METHODS

Materials:

All the reagents used were of analar grades and purity. Porcelain crucibles, plastic sample bottles, appropriate glasswares used were properly washed using detergents and rinsed with deionised water. Other equipments used are water bath, Muffled furnace, Atomic Absorption Spectrometer and Analytical Plus.

Sample Collection

Twenty (20) brands of lipsticks which comprised ten (10) Local and ten (10) Foreign brands were purchased from different cosmetic stores in Federal Capital Territory (FCT), Abuja Nigeria. The samples were coded as LipL1, LipL2, LipL3, LipL4, LipL5, LipL6, LipL7, LipL8, LipL9 and LipL10 (Local brands) and LipF1, LipF2, LipF3, LipF4, LipF5, LipF6, LipF7, LipF8, LipF9 and LipF10 (Foreign brands) and were taken to the laboratory and kept at room temperature for subsequent preparation and analysis.

Reagents and standards

Analytical grade concentrated nitric acid (S.G. 1.4 at 25°C; 69% W/V) and concentrated

I. Concentration:

$$\text{Conc. } (\mu\text{g/g}) = \frac{\text{Conc. } \mu\frac{\text{g}}{\text{ml}} \times \text{volume.}}{\text{weight (g)}}$$

II. Concentration of average estimated daily intake ($\mu\text{g/g}$):

$$\text{Conc.} = \frac{\text{Conc. obtained} \times \text{daily usage}}{\text{weight sample}}$$

hydrochloric acid (S.G. 1.18; 37% W/V) were used for sample preparation and standards for the metal of interest of concentrations 0.5, 2.5, 4.5, 6.5, 8.5 and 10.5 $\mu\text{g/cm}^3$ by diluting 0.05, 0.25, 0.45, 0.65, 0.85 and 1.05 cm^3 of the standard stock solution (1000ppm) with deionized water using appropriate sizes of precision pipette and volumetric flask.

Sample Preparation

The glassware and plastic containers were thoroughly washed, rinsed with tap water and then soaked in 5% nitric (HNO_3) solution for 24 hours, rinsed with deionized water and dried prior to use. 0.5g of each of the samples was weighed in a porcelain crucible and dry ash in a muffled furnace by stepwise temperature increase up to 550⁰ C until completely ash (Ayenimo *et al.*, 2010). The ash samples were digested over steamed water-bath with 12 cm^3 of 20% HCl, diluted with deionized water, filtered through Whatman filter paper and made-up to mark in 50 cm^3 volumetric flasks, transferred to sample plastic bottles and kept at room temperature for subsequent analysis.

Samples Analysis

The evaluation of heavy metal content of lipstick is vital due to safety issues associated to it. Ullah *et al.* (2013) reported various available analytical methods use for analysis of heavy metals. In this study, Flame Atomic Absorption Spectrometric (Model: GBC Avanta, Versin 2.0) method was used for the determination of Lead. The instrument operating conditions are: wavelength 217nm, lamp current at 5 mA, slit width at 0.5nm, measurement mode was by integration, calibration mode was linear least square through zero and the flame type was air-acetylene (2.25-13.10). The readings of the standards, blank and the analyte concentrations and absorbance were rounded off from measurements in triplicate. The data obtained were processed by calculating the actual concentration in the samples analyzed using the relation:

III. Relative Intake Indices (RII):

$$RII = \frac{\text{Estimated daily intake}}{\text{Accepted daily intake}}$$

RESULTS AND DISCUSSION

Table 1 shows the mean concentration of Lead in the Local and the foreign lipsticks analyzed. The results of the study obtained indicated higher concentration of Lead in the Foreign lipsticks as compared to the Local. The mean concentration and range of Lead in the overall (n = 10) Local and the Foreign lipstick analyzed are: 207.66 µg/g (range 22 -714.70 µg/g) with the highest concentration being obtained in sample 2 (LipL2) and 5465.23 µg/g (range 74.90 - 47927.00 µg/g) with the highest concentration in sample 5 (LipF5). The results obtained from this study indicated higher concentration of Lead in the samples analyzed compared to results obtained from similar study reported by Brandão *et al.*

(2012) where the highest concentration obtained was 73.1 ± 5.2 µg g⁻¹. The concentrations obtained in all the samples analyzed were above the maximum permissible limits recommended (10ppm) by USA/FDA for Lead as impurities in cosmetics (U.S/FDA, 2016). Therefore, since simple absorption of Lead can be achieved after a consumer licks her lips, the health of the users' of both these Local and the Foreign lipsticks are under threat. Cosmetics manufacturers should therefore take responsibility for averting potentially harmful levels of Lead in their finished products by adopting good manufacturing practices that can achieve lower levels of Lead.

Table I: Mean Concentration (µg/g) of Lead in Lipsticks

S/N	Local Samples (LipL)	Foreign samples (LipF)
Lip1	674.86±0.04	551.00±0.21
Lip2	714.70±0.02	74.90±0.05
Lip 3	28.59±0.02	1414.70±0.55
Lip 4	27.24±0.11	1474.90±0.40
Lip 5	22.00±0.01	47927.00±0.35
Lip 6	33.73±0.10	423.11±0.11
Lip 7	25.85±0.12	1084.45±0.12
Lip 8	174.80±0.32	1340.55±0.32
Lip 9	181.40±0.22	187.50±0.11
Lip 10	193.40±0.50	174.20±1.11
Mean	207.66	5465.23
Range	22.00-674.86	74.90-47927.00

The prediction of the daily intake of Lead residue for average users based on the most realistic estimation of the residue levels in lipstick was also determined and the results presented in Table 2 which indicates the estimated daily intake (EDI) of the mean and the ranges of concentrations of Lead from both the Local (LipL) and the Foreign samples (LipF) by average users' as 9.9675 µg/g (1.056-34.306 µg/g) and 262.3454 µg/g (9-2300.496 µg/g) respectively. The results obtained were above the maximum limits of estimated daily intake (EDI) of Lead

(0.024µg/day) specified for average users' by NIOSH. (2003). Health status of the average users of both the Local and the Foreign brands of the lipsticks are exposed to danger of Lead associated disease conditions such as cancer (Zhao *et al.*, 2013). The findings of this study have corresponded with studies from other parts of the world which also reported high level of Lead lipsticks and other cosmetics (Hepp *et al.* 2009; Al-Saleh *et al.* 2009; FDA 2011; Adepoju-Bello *et al.* 2012; Brandao *et al.* 2012; Gondal *et al.* 2010)

Table 2: Mean Concentration of Estimated Daily Lead Intake for Average Users.

Samples' code	Concentration ($\mu\text{g/g}$)	
	Local Samples (LipL)	Foreign samples (LipF)
Lip1	32.393	26.448
Lip2	34.306	3.595
Lip 3	1.372	67.905
Lip 4	1.308	70.795
Lip 5	1.056	2300.496
Lip 6	1.619	20.309
Lip 7	1.241	52.198
Lip 8	8.390	64.346
Lip 9	8.707	9.000
Lip 10	9.283	8.362
Mean	9.9675	262.3454
Range	1.056-34.306	9-2300.496

The mean and range concentrations of for the higher users of the Local and the Foreign brands are $36.1322\mu\text{g/g}$ ($3.828-124.358\mu\text{g/g}$) and $2597.735\mu\text{g/g}$ ($13.033-8339.298\mu\text{g/g}$) as

presented in Table 3. The results obtained were higher as compared to the maximum limits for estimated daily intake (EDI) which is $0.087\mu\text{g/day}$ (Zhao *et al.*, 2013).

Table 3: Mean Concentration of Estimated Daily Lead Intake for Higher Users

Samples' code	Concentration ($\mu\text{g/g}$)	
	Local Samples (LipL)	Foreign samples (LipF)
Lip1	117.425	95.874
Lip2	124.358	13.033
Lip 3	4.975	246.157
Lip 4	4.739	256.633
Lip 5	3.828	8339.298
Lip 6	5.869	73.621
Lip 7	4.497	188.694
Lip 8	30.415	233.256
Lip 9	31.564	32.625
Lip 10	33.652	30.311
Mean	36.1322	2597.735
Average	3.828-124.358	13.033-8339.298

CONCLUSION

The results obtained shown that Local and Foreign brands of lipsticks use by most Nigerian women are highly contaminated. Lead is found to be beyond permissible limit in cosmetics. This shows that users of this cosmetic product are

highly exposed to hazardous chemicals therefore their health is at risk of Lead related disease conditions such as cancer. The result of this finding will be published for accessibility by the public in order to use it as caution tool to lipstick users.

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