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Detection of Some Toxic Metals in Selected Brands of Skin Powders Sold In Kano Metropolis Markets, Northern Nigeria

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Abstract: *A total of 20skin powder productwere sampled from market Sabon Gari (Bata) market Kano, with the aim of detecting the presence of chromium (Cr) and Cadmium (Cd). The samples were processed, digested and analyzed for Cr and Cd using atomic absorption spectrophotometer VGP 210 Model. All the metals (Cr and Cd) were detected in all the samples, even though at different concentrations (P≤0.05).The concentration of the chromium was lower when compared with that of Cd. All the Cr and Cd concentration were beyond the permissible limits. Among the different brands of skin powder products studied, the highest Cr and Cd concentrationswerefound incategoriesrespectively. It is worthy of note that all the skin powders sampled contained Cr and Cd concentrations well above the Maximum Allowable Level (MAL), Threshold Level (TL), Minimum Risk Level (MRL) and Permitted Daily Exposure Level (PEL). Present study concludes that such products are contaminated with heavy metals i.e Cr and Cd hence their usage may results in dermatological problems, consequently and other systemic disorders.Therefore, limited application of such products is recommended,where possible, total abstinence of their usage is best advised.*

Keywords: *Cadmium, Chromium, Permissible limit, Skin Powders, Toxic metals*

I. Introduction

Since the dawn of civilization, powders have constituted a part of routine body care, not only by the upper strata society but also by middle and low class people. Last few decades have shown a big boost in powders and cosmetics in industries by the production of the various types of skin powders such as talcum powders, face powder, mentholated dusting powders etc which are needed for the care and beautification of the skin as well as source of oil control (ATSDR, 2000).

Heavy metals such as chromium (Cr) and Cadmium (Cd) contamination are one of the important reasons behind the same problem. They may likely to be a common contaminant in various skin powders (Guy et al., 1999).Skin powders are a form of cosmetics for women, also used for children and sometimes men use the loosed powder to control oil in their face. As a result, some powdere might contain some toxic metals that cause damages and diseases in the body. Use of powder and type depend on the socio-economic status of the individual. Three classes of people were recognized based on their income as well as their purchasing power, which are: i) Lower Class: refers to a class of people having the lowest special rank or standing due to low income, lack of skills or education; ii) Middle Class:a class of people in the middle societal hierarchy, who fall socio – economically between the lower class and higher class; and iii) Higher Class: In modern societies is the social composed of the wealthiest members of society who also wield the greatest political power.

Heavy metals become toxic when they are not metabolized by the body and accumulate in the soft tissues. They may enter the human body through food, water, air or absorption through the skin (ATSDR, 2000).

Cadmium is a deep yellow to orange pigment and mostly present in face powders (coloured). The use of cadmium in skin powders are due to its colour property as it has been used as colour pigment in many industries. Although many studies have been reported the presence of other elements in skin powders, studies on Cr and Cd contamination in skin powder is scanty (Jarup, et al.,1993; Guy, et al., 1999).

Present study thus aimed at detecting presence of chromium (Cr) and Cadmium (Cd) skin powders sold at Kano metropolis market.

II. Materials And Methods

Quality Assurance

All reagents used in this study were of analytical grade, and distilled deoinized water was used throughout experimentation except where indicated otherwise. Procedural blanks, reagent blanks, preparation of standard solutions were conducted accordingly. The digestion methods and AAS analysis were also validated by spike recoveries using multi-element standard solution (MESS).

Sample Collection

Out of fifty (50) skin powder brands surveyed, twenty (20) samples were randomly selected using balloting technique and processed accordingly. The skin powders sample were bought or collected once to a visit from the markets (Sabon Gari), then a total of 20 samples were brought, labeled in the laboratory for the detection of chromium and cadmium toxicity. The samples were coded alphabetically. Local products were coded A, B, C, D, E, F, G, H, I, and I; while imported product were coded as follows J, K, L, M, N, O, P, Q, R, S and T.

3.2Ashing, Digestion and Determination of Cr and Cd using AAS

One (1) gram of the sample was weighed into a high porcelain crucible the ashing was done in a muffle furnace by heating at 475 -500^0 for 2 – 4 hours. The ash was then cooled and dissolved in 5ml of 1M of nitric acid (HNO_3). The solution was warmed to a hot plate to effect complete dissolution of the residue. The solution was returned to a furnace for at least 10 – 15 minutes. The solution removed and introduced 10ml of 1M of HCl. An acid – washed filter paper was used to filter the solution into a 50ml volumetric flask 0.1M of HCl was added to a volumetric flask and marked 50ml. After which the chromium and cadmium were analyzed using AAS VGP 210 Model (APHA, 2005). Cr and Cd concentrations were obtained using standard calibration plots (Figures 1 and 2).

Statistical Analysis

SPSS Version 15.0 Statistical Software was utilized in computing students t- test between brands and concentration of Cr and Cd at $P \leq 0.05$.

III. Results

Table 1 illustrates skin powder brands, class, source of product and price ranges. Three brand classes namely lower, middle and higher classes were obtained based on price range of the products, and also kind of people using the products. Highest number of skin powders belongs to middle class, while least number of 3 belong to the lower class.

Table 2 shows Cr and Cd concentration in both imported and local products. Highest Cr concentration of 3.97mg/Kg was obtained from sample M, which is a local product belonging to lower class, while highest Cd concentration of 6.33 mg/Kg was recorded from sample S, which is a local product belonging to the middle class.

Table 3 compares mean Cr and Cd concentrations in relation to brand class. Highest mean Cr of 2.86±1.00 mg/Kg was obtained from sample of lower class; while highest mean Cd concentration of 3.91±1.69 mg/Kg was recorded from samples of middle class.

Table 4 compares mean Cr and Cd concentrations with standards. Both cr and Cd detected in the skin powders sampled in the current study exceeded Minimum Risk Level (MRL), Threshold Level (TL), Maximum Allowable

Limit (MAL), as well as Permitted Daily Exposure Level (PEL).

Table 1:Brand Class, Source of Product, Range of Price of the Sampled Skin Powder

Brand Class	Source of Products	Range price(₦)	Number of items
Lower	Local	20 – 50	03
Middle	Local and imported	120 – 200	12
Higher	Imported	200 - >	05

Table 2:Chromium (Cr) and Cadmium (Cd) Concentrations in both Imported and Local Skin Powder Product Sold in Kano Metropolis Markets Northern – Nigeria

			Heavy Metal Concentration (mg/kg)	
Sample I.D	Source of product	Brand Class	Cr	Cd
A	Imported	Middle	2.99	2.04
B	Imported	Middle	2.01	4.90
C	Imported	Middle	1.36	4.18
D	Imported	Middle	3.32	0.97
E	Imported	Higher	1.36	2.40
F	Imported	Higher	3.64	3.83
G	Imported	Higher	2.34	2.39
H	Imported	Higher	1.36	3.83
I	Imported	Middle	1.36	2.04
J	Imported	Middle	2.67	4.90
K	Local	Middle	1.36	4.54
L	Local	Middle	1.36	5.62
M	Local	Lower	3.97	1.68
N	Local	Middle	3.32	4.90
O	Local	Lower	1.68	3.47
P	Local	Lower	2.93	2.39
Q	Local	Middle	1.68	3.11
R	Local	Middle	2.67	2.75
S	Local	Middle	1.36	6.33
T	Local	Middle	2.34	5.62

Table 3: Mean Cr and Cd Concentrations According to Brand Classes in Skin Powders Sold in Kano Metropolis Market, Northern – Nigeria

Element	Brand Class			Range	
(mg/kg	Lower	Middle	Higher	Minimum	Maximum
Chromium (Cr)	2.86 ± 1.14	2.14± 0.81	2.14 ± 0.93	1.36	3.97
Cadmium (Cd)	2.51 ± 0.90	3.91 ± 1.69	2.72 ± 1.53	0.97	6.33

*Results are mean ± standard deviation

Table 4: Comparing Mean Cr and Cd Concentrations with Standards by WHO (1988), NEPC (1999), ACGIH (2004), USEPA (1998)

Element	Brand code			Standards in mg/kg			
(mg/kg	Lower class	Middle class	Higher class	Minimum risk level (MRL)	Threshold level(TL)	Maximum allowable limit (MAL)	Permitted Daily exposure level (PEL)
Chromium (Cr)	2.86	2.14	2.14	0.001	0.05	0.05	0.05
Cadmium (Cd)	2.51	3.91	2.72	0.005	0.01	0.01	0.05

Source: WHO (1984, 1988), NEPC (1999, 2009),Baars et al., (2001) EA (2009)

IV. Discussion

Skin powders are potentially one of the most important sources releasing heavy metals in the environment. The possibility of skin allergy or contact dermatitis may increase due to the presence of heavy metals in skin powders. Since the heavy metals toxicity has been exemplified the problem of environmental pollution, it is important to know about the all possible sources (Hardy et al., 2002).

In this context, twenty different brands of skin powder products have been tested for the presence of Cr and Cd in both local and imported were taken for the study. They were categorized according to their use by different society of people for instance, those are mostly used by lower class people with brand code (M, O, and P), and A, C, D, I, J, K, L, N, P, R, S, and T was for middle class and brands (B, E,F, G and H) were for high class people.

Among the different samples analyzed the highest concentration of chromium was detected in local skin powder (lower class) products with brand code (M) followed by imported skin powder (higher class) products with brand code (F) while brand code (C, E, H, I, K, L and S) middle class showed lowest chromium content. In compare between same products with different brand, mostly lower class showed the highest concentration, followed by brand of higher class.

Recently heavy metals like lead and 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 (MPL) i.e. 0.5ppm, 0.5ppm and 1.0ppm respectively (Gondal, et al., 2010).

All brands of selected skin powder showed the presence of chromium. Dermal exposure to Cr has been demonstrated to produce irritant and allergic contact dermatitis (USEPA, 1998). Primary irritant dermatitis is related to Cr, cytotoxic properties, while allergic contact dermatitis is an inflammatory response mediated by the immune system (ATSDR, 2000).

The highest concentration of cadmium was detected in local, middle class products with brand code (S) followed by local (middle class) products with brand codes (L) and (T). Imported (middle class) with brand code (D) showed the lowest cadmium content. All brands of selected skin powders showed the presence of cadmium. The result is described in table 3. Cd is toxic to a wide range oof organs and tissues, and a variety of toxicological end points (reproductive toxicity, neurotoxicity, carcinogenicity) have been observed in experimental animals and subsequently investigated in human populations (WHO, 1992; EA, 2002).

The analyzed samples indicated that chromium (Cr) and cadmium (Cd) were presence in the selected 20 samples, and exceeded the allowable limits when compared to the regulatory environmental standards for heavy metals. According to world Health Organization (WHO, 1988), National Environment Protection Council (NEPC) 1999, 2009; National Environment Protection Council (NEPC) 1999; and USEPA (United State Environmental Protection Agency (1998).

V. Conclusion

In the current study, the Cr and Cd were determined in various skin powder products of different brands. Based upon the results, it is concluded that both Cr and Cdconcentrations were higher in the products sampled, thus, with toxic potentialities. However; it is noteworthy that both Cr and Cd exceeded the allowable safe limit, according to regulatory standard organizations.

The continued use of products contaminated with such heavy metals may cause slow release of these metals into the human systemic circulation through dermal exposure, and thus cause harmful effect.

VI. Recommendations

1. The extensive use of such products should be avoided
2. Further research work need to be conducted to increase the number of skin powder samples from other brands to discover the more comprehensive effects base on the products in the market.

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