POTENTIAL HAZARD OF SOME TOXIC METALS IN SELECTED ANTIBIOTIC CREAM COMMONLY SOLD AT SANNGO MARKET, SAKI, OYO STATE, NIGERIA.

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Abstract

Cosmetics are substances that are applied to improve and change one's look, hence increasing one's appeal and attractiveness. There are numerous substances included in their formulations. There are a number of safety and health problems about the manufacturing of cosmetics including certain components. In this investigation, the presence and concentration of heavy metals in certain samples of commercial cream were evaluated. Using the Flame Atomic Absorption Spectrophotometer (FAAS) modeled after the AA990PG Instrument Ltd., England, five different cream samples—Fun Bact A, Movate, Carotene, Crusader, and Hyprogel—were examined for the presence of heavy metals (Pb, Cd, Cr, Cu, Ni, and Mn). The samples of Fun BactA (0.31ppm), Movate (0.3ppm), Hyprogel (0.22ppm), Crusader (0.1ppm), and Carotene (0.1ppm) have the lowest lead (Pb) concentrations, according to this investigation.

Keywords: cosmetics, heavy metals, bleaching, safe limits, antiquity.

Introduction

Any substance meant to be administered topically to the human body in order to maintain the health of the area being treated is referred to as a cosmetic. The physiological functioning of the body shouldn't be changed throughout this process by cosmetics. Since antiquity, people have used cosmetics to enhance and change their appearance in addition to washing the skin. This makes them more appealing and attractive. In the creation of cosmetics, wide varieties of ingredients have been and are employed. Throughout the ages and millennia, cosmetics have been used for the same general reasons. However, the formulation of these cosmetics has evolved significantly over time, with some changes related to the components and methods utilized to create them. Domestic and small-scale production for processing has changed to.

As a result, there are a number of safety and health problems related to the widespread production of cosmetic goods using different components. Cosmetics are now generally controlled (Oyedeji et al., 2011). One key issue is the use and functioning overlap between topical medications and cosmetics. With the goal of separating cosmetic items from topical medicinal medicines, several regulatory authorities tried to come up with an appropriate definition for cosmetic products. In the European Union (EU), a definition for cosmetic items was established in article 1 of Council Directive 93/35/ EEC (Rao and Reddi, 2000) modifying Council Directive 76/768/EEC. The exterior body parts that can be treated with cosmetics are described in the definition's first section. Other body components aren't included, which implies that. Other body parts are not included, which implies that these other body parts shouldn't be treated with cosmetics. The second section deals with the 'actions' that are permitted for a product to qualify as cosmetics. These set topical pharmaceutical treatments for the control or treatment of disorders or for making a medical diagnosis apart from cosmetics (Peter et al., 2005).

But unlike topical medications, which must pass stringent testing before being sold, cosmetics are not subjected to the same scrutiny. The responsibility for ensuring the marketability of cosmetic items rests with the makers, distributors, and importers (Nesterenko et al., 1997). The latter law specifies exactly which compounds are forbidden from being used in cosmetics. There are also numerous heavy metals among the forbidden substances. While some metals and their salts are completely forbidden (such as tin, arsenic, cadmium, nickel, and lead), others are either permitted up to a certain limit or are only permitted in the form of specific salts for those metals (such as cobalt, chromium, gold, mercury, and selenium, among others). These additions might not be deliberate since some minerals come from natural sources. Numerous other raw materials that might be used to make cosmetics that are regarded as natural goods have also been found to contain heavy metals like cadmium (Cd), lead (Pb), nickel (Ni), arsenic (As), and mercury (Hg). These include olive oil (Maibachet), honey (Sainio et al., 2010), and argan oil (Hostunek, 2000). The

Food and Drug Administration (FDA) in the United States defined the limits for as (5 ppm), Pb (5 ppm), and other heavy metals (20 ppm) (Adepoju et al., 2012).

Limits were established for Pb (10 ppm), Cd (0.3 ppm), and Hg (1 ppm) by the World Health Organization (WHO). Pb, Cd, and chromium have respective limits of 0.5, 0.5, and 1.0 ppm in the EU, whereas Pb, Cd, and Hg have limits of 10 ppm, 3 ppm, and 3 ppm in Canada. The types of metals and the limits placed on them by various agencies, however, frequently vary. This lack of harmonization has the effect of confusing various manufacturers as producers, government agencies as regulators, and the general public as customers. Despite this, a number of academics looked into the possibility of heavy metals in a variety of items (Panico et al., 2019) .

The metals result from contaminated raw materials, the use of inferior raw materials, the noncompliance of small-scale manufacturers, and the lax enforcement of regulations. Additionally, according to (Alam et al., 2019), many cosmetic items contain heavy metals as ingredients or impurities. (Vella and Attard, 2019) reported that toothpastes contained lead levels beyond US and EU regulations. According to (Panico et al., 2019), PEGs (favorably used as penetration enhancers) may contain lingering impurities like lead, iron, cobalt, nickel, cadmium, and arsenic at levels that are restricted by European guidelines in the Polish market. Lead and nickel are particularly close by in lipsticks and powders at this level (Panico et al., 2019).

Kajal, also known as Kohl or Surma, is applied to infants' eyes as part of an ancient tradition in many communities around the world, including those in Asia, the Middle East, Europe, North America, and Africa. According to reports, lead is present in kajal/surma and may cause lead poisoning in children, which can result in long-term harm to several organ systems. The infant's eyelids were painted with a comparable Nigerian cosmetic called "Tiro," which contains 82.6% lead, up from 70% in Kajal or Surma. According to research by Sprinkle (1995), there is a direct correlation between using imported Pakistani eye cosmetics and having elevated blood lead levels. According to Massadeh et al. (2017), the Middle Eastern eyeliner known as "kohl" contains more than 50% lead. The same lead content exceeds the international level according to a study done with Malaysian eye shadows (Lim et al., 2017).

According to Saadatzadeh et al. (2019), the BVL's arsenic content was much lower than that of lipsticks, eye shadows, and eyebrow pencils. Mercury, arsenic, lead, cobalt, antimony, cadmium, nickel, and chromium are heavy metal contaminants that are particularly dangerous and can be detected in the EU and US (SCOOPWHOOP 2017). According to Claus et al. (2016), exposure to Cd at any level may prevent neurodevelopment. Heavy metal exposure during the fetal period of pregnancy may cause intrauterine development retardation, according to Li et al. (2016). Prenatal As exposure has been linked to low growth in utero, low birth weight, and small head and chest circumference in babies. Eye shadow, blush, and concealer frequently contain iron oxides as a coloring agent (Bruzzoniti et al., 2017). In nail polish, lip gloss, and lipstick, several aluminum compounds serve as coloring agents (Brown, 2013). Additionally, toothpaste, sunblock, and antiperspirants all contain aluminum. Alzheimer's disease and breast cancer are two chronic conditions that are currently being explored in relation to aluminum exposure.

However, due to its whitening effect, mercury is typically included to skin-lightening cosmetics. Mercury ions take the place of the anions produced by the tyrosinase enzyme, which prevent melanin from forming and result in the whitening and anti-freckle benefits (Mohiuddin 2019). According to Sun et al. (2017), chronic mercury poisoning is linked to hyperthyroidism, abortion, tremor, gingivitis, memory loss, edema, proteinuria, stomach pain, nausea, and dizziness.

According to Wang et al. (2018), chronic illnesses like obesity and its related diseases like hypertension and T2DM are linked to cumulative exposure to combinations of heavy metals. At low doses, lead poisoning serves as a strong, reversible, and selective blocker of voltage-dependent calcium channels, causing anemia as a result of compromised heme production (Wani et al., 2015). Death from exposure to high levels of lead was found to be associated with severe damage to the brain and kidneys in both adults and children (Sander et al., 2009). High lead exposure during pregnancy may result in miscarriage (Cleveland et al., 2008). Men were mostly exposed to lead through hair dyes (Marzullie et al., 1978). The Lead-Care Testing Systems from Magellan Diagnostics were subject to a 2017 US FDA safety recall to cease lead testing and surveillance.

Both of Cr's oxidation states, i.e., Cr^{3+} and Cr^{6+}, have the potential to serve as haptens causing ACD and skin ulcers (Shelnutt et al., 2007). Cr has two valence states. Because chromium is so hard to avoid, ACD can be a chronic, severe condition. According to Theresa et al. (2011), body lotions that are primarily moisturizers and skin-lightening (toning/bleaching) creams include toxic metals (cadmium, cobalt, copper, nickel, and lead). According to reports, a

rise in cadmium levels prevents DNA repair processes such mismatch, base excision, and nucleotide excision. Sunscreens commonly contain zinc oxide (ZnO), an inorganic chemical that takes the form of a white powder.

According to reports, zinc exhibits the same symptoms as lead and is readily misdiagnosed as having lead poisoning (Martin et al., 2004). According to Le et al. (2002), excessive zinc exposure can have deleterious effects on the haematopoietic system, biochemistry, and endocrine system. Copper, according to US skin care specialists, will be the anti-aging ingredient of choice this decade (Yeomans, 2014). Although copper can have positive effects when delivered through the skin, this substance can also cause skin irritation reactions, which are frequently ignored (Li et al., 2016). Because of their associated general effects of sudden skin color change, lotions and standard creams should be used with caution rather than the historically utilized creams (Shea butter and verselines). This cannot be avoided, and thus necessitates a thorough examination for the presence of potentially dangerous materials like heavy metals. And this is why it is important to investigate whether there are heavy metals in some of these commercial creams.

Resources and techniques

Sample collection

A total of five (5) different cream samples (Fun Bact A, Movate, Carotene, Crusader, Hyprogel) were purchased from a store at Sanngo market in Saki, Oyo- state, Nigeria.

Sample Preparation and Digestion

By carefully combining 35% HNO3 and 65% HCl, all of the samples were digested using Aqua regia.According to Muhamad et al., (2017). Each sample was properly weighed (0.5 g) into a digestion tube, and 10 ml of HCl and HNO_3 (3:1) were added. The samples were then cooked at 60 ^oC on a hot plate for 30 minutes. Following digestion, the samples were allowed to cool to ambient temperature, diluted with distilled water to a volume of 50 ml, and then filtered through Whatman filter paper No. 41 into a cleaned sample container before being subjected to Flame Atomic Absorption Spectroscopy (FAAS) examination.

Determination of Heavy Metals

The heavy metal concentrations were assessed using the methodology described in the AOAC Manual (2019).The various heavy metals were identified using the Flame Atomic Absorption Spectrophotometer (FAAS) model AA990PG Instrument Ltd, England, and the filtrate collected after digestion. Parts per million (ppm) measurements were used to determine each element's concentration. Prior to determining each element, the calibration was performed using standards.

Results and discussion

Results

Table 1: Heavy metal concentrations in the cream samples

Sample	Concentrations of heavy metals (ppm)					
	Pb	**Cd**	**Cr**	**Cu**	**Ni**	**Mn**
FunbactA	0.31	0	0	0.2	0	0.02
Movate	0.3	0	0	0.3	0.2	0.01
Carotene	0.03	0.01	0	0.21	0	0.01
Crusader	0.1	0.01	0	0.42	0.2	0.02
Hyprogel	0.22	0	0	0.37	0.1	0.01
WHO limit	10	0.3	0.3		0.6	

Discussion

This study involves the analysis of five different cream samples Fun bact A, Movate, Carotene, Crusader and Hyprogel) for the presence of some specific heavy metals. The above table is the results from the metal assessment.

Table 1 lists the amounts of specific heavy metals in the five cream sample samples. Funbact A and Movate had somewhat higher Pb amounts than the other samples, with respective values of 0.31 and 0.3 ppm. At the same quantity of 0.01 ppm, only carotene and Crusader produced Cd. Cu levels in the samples varied from 0.42 ppm in Crusader to 0.2 ppm in Funbact A, however no sample had data on chromium levels. The sample included the same amount of Mn in Movate, Carotene and Hyprogel (0.01 ppm), while Mn and Crusader contained 0.02 ppm. These results are consistent with prior investigations that detected heavy metals in ingredients that were either naturally contaminated with heavy metals, or that had heavy metals added to them during production or from containers.

Lead (Pb)

Lead is a heavy metal that has been extensively examined. Lead is typically not employed for its potential properties but is instead viewed as a contaminant that can have a negative impact on human health. Lead is neurotoxic, nephrotoxic, and hepatotoxic when it comes into contact with important organs, and it can also have effects on the reproductive system. Through its passage through the placenta, lead can also have an impact on fetal growth. According to certain research, it is regarded as a possible human carcinogen (Sprinkle, 1995). (Jaspreet et al., 2012) The World Health Organization set a limit of 10 ppm. The samples of Fun bactA (0.31 ppm), Movate (0.3 ppm), Hyprogel (0.22 ppm), Crusader (0.1 ppm), and Carotene (0.03 ppm) have the lowest lead concentrations according to this investigation. In each of the cream samples, the lead concentration was found to be still within the acceptable range when compared to the WHO standard limit.

Cadmium (Cd)

In Only two of the cream samples used in this investigation, Carotene and Crusader, had cadmium at the same concentration of 0.01 ppm. As a result, the cadmium concentration in the cream samples is likewise below WHO acceptable levels. One metal that has been utilized in cosmetics is cadmium, whose colored salts range from bright yellow to orange. It has been linked to multiple toxicities in people, mostly because of its very low (0.5%) absorption following topical application of various cosmetics (Alamet et al., 2019). The fundamental difficulty with Cd is that it has a propensity to build up in human tissues before slowly releasing into the bloodstream. But often, it attaches to keratin. As it may cause oxidative stress, it also accelerates the aging process of the skin. Despite being present in cosmetics, it can also be found in industrial waste, agrochemicals (pesticides and fertilizers), and batteries, to name a few sources. The WHO has established a cadmium acceptable limit of 0.3ppm.

Copper (Cu)

Crusader has the highest level of copper (0.42 ppm) of any of the cream samples. Copper-containing chemicals may have been utilized as pigments in these kinds of facial cosmetics, which could explain Crusader's higher copper content. The remaining samples' copper concentrations are as follows, in decreasing order of magnitude: Hyprogel (0.37ppm), Movate (0.3ppm), Carotene (0.21ppm), and Fun bactA (0.2ppm).

Nickel (Ni)

In this study, the results of the nickel concentration in the cream samples are presented in descending order, with Movate and Crusader having 0.2ppm of nickel each, Hyprogel having 0.1ppm of nickel, and the combination of Fun bact A and Carotene having 0ppm of nickel each. Several natural components used in cosmetic products invariably contain metal contaminants, including nickel. Nickel can potentially be used as a colorant because the majority of nickel-containing salts are green in hue. By direct and frequently extended exposure, nickel is thought to be a contact allergen that can cause dermatitis, allergies, and skin sensitization (Tuchman et al., 2015). The metallic Ni has been categorized by the International Agency for Research on Cancer (IARC) as a probable human carcinogen (Group 2B), and its compounds have been categorized as carcinogenic (Group 1). In soil and volcanic dust, nickel can be found naturally. This could be obtained through industrial pollutants and dust. There have been suggested restrictions for the amount of Ni in products because of the potential skin sensitivity. For some household goods and detergents, limits of 5 ppm (Bocca et al., 2007) and 1 ppm (Basketter et al., 1993) were recommended. Similar to cosmetics, a Ni limit was also suggested with a focus on people with sensitive skin. Less than 1 ppm of nickel is present in the majority of "nickel-free" items on the market (Le Coz et al., 2002).

Manganese

Following is a decline in the samples' manganese concentration. Crusader and Fun bactA (0.02 ppm each), Hyprogel, Movate, and Carotene all (0.00ppm) each. Even though the toxic metals were present in trace amounts in all of the samples, if they were to slowly enter a person's system over time and accumulate, they might be damaging to their biological system. The extended half-life of this metal may cause it to accumulate in the body's organs. The samples are safe to use and all test findings for the heavy metals were within the safe levels advised by the World Health Organization. (Hamna et al., 2020) carried out evaluation of heavy metals in cosmetic products and the result revealed 0.26ppm of cadmium, 0.28ppm Cr, 2.14ppm Fe, 3.01ppm Ni and 2.81ppm Pb also (Pogisego et al., 2023) worked on the assessment of heavy metals in cosmetics with Pb, As, Cr and Ni concentration where 0.026ppm,0.093ppm, 0.002ppm and 0.006ppm respectively. The findings of this study are still within the realm of previous researchers worldwide.

Conclusion

Assessments of the presence of heavy metals in the creams under study reveal that some of them are present in each sample of cream. Even so, the level of concentration is incredibly low and is within all of the metals' safe W.H.O. standards.

Recommendation

Due to a lack of manufacturer testing and regulatory monitoring, it is likely that the corporations are not even aware that the items are contaminated with these harmful metals. The metals examined in this study are not specified as components on any of the products. It is therefore advised to always include a test for heavy metals during the quality assurance check of creams and cosmetics. This is because the results of this study showed that some heavy metals were present in the cream samples, although at very low concentrations.

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