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Estimation of heavy metals found in hair gels and deodorants used by population

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ABSTRACT

In this paper, the study and estimation of the amount of heavy metals (lead and cadmium) for a group of samples of different brands imported for hair gel and deodorant widely used for both sexes in Iraq, specifically in Baghdad. 50 samples of hair gel and 40 samples of deodorants were taken. The percentage of heavy metals mentioned above was measured for each sample by atomic flame spectrometer. After obtaining the results, a tabular study of the percentage of elements was done. The results were obtained and compared. It was noted that the hair gel contains high concentration of lead, compared to the lack of cadmium, and this indicates a danger to the health of users of hair gel in abundance. So differently in skin lotion samples

1. Introduction

Nowadays, cosmetics have become an important and daily thing to use, especially those that contain cleaning products such as shampoo, bath products, deodorants, and makeup products, as they contain ingredients such as the raw materials used in them, additional materials, and solvents that carry the fragrance and the aromatic composition, there are several factors that affect the quality of cosmetic products, including the storage method, impurities, and some color additives, which affect the compositional effectiveness of these products (Jafari;, 2020). Heavy metal elements are elements that have a specific gravity five times or higher than water, meaning their specific gravity is greater or equal to 5 g / cm3. It is also known as the high molecular weight mineral elements that cause their concentrations low in harmful natural ingredients, which accumulate in food (Saleh, 2020). Including lead, nickel, cadmium and mercury, where their toxicity and danger to human health have been proven through direct and continuous exposure to these elements. The toxic effects of lead include all organs and systems of the body, due to the ability of lead to inhibit the action of calcium and bind with important proteins in the body. Lead causes changes in vitamin D3 levels and leads to calcium homeostasis in the bones and alteration of bone cell function. Excessive exposure of lead results in abdominal pain,

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constipation, and nausea (Alharbi, 2017). As for cadmium, cadmium was classified as a carcinogen for humans, as occupational exposure to it led to the infection of those exposed to prostate and lung cancers, by an unclear mechanism. These and other elements are being used in cosmetic products in the form of dyes, preservatives, UV filters, as well as anti- deodorants, anti-fungal and anti-bacterial agents. The ability of chromium (VI) to be absorbed into the skin is greater than that of chromium (II) this is due to the high solubility Chromium (III) ions are unable to diffusion of biological membranes and contact with skin tissue. While Chromium (VI) compounds are rapidly absorbed by anion transporters that pass through the skin, The skin is more sensitive than the rest of the body to absorbing cadmium, especially the face because of women use many products and lotions in addition to exposure to air pollution and It can cause chronic diseases in addition to skin diseases and affect the eyes, according to the expectations of manufacturers of these preparations and as important ingredients in sunscreen cosmetics and other daily cosmetics (Inam, 2013). The flame atomic spectrometer device analyzes metals such as sodium, calcium, magnesium, lead, chromium, cadmium, copper, and mercury in liquid samples, as it identifies their presence or not, in addition to their quantity. This device relies on the principle of flame atomic absorption, meaning that the flame is the basis for the work of this device, one of the conditions for analysis for this device is the presence of standard solutions containing these elements in a known quantity so that the device can estimate the percentage of the sample, in addition to light sources. Each metal has its own light source (Hussein, 2015). This absorption or radiation emission is in the visible spectrum for some minerals. Because the atom's electrons are essentially at different energy levels, they all absorb the light of the flame, thus emitting a mixture of different wavelengths for a single atom (Saeed M., 2011).

2. Experimental Section:

2.1. Materials

90 random samples were collected from several types, hair gel and liquid deodorants, samples of different brands were collected from different local stores of the cosmetic shop center of Baghdad, Samples are taken after being prepared as solutions with concentrations of parts per million to an “atomic absorption spectroscopy” device manufactured by “Spectra AA Varian” was used. The sensitivity of the device is defined as the smallest concentration of the element that causes a change in absorbance of 0.1%, or the concentration that gives an absorbance reading of “0.0044 Phillips units”, and the detection limits reach (2ppm). After operating the device, we perform a calibration of the special hollow lamp for each corresponding lamp metal by taking its highest absorbance through the automatic calibration included in the device (Saeed, 2010).

2.2. Methods

Then we permit the solution and the standard solutions prepared before to obtain the graph on the flame atomic absorption device for each metal, which shows the existence of a linear connection between the concentrations of the standard series and the absorbance values corresponding to each concentration. We then pass the studied samples and the absorbance values appear, giving the conforming concentrations (Sukender, 2012). The samples estimated in ppm, associated to the results of the standard series with known concentration. The wavelengths of each element were also used, as follows: The wavelength used for lead is 217 nm and cadmium is 228.8.

3. Result:

The percentage of heavy metals mentioned above was measured for each sample by atomic flame spectrometer. After obtaining the results, a tabular study of the percentage of elements was done. The results were obtained and compared. It was noted that the hair gel contains high concentration of lead, compared to the lack of cadmium, and this indicates a danger to the health of users of hair gel in abundance. So differently in skin lotion samples that contain a small amount of each of the elements lead and cadmium, which has almost a minimal impact on the health of the individual, depending on the percentage of exposure to them, as the study showed. It was also noted that anti deodorants contain unauthorized levels of lead and cadmium with a slight presence, and this indicates the danger of using these products, especially as they come into contact with human skin directly, causing some serious diseases, including cancer and skin diseases, as a result of continuous exposure. These preparations are intended to be used by people directly and continuously.

The results were collected and the concentrations of the two components were obtained for each sample according to the table below:

Table 1/ the concentrations of elements in ppm in hair gel samples

Sample no.	Pb	Cd	Sample no.	Pb	Cd
Pr1	2.014	0.026	Pr26	3.121	1.256
Pr2	3.098	0.342	Pr27	1.002	0.376
Pr3	2.676	1.213	Pr28	2.765	1.260
Pr4	3.765	1.003	Pr29	1.998	1.022
Pr5	2.376	1.015	Pr30	1.263	0.899
Pr6	2.098	1.310	Pr31	2.653	1.990
Pr7	2.021	2.056	Pr32	2.021	0.763
Pr8	3.422	1.789	Pr33	3.422	1.006
Pr9	2.321	1.396	Pr34	2.321	0.263
Pr10	2.001	0.137	Pr35	2.001	1.004
Pr11	0.221	1.111	Pr36	3.221	1.526
Pr12	3.763	1.024	Pr37	3.763	1.221

Pr13	2.376	2.987	Pr38	2.765	0.564
Pr14	3.514	1.078	Pr39	2.984	1.982
Pr15	0.997	1.459	Pr40	2.098	1.453
Pr16	2.769	1.444	Pr41	3.165	1.876
Pr17	2.342	0.643	Pr42	3.021	0.971
Pr18	2.338	1.545	Pr43	2.206	0.004
Pr19	2.980	2.999	Pr44	3.004	0.256
Pr20	1.011	0.999	Pr45	3.221	0.876
Pr21	1.423	0.555	Pr46	2.897	1.006
Pr22	0.356	1.102	Pr47	2.365	0.054
Pr23	0.354	1.265	Pr48	3.212	2.003
Pr24	1.236	2.223	Pr49	3.442	1.982
Pr25	1.001	1.330	Pr50	2.662	0.880

Standard deviation for the second group, which consists of (50 samples)

Descriptive Statistics

	N	Mean	Std. Deviation
Pb2	50	2.38132	0.920793
Cd2	50	1.17088	0.675942

These results confirm what was stated in the previous results of the first group, which showed the same result, which is the weak correlation (Gondal, 2014).

Table 2/ the concentrations of elements in ppm in deodorant samples

Sample no.	Pb	Cd	Sample no.	Pb	Cd
D1	2.111	1.243	D21	2.111	0.808
D2	1.222	1.665	D22	3.222	0.459
D3	0.933	1.3272	D23	1.333	1.890

D4	1.098	0.982	D24	2.464	1.873
D5	0.657	1.623	D25	0.559	0.345
D6	1.332	1.098	D26	0.696	0.056
D7	2.456	1.76	D27	0.977	1.089
D8	2.321	1.009	D28	2.848	2.003
D9	1.666	0.753	D29	1.269	1.659
D10	2.098	1.760	D30	1.888	1.056
D11	2.099	1.667	D31	1.606	0.981
D12	1.711	2.001	D32	1.099	1.721
D13	1.577	1.730	D33	2.086	0.992
D14	2.877	0.243	D34	2.956	1.003
D15	2.100	0.443	D35	2.543	1.762
D16	0.772	1.887	D36	1.565	2.006
D17	0.234	1.993	D37	1.201	1.093
D18	0.567	1.995	D38	2.709	1.762
D19	0.167	1.002	D39	0.991	1.450
D20	2.887	0.707	D40	2.910	0.005

Standard deviation of the first group, which consists of (40 samples)

3.1. Descriptive Statistics

	N	Mean	Std. Deviation
Pb	40	1.69795	0.833521
Cd	40	1.27253	0.588645

Descriptive statistics table for the studied variables and the two groups consisting of (40 samples and 50 samples)

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean
Pb	40	3.055	0.167	3.222	1.69795
Cd	40	2.001	0.005	2.006	1.27253
Pb2	50	3.544	0.221	3.765	2.38132
Cd2	50	2.995	0.004	2.999	1.17088

From the table above (mean) represents the arithmetic mean, and it became clear to us that the average use of lead for the first group was (1.697), the average for cadmium for the first group (1.275), the average for lead for the second group was (2.381), and the average for cadmium for the second group was (1.170) measured With ppm

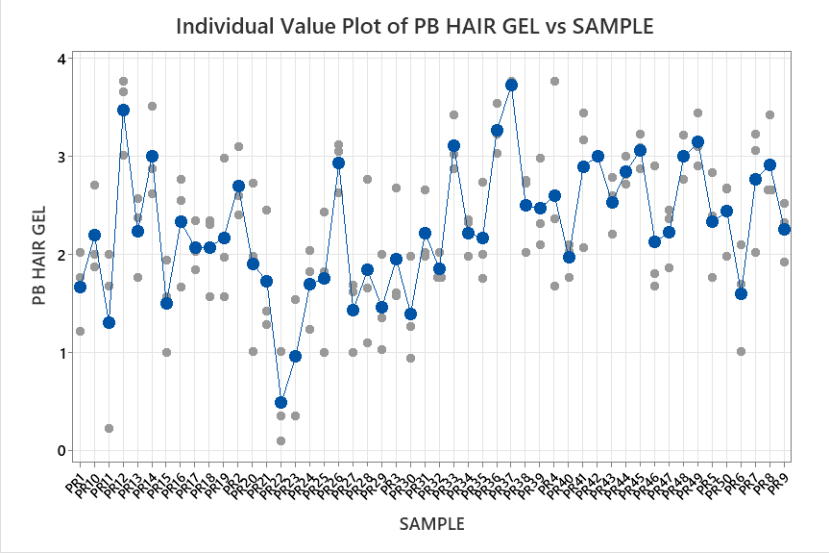
It is clear to us from the table above that the “Range” range, which is the difference between the largest amount of lead used for the first group and the smallest amount, amounted to (3.055 ppm).

It is clear to us from the table above that the “Range” range, which is the difference between the largest amount of cadmium used for the first group and the smallest amount, was (2.001 ppm).

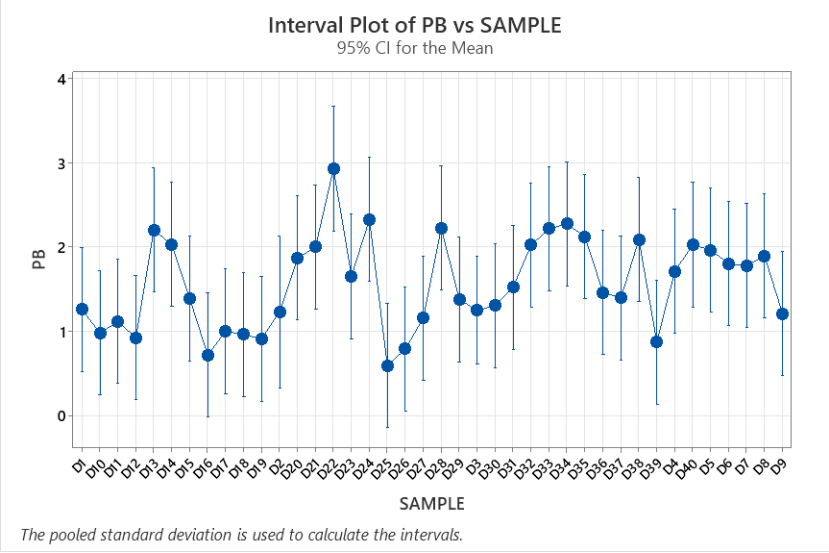
It is clear to us from the table above that the “Range” range, which is the difference between the largest amount of lead used for the second group and the smallest amount, amounted to (3.544 ppm).

It is clear to us from the table above that the “Range” range, which is the difference between the largest amount of cadmium used for the second group and the smallest amount, was (2.995 ppm).

- Maximum represents the largest amount of materials used.
- Minimum represents the least amount of materials used.



Fig(1) hair gel sample statistics data



Fig(2) Deodorant sample statistics data

This is information that can be used if this is used materials combined in other products. From the table above, the results showed the average level of cadmium in hair gel (Punia, 2014), as all average concentrations of cadmium in the different brands exceeded the permissible limit value for its presence according to the World Health Organization. It is 0.003 parts per million (Abd Byty, 2021).

4. Discussion:

The goal of the study is to determine the concentration of some toxic heavy metals. -If they are present in the samples of those materials where the elements (lead and cadmium) were estimated.

The results were obtained and found impermissible quantities of heavy metals that may cause toxicity as they penetrate the membranes and enter the body, in moderate quantities repeatedly in some samples.

The presence of cadmium in the samples may be due to the use of raw materials contaminated with it. Such as oils, such as castor oil, which is characterized by the presence of cadmium in it at a rate of up to 0.5 parts per million, according to the British Pharmacopoeia, and the reason is also due to the presence of some contaminants through the use of hair gel tools (Wang, 2014).The values of lead in hair gel also exceeded the permissible natural value, and the results showed these values, as all natural concentrations of lead in all brands exceed the permissible limit value according to the World Health Organization (WHO), which is 0.001 parts per million. The number of tests that exceed the permissible limit value is 40 samples out of 40. The presence of lead in samples may be due to the use of raw materials that contain impurities in them, such as waxes, oils, or colorings (Ghaderpoori, 2020). It may also be the result of the use of zinc oxide or zinc stearate, which poisoned by the presence of lead in them separately, according to the British Pharmacopoeia 2013.And the use of industrial equipment such as stainless steel, which contains various heavy metals, including lead (Alam, 2019). The same was true for antiperspirant tests, where average lead and cadmium concentrations exceeded the limit value of 0.003 ppm for cadmium and 0.001 ppm for lead (Sharma, 2012). The results showed the presence of some toxic elements in samples of hair gel and deodorants, which may cause harm to public health as a result of their absorption by skin exposed to these substances (K Mishra, 2016). Cadmium is a cumulative toxic element with a biological half-life of several years it negatively affects the liver and kidneys, Clinical lead toxicity affects gamete toxicity in both males and females in addition to intestinal fluctuations and heart diseases (Adepoju-Bello, 2012). On comparative basis of study of Hamna Arshad paper, different products of sunblock creams showed highest concentration of Ni, Pb and Cr by reason the type and basis of raw materials used, processing system, storage and transference (Arshad, 2020). In study was done by Nathan The study was conducted on flame atomic absorption of toxic elements.

Specifically for lead metal, assuming that the metal present in hair dyes is absorbed through the skin and is affected by the body after its absorption. It was found that there are certain percentages through the study (Nathan, 2014). In study of Mishra proved that the toxic metal in some creams used in cosmetics contain lead, titanium and mercury and it was very harmful of the health (K Mishra, 2016).

5. Conclusion:

From the results above, it was found that there is a difference in the data listed for both hair gel and deodorant samples in the presence of both lead and cadmium elements for each type in the samples, in varying proportions that exceed the permissible values, according to the World Health Organization for cadmium 0.003ppm and lead 0.001ppm (Quraishi SM, 2016), which indicated that the permissible values for toxic elements should not exceed 20ppm. In samples, if they exceed the permissible limit, they may be absorbed by the skin through use, and this leads to their accumulation in the human body, causing health damage (Schares, 2020).

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