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DETERMINATION OF HEAVY METALS IN TATTOO INKS FROM THE LOCAL MARKET IN BAGHDAD CITY

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Abstract

Tattoos have become very common worldwide in latest years and tattoos have been carried out by millions of individuals. The aim of the study is to measure whether the common or commercially purchased permanent tattoo inks on the Iraqi market meet the maximum concentrations of heavy metals in the guidelines of the EPA and to determine the color relationship by lead, cadmium, mercury , titanium, copper, chromium, iron and nickel contents. The lead, cadmium, titanium, copper, chromium, iron and nickel contents were analyzed by a Flame Atomic Absorption Spectrometer and mercury contents was analyzed by Cold-Vapor Atomic Absorption. Variance analysis was performed on each tattoo ink product to determine whether there is significant variation in heavy metal levels in distinct colors of each brand. This effects in the color form used in tattoo inks that contributes to its heavy metal concentration.

Key words: Heavy metals, Tattoo inks, Cold-Vapor Atomic Absorption.

Introduction

Tattooing is an old method used to stain the skin of human, tattooing has been an significant instrument in religion and hierarchy in some societies, such as Polynesian tribes (Dorfer *et al.*, 1999). Skin tattooing causes skin trauma, and many of the participants reported bleeding, edema, burning, and pain Direct after tattooing, In the course of wound healing after tattooing, it would be regarded normal for individuals to also define crusts, itching, blister formation and, in some instances, wound infection followed by suppuration (Bachmeyer et al., 2007). The Environmental Protection Agency (EPA) approved standard, the Tattoo and Permanent Make-up Substances Collection Standard, to better control the hazards associated with chemical composition of tattoo inks and permanent make-up substances (Eghbali *et al.*, 2014).

The aim of study Investigation of the chemical composition of tattoo ink (some heavy metal) and for the assorted varieties that obtain in different markets in Baghdad city.

Materials and Methods

Collection of samples

Five (5) Samples of tattoo inks with a different color (white, brown, green, blue and pink) which represent as permanent make up ink tattoo, were chosen (Schneider brand, German Manufacturing) net wet (40g) bottle. These samples were purchased from the local market (Al-Shorjh area) in Baghdad city which is usually supply the beauty and tattoo centers with different types of tattoo inks.

The samples of tattoo inks considered as the most dominant brand also have a suitable price for centers and clients in both.

Determination of the chemical composition of tattoo ink

Estimation of heavy metals concentrations

Flame Atomic Absorption Spectrometer (FAAS) Examination:

The heavy metal concentrations in tattoo inks (liquid sample)were determent using flame Atomic Absorption Spectrometer (FAAS) this analytical technique measures the concentrations of elements present in samples. The technique is based on the principle that ground state metals absorb light at a specific wavelength. Metal ions in a solution are converted to the atomic state by means of a flame.

The sample preparation for this technique required about 0.2g of each ink sample weighed by accurate

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balance and then digested in a microwave oven with a mixture of nitric acid 65% and hydrogen peroxide 30%. After digestion, the resulting solution was diluted with water (Maulvault *et al.*, 2011), then the sample measured through the device. The aim behind this method to detect some heavy metals such as Pb, Cd, Ti, Ni, Cr, F and Cu.

Cold-Vapor Atomic Absorption(CVAA)

Spectroscopy examination:

The mercury concentration in tattoo ink samples was determined by using Cold Vapor Atomic Absorption (CVAA) spectroscopy that available in laboratories of environment and water directorate/ministry of science and technology.

This method including wet digestion, reduction, and absorption. The technique includes wet digestion with a mixture of strong acids (HCl, HNO_3) followed by the addition of a reducing agent ($SnCl_2$) to convert inorganic mercury to elemental mercury vapor (HgO) which is introduced into an absorption cell. The concentration is determined by determining the absorbance of this gas at 253.7 nm. Data are presented as total mercury (µg/L) (Makiese, 2008).

Table 1: The heavy metals concentration found in tattoo inks by used (FAAS) method, (N.D) refer to not detected and the yellow color refer to value which are high concentration.

The concentration of heavy metal (ppm)							Color of tattoo
Fe	Ni	Cr	Cu	Pb	Cd	Ti	ink used in current study
4.157	4.6	180	55	N.D	0.043	36.58	White
5	2.7	200	72	1.1	0.185	44.27	Pink
5.22	3.1	226.3	30	0.7	1.457	29.84	Brown
12.7	1.6	120	97	N.D	N.D	62.05	Blue
9.8	6.8	170	63	2.27	1.617	50.01	Green

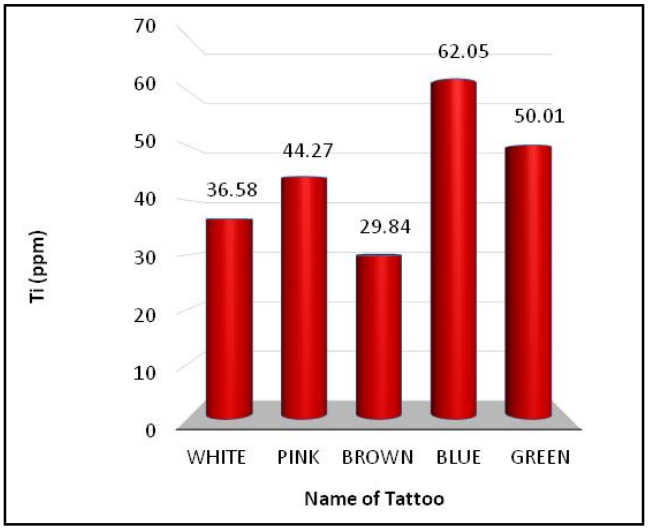

Fig. 1: The concentrations of titanium.

Results

The concentration of the seven heavy metals (Pb, Cd, Ti, Cr, F, and Ni) were measured in five color of tattoo inks as shown in table 1.

The results revealed that the highest concentration (62.05 ppm) of titanium was found in blue tattoo ink, whereas the lowest concentration (29.8 ppm) of titanium was found in brown tattoo ink as shown in table 3, Fig. 1.

For cadmium the results that highest concentration (1.617 ppm) was found in green tattoo ink, while the lowest concentration (0.043ppm) was found in white tattoo ink, cadmium was not detected in blue tattoo ink as shown in table 1, Fig. 2.

The concentration of lead records the highest value (2.27 ppm) in green tattoo ink, whereas the lowest concentration (0.7 ppm) of cadmium in was found in brown tattoo ink. Lead not detected in both white and as

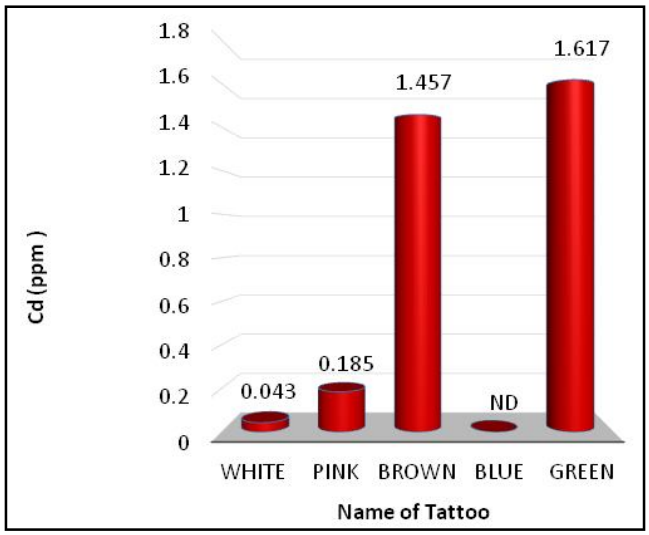

Fig. 2: concentrations of cadmium.

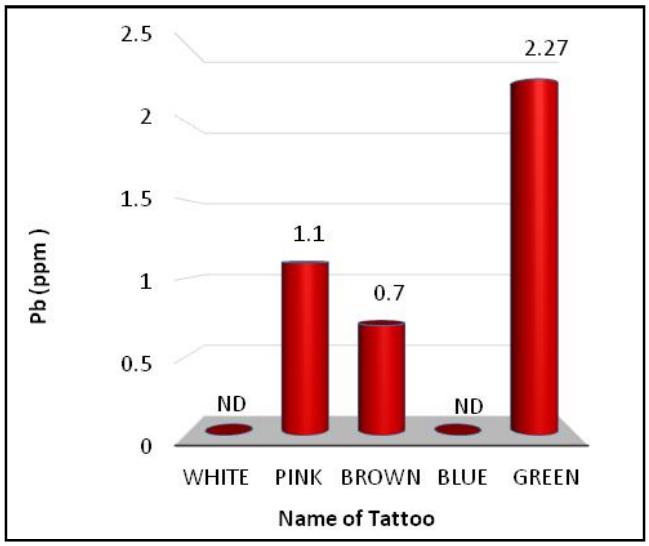

Fig. 3: concentrations of lead.

shown in table 1, Fig. 3.

For Copper the highest concentration (97 ppm) was found in blue tattoo ink, whereas the lowest concentration

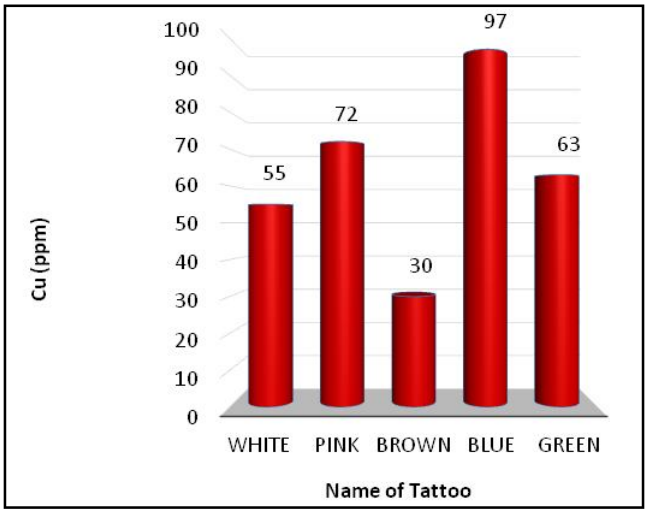

Fig. 4: concentration of copper.

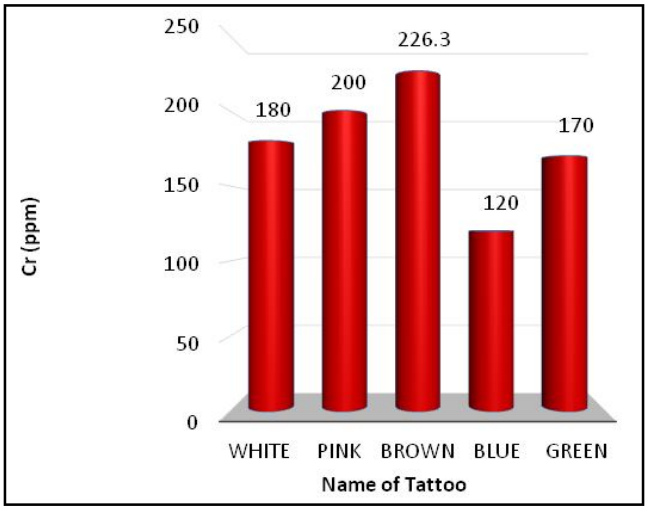

Fig. 5: concentrations of Chromium.

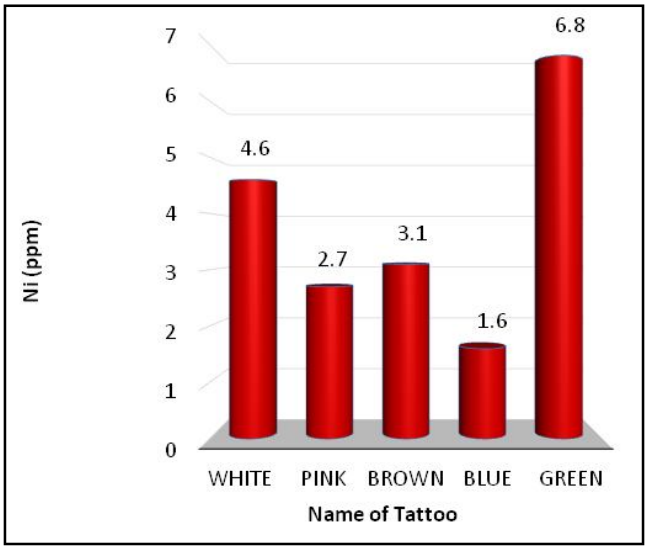

Fig. 6: concentrations of nickel.

(30 ppm) was found in brown tattoo ink as shown in table 3, Fig. 4.

The results in this study showed that Chromium concentration were (226.3, 200, 180, 170 and 120) ppm and found in the colors of inks (brown, pink, white, green and blue) respectively table 1, Fig. 5.

The concentration of nickel records (6.8, 4.6, 3.1,

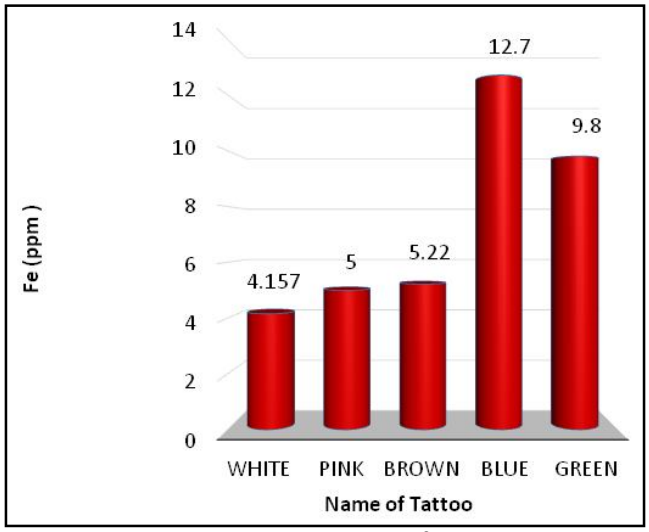

Fig. 7: concentrations of iron.

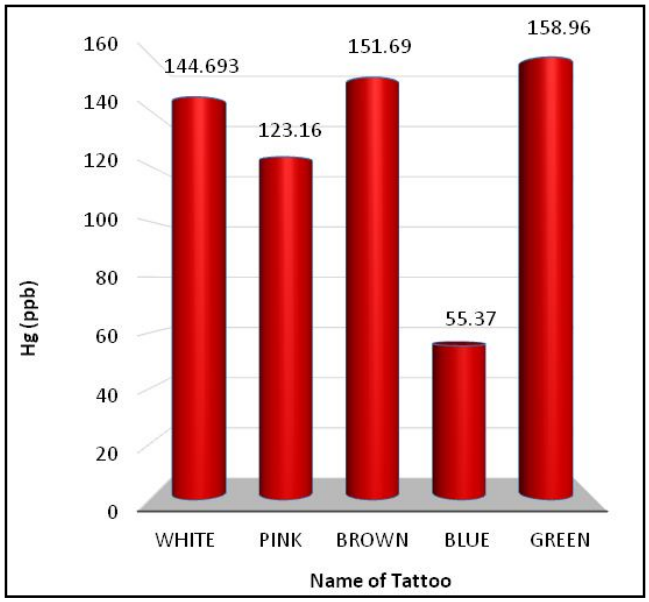

Fig. 8: Concentrations of Mercury.

Table 2: The concentrations of heavy metals in tattoo inks and make-up substances agreed in the EPA's Guidelines (2012).

Heavy metal	ppm
Cadmium (Cd)	0.2
Chromium (Cr)	0.2
Copper (Cu)	25
Nickel (Ni)	'as low as technically achieved'
Lead (Pb)	2

2.7 and 1, 6) ppm in colors of tattoo inks (green, white, brown, pink and blue) respectively table 1, Fig. 6.

Fig. 7 showed different concentration of iron in different colors of examined tattoo inks its records (12.7, 9.8, 5.22, 5, 4.157) ppm in tattoo inks (blue, green, brown, pink, white) respectively table 1.

The results in Fig. 8 showed the mercury concentration in tattoo ink The highest concentration (158.96 ppb) of Mercury was found in green tattoo ink, whereas the lowest concentration (55.37 ppb) of mercury in found in blue tattoo ink.

Discussion

The result demonstrated that the concentration of heavy metals are variable in the examined tattoo inks colors and green tattoo inks contain the highest concentration of the most health hazard heavy metals (Cd, Pb, Ni) as compared with other tattoo inks.

The Environmental Protection Agency (EPA) released the Guidelines for tattoo inks and Make-up Substances , the guidelines recommend that tattoo inks must not have levels of heavy metals above the concentrations set out (Tighe *et al.*, 2017) in as shown in table 2.

The Environmental Protection Agency (EPA) recommended that the maximum concentration of mercury in EPA Guidelines found in tattoo inks and makeup substances must be 200 ppb (Tighe *et al.*, 2017).

The results in this study showed the concentration of mercury are less than the recommended concentration by EPA.

Conclusion

Most samples contain metals that are larger than the EPA guidelines and may present a danger to public health. Many persons may not be conscious of the damage caused by tattoo inks from the chemicals they are produced from. Making the findings accessible to the public may provide tattoo performers with helpful, but restricted, records when choosing to buy tattoo inks. If they choose to apply for a tattoo, the public may also discover the data helpful.

References

Bachmeyer, C., L. Blum, B. Petitjean, F. Kemiche and E. Pertuiset (2007). Granulomatous tattoo reaction in a patient treated with etanercept. *Journal of the european academy of dermatology and venereology,* **21:** 550-552.

Dorfer, l., M. Moser, F. Bahr, K. Spindler, E. Egarter-vigl, S. Giullen, G. Dohr and T. Kenner (1999). A medical report from the stone age? *The lancet,* **354:** 1023-1025.

Eghbali, K., Z. Mousavi and P. Ziarati (2014). Determination of heavy metals in tattoo ink. *Biosci. Biotech. Res. Asia,* **11:** 941-946.

Maulvault, A.L., R. Machado, C. Afonso, H.M. lourenco, M.L. Nunes, I. Coelho, T. langerholc and A. Marques (2011). Bioaccessibility of hg, cd and as in cooked black scabbard fish and edible crab. *Food and chemical toxicology,* **49:** 2808-2815.

Makkai, T. and I. Mcallister (2001). Prevalence of tattooing and body piercing in the australian community. *Communicable diseases intelligence quarterly report,* **25:** 67.

Tighe, M.E., D.K. Libby, S.K. Dorn, J.R. Hosmer and G.F. Peaslee (2017). A survey of metals found in tattoo inks. *Journal of environmental protection,* **8:** 1243.