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Analysis of Lead Content in Paints Used for Face Painting in Nairobi County

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Face painting is a common practice among young children. 59 samples from 7 manufacturers of paints used for face painting in Nairobi County were purchased and analysed for lead content using atomic absorption spectroscopy. The labels were also examined for batch number, date of manufacture and expiry as well as instructions for use. All samples analysed were found to contain lead with the highest being 10.5413 ppm. Only one manufacturer declared on the label that the paint was intended for use in face painting.

***Keywords*:** Face painting, lead content

INTRODUCTION

Lead is a ubiquitous metal found in the environment and has been used by humans since ancient times when the ancient Romans used it in glazing pottery, sweetening wine and cooking utensils. Its toxicity has also been documented from the times of the Egyptian papyrus rolls [1]. Lead poisoning is a global public health concern with the World Health Organization estimating that it contributes 0.6% of the global health burden [2]. Children are at most risk of lead poisoning and the health effects of poisoning are more severe in children who are still developing. The typical sources of lead exposure to children include soil, air, water, toys, cosmetics, batteries, putty, cement, canned foods, jewellery and paints, especially from houses painted before 1979 [3-6]. Children under the age of six years are particularly at risk because of their frequent hand to mouth and object to mouth behaviours which exposes them to toxicity by ingestion [7-8].

There is no safe level of lead in the body and the Centers for Disease Control and Prevention (CDC) has set the intervention level at a venous blood level of 10 µg/dL in children. It is important to note that this threshold has come down over the years as it was recorded to be 60µg/dL in the early 1960s [9]. Lead toxicity affects multiple organs in the body with neurological effects being the most pronounced. Clinical symptoms mainly present as cognitive and behavioural anomalies [3, 4, 6, 10-12].

Face painting is a common phenomenon in Kenya. In many recreational places, entertainment for children will often include face painting. Lead in paint used for face painting can therefore be source of lead poisoning. The exposure can be by inhalation, absorption through the skin and most importantly through ingestion as the painting is carried out on young children who are very likely to touch the paint and ingest it. The objective in this project was to analyse the lead content in paints used for face painting in Nairobi County, Kenya.

EXPERIMENTAL

Study site

Nairobi County, being the capital city of Kenya was selected for this study.

Sample Collection

Samples were collected in May 2018. Universal sampling was used in purchasing the paints. All available brands were purchased from each of the outlets visited in the locations identified. Samples were purchased from upmarket malls such as The Hub and Galleria as well as the outlets in the Central Business District such as Kijabe Street and River Road. Sample collection was terminated when no new brands or colors were found in the retail outlets.

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Sample analysis

Visual inspection

The primary and secondary packaging were visually inspected for labelling. The labels were inspected for manufacturer's contact details, batch number, date of manufacture, expiry date and instructions for use. The price was also noted.

AAS of samples

Sample preparation

About 5g of the paint samples were placed on pieces of aluminium foil then dried at 130°C in an oven for one hour. The samples were then cooled, finely ground using a pestle and motor and sieved.

Triplicate aliquots each weighing 0.2g were placed in boiling tubes then aqua regia (conc. nitric acid and hydrochloric acid in the ratio of 3:1) was added to the boiling tubes. The boiling tubes were covered with clean glass plates and allowed to predigest overnight at room temperature in a fume hood. After predigesting, the samples were digested at 135-140°C for 4hrs, with occasional swirling to avoid bumping then they were then cooled and diluted with 10mL distilled water. The resulting mixture was filtered through Whatman #1 filter paper into 25 mL volumetric flasks, and made up to the mark, with distilled water.

Spectroscopic analysis

The atomic absorption spectrometer was set up with a lead hollow cathode lamp at a wavelength of 283.3nm with an air-acetylene support and fuel gas mixture and a slit-width of 0.7nm.

About 25mL volumes of lead standards were prepared, using the 100 ppm stock standard :(0.5, 1.0, 2.0, 4.0, 3.0, and 10 ppm). The standards were aspirated, noting the absorbance for each solution. The samples and blank solutions were then aspirated and the absorbance noted.

Data analysis

A calibration curve was drawn from the absorbance obtained versus the concentration of lead standards prepared. The calibration curve was then used to determine the lead content in the sample solutions. The lead contents of paint samples were calculated as parts per million taking all sample dilutions into account.

RESULTS AND DISCUSSION

Sample collection and inspection

A total of 74 samples were collected from eight retail outlets. The samples were inspected and results recorded as shown on table 1. All samples collected had labels. Labels from manufacturer 001, 002, 003 and 005 had the date of manufacture, the expiry date, batch number and a precaution on the age limit. The contacts of the manufacturers were given. However, it was only manufacturer 003 who indicated that the paint was intended for face painting. This manufacturers had both primary and secondary packaging with the information being given on both packaging materials. Manufacturers 001, 002 and 005 were silent on the indications of the paint though they indicated that the paint is not suitable for children under 3 years. Manufacturers 004 and 006 did not have any batch number, manufacture and expiry date or instructions for use. The manufacturer name and contact details were present.

Lead content in the paints

The lead content of 59 samples was determined and reported as ppm as shown on table 2. From the data obtained the blue color from manufacturer 004, which is locally manufactured had the highest lead values while the chrome yellow from manufacturer 006 from China had the least amount of lead present. Blue paints from other manufacturers had relatively low lead content. The white color from manufacturer 005 had a high lead content (8.2939) compared to the white paints from other manufacturers (0.1046, 0.0717, 0.1704, and 0.2636) from manufacturers 001, 002, 003 and 006, respectively.

CONCLUSION

In conclusion, the samples analysed all contained lead of varying quantities with the highest being 10.5413 ppm and the lowest being 0.0388 ppm. There was no correlation noted between the color and lead content as each color analysed had a range of lead contents.

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Table 1: Labels of paints used for face painting

Manufacturer code	Source	Country of manufacture	Cost/pack (USD)	Pack size	Unit size	Information on label
001	River Road	China	2.5	12	Not indicated	Batch number Date of manufacture Expiry date Not suitable for children under age of 3
002	River Road	China	1.5	12	Not indicated	Not suitable for children under age of 3
003	Galleria	United Kingdom	9.6	8	2ml	Batch number Date of manufacture Expiry date Not suitable for children under age of 3
004	River Road	Kenya	1.8	1	500mg	N/A
005	The Hub	India	4.5	6	15ml	Batch number Date of manufacture Expiry date Not suitable for children under age of 3
006	River Road	China	3.9	20	Not indicated	N/A

Table 2: Lead content in paint samples

Sample	Lead conc. (ppm)	Manufacturer Code	Color	Source of paints
A1	0.1813	001	Pink	River Road
A2	0.1046		White	
A3	0.0498		Yellow	
A4	0.0717		Lime green	
A5	0.0936		Brown	
A6	0.2361		Sky blue	
A7	1.4530		Dark blue	
A8	0.1046		Dark green	

A9	1.5517		Purple	
A10	0.1320		Black	
A11	0.1156		Orange	
A12	0.1375		Red	
B1	0.0717	002	White	River road
B2	0.1484		Black	
B3	0.0607		Green	
B4	0.0936		Red maroon purple	
B5	0.0717		Dark blue	
B6	0.0827		Grey	
B7	0.1158		Lilac	
B8	0.1430		Brown	
B9	0.1978		Orange	
B10	0.1156		Beige	
B11	0.0936		Pink	
B12	0.1813		Light blue	
C1	0.1210	003	Blue	Galleria
C2	0.0881		Yellow	
C3	0.0827		Black	
C4	0.1265		Pink	
C5	0.0936		Red	
C6	0.2581		Purple	
C7	0.1704		Dark green	
C8	0.1704		white	
D1	10.5413	004	blue	River road
E1	0.1046	005	Poster black	The Hub
E2	0.1046		Lemon yellow	
E3	8.6228		Poster green	
E4	0.8994		Poster red	
E5	0.0827		Ultramarine blue	
E6	8.2939		Poster white	
F1	0.4061	006	Naples yellow	River road
F2	0.0772		Purple	
F3	0.6308		Lemon yellow	
F4	0.2636		White	
F5	0.1265		Yellow Ochre	
F6	0.0388		Chrome yellow	
F7	0.0662		Vandyke brown	
F8	0.0498		Vermilion	
F9	0.0827		Emerald green	
F10	0.0279		Ultramarine	
F11	0.1430		Yellow	
F12	0.1210		Deep green	
F13	0.0607		Prussian blue	
F14	0.1704		Cobalt blue	
F15	0.0607		Sky blue	
F16	0.0607		Carmine	
F17	0.0827		Green lime	
F18	0.0991		Black	
F19	0.0590		Burnt senna	
F20	0.0607		Dark green	

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