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THE DANGERS OF A CHILD'S PLAY

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ABSTRACT

Toys, an integral part of a child's developmental process, are usually made of polyvinyl chloride (PVC) and metals in which lead (Pb) compounds are the most common stabiliser. In paints in toy's materials these stabilisers are loosely bound to the surface and can be easily leached. Chewing, licking and swallowing of such is a common source of Pb exposure from toys. The toy's market in Kolkata, India, is flooded with non-branded PVC and metal toys. The aim of this study is to assess their Pb levels. A total of thirty-six plastic toys from Kolkata, India, were estimated for Pb by graphite furnace atomic absorption spectroscopy with Zeeman background correction. All samples analysed contained Pb, in significantly much higher concentration compared to Indian Standard Safety Requirements, with a national average (112.51 ppm}, as well as European Standards. which is 90 ppm in painted toys. Periodic market surveillance by regulatory agencies is advisable to control this health hazard.

KEYWORDS: Lead, Toy, Atomic absorption spectroscopy, Polyvinyl chloride, Paint.

INTRODUCTION

Toys are an integral part of a child's developmental process and playing with toys help them learn about the world; but it is not unusual for animals to play with toys. Many toys are made of polyvinyl chloride (PVC) and metals. Lead (Pb) compounds are the most common stabiliser in PVC; these are mostly lead carbonate, lead stearate and lead phthalate.[1] In paints in toy's materials these stabilisers are loosely bound to the surface and can be easily leached. Chewing, licking and swallowing of such is a common source of Pb exposure from toys.[2]

In fact, paediatricians agree that, no level of Pb in blood is safe or normal.[3] Children are more vulnerable to Pb because of increased risk for exposure and adverse health effects than adults, and Pb has been linked to irreversible nervous system damage, decreased intelligence, behavioural abnormalities and learning disabilities. Pb also damage kidney function and blood cell formation.[4]

The toy's market in Kolkata, India, is flooded with non-branded PVC and metal toys that are exposed to tropical sunlight, adding to their harmful effects.

The aim of this study is to assess the Pb levels in selected toys and determine their harmful effects on children using them.

MATERIALS AND METHODS

A total of thirty-six (36) plastic toys were collected from three locations in the Kolkata, India. Sample collection area included mini shops and road side vendors at Burra bazar-China Bazar, Esplanade-New Market-Chandi Chowk and Shyambazar in Kolkata, India. These samples included dolls, cars, building blocks, musical instruments, etc. all of which are unbranded. Each sample was labelled as Burra bazar were coded B_1, B_2, through to B_{12}, whilst those collected from New Market were coded N_1, N_2, through to N_{12}, Shyambazar procured toys were coded S_1, S_2 through S_{12} and transported laboratory for analysis.

Each sample was cut into several pieces and further broken down in smaller particles using mortar and pestle. 100 mg of each plastic toy was accurately weighed in triplicate in pre cleaned falcon tubes and filled with 10 ml of 0.07 (M) HCl for extraction. Each falcon tube was centrifuged for 30 seconds with 5 minutes interval while storing in water bath at 37°C ± 1°C for 1 hour. To protect the samples from light, falcon tubes were covered with aluminium foil and placed into the refrigerator.

Estimation of Pb in samples were done by graphite furnace atomic absorption spectroscopy with Zeeman background correction (Perkin Elmer 2380).[5] The calibration curve was plotted with standard solutions of Pb (10 to 30 ppm). The stock solutions used was of

analytical grades standards provided by E Merck. The stock standard had a concentration of 1000 mg/l supplied in 0.1 (N) HNO_3.

The measurements were done as triplicate and mean of these values were used. The manufacturer's guidelines for graphite furnace parameters were as follows in Table 1.

Conditions	Temperature (in °C)
Drying	90°C
Pyrolysis	900°C
Atomisation	1400°C

Appropriate quality assurance procedures and precautions are carried out to ensure reliability of the results. Results of each batch were accepted if control samples were within 10% of the accepted value of these samples.

The statistical package (SPSS, Version 17.0) was used for the statistical analysis. All the samples were measured in triplicate and the mean and standard deviation determined.

RESULTS

All samples analysed contained Pb. In all cases the level of Pb was significantly much higher compared to Indian Standard Safety Requirements for Toys (Part 3) [6] as well as European Standards [7]. In all cases the average, range and standard deviation of Pb content recorded for samples obtained from different location of Kolkata, India was shown in Table 2.

Table 2: Average, range and standard deviation of data related to Lead (Pb) concentration (in ppm) in toy sampled from different parts of Kolkata, India.

Locations (Number of Samples)	Average	Minimum	Maximum	Standard Deviation
Burra bazar (B_1 – B_{12}) (12)	316.72	109.16	706.42	388.99
New Market (N_1 – N_{12} (12)	333.56	178.99	685.12	345.06
Shyambazar (S_1 – S_{12}) (12)	292.31	146,54	399.39	109.11
All (Kolkata, India) (36)	314.20	109.16	706.42	281.05

The results showed that the lead concentration ranged between 109.16 ppm to 706.42 ppm in the different toys.

The highest value of Pb at 706.42 ppm was recorded in cars, followed by dolls with the value of 685.12 ppm; these toys were the most colourful of all toys.

DISCUSSION

The results showed the approximate amount of Pb content in the toys which are used to be played with by children. Pb both in paints and polyvinyl chloride (PVC) toys is a major health concern. The quality assurance from such toys is extremely poor to non-existent. The Pb was used as stabiliser in toys or a combination of colour pigments, though overall Pb seems to be largely used as stabiliser in PVC toys.

Amount of Pb was high in all the samples. In fact, average Pb content in toys in Kolkata (314.20 ppm) was higher than that of the national average (112.51 ppm).[8] It is also observed that all the 36 samples analysed from different areas of Kolkata, showed concentration higher than the limit proposed by the EU limit, which is 90 ppm in painted toys.[7] In fact, these toys were made more colourful to look attractive. There is also accumulation of vehicular exhaust on them from the roadside shops, which might add to their lead content.

Regarding the regulatory limit in the content of Pb in PVC toys existing in different parts of the world some research articles have recorded significant levels of Pb far above permissible limits.[9] Also, this seems to be a Pan Asian problem; High Pb levels in toy paints have been recorded in China (116,200 ppm),[10] Thailand (505,716 ppm),[10] etc. just to mention a few.

In conclusion, despite the regulations and restrictions, children's toys imported into India from China, Thailand, etc. still contain higher amount of Pb than allowable limit. The results showed that the Pb concentrations ranged from 109.16 ppm to 706.42 ppm in different toys.

As children play with toys and they may chew, suck or lick, ingestion of Pb will continue as long as they are present in the products.

Periodic market surveillance by regulatory agencies in this regard can be useful in maintenance of children's safety.

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Conflict of Interest

The authors declare no conflict of interest in the present study.

Ethics Statement

No specific permits were required for these described field studies because sample collection doesn't involve

any endangered or protected human, animal or plant species or privately owned locations.

REFERENCES

1. Mazumdar I, Goswami K, Chronic exposure to lead: A cause of oxidative stress and altered liver function in plastic industry workers in Kolkata, India. *Indian J Clin Biochem*, 2014; 29(1): 89-92.
2. Mohammed T, Dial D, Maharaj D, Smith C, Persad N, Mohammed S, Mohammed A, Heavy metals in children's toys and baby items commonly sold in Trinidad and Tobago. *J Environ Chem Ecotoxicol*, 2020; 12(1): 59 – 64.
3. https://www.mayoclinic.org/diseases-conditions/lead-poisoning/diagnosis-treatment/drc-20354723.
4. Mazumdar I, Goswami K, Ali S, Status of serum Calcium, Vitamin D and Parathyroid Hormone and hematalogical indices among lead exposed Jewellery workers in Dhaka, Bangladesh. *Indian J Clin Biochem*, 2017; 32(1): 110 – 16.
5. Goswami K, Mazumdar I, Estimation of lead compounds in cosmetic hair colorants available in the Indian market. *J Chem and Pharma Res*, 2016; 8(9): 176 – 79.
6. https://law.resource.org/pub/in/bis/S11/is.9873.3.1999.pdf.
7. https://ec.europa.eu/growth/single-market/european-standards/harmonised-standards/toys_en.
8. Kumar A., Pastore P, Lead and cadmium in soft plastic toys. *Current Science*, 2007; 93(6): 818-822.
9. Goswami K. Eye cosmetic 'Surma': hidden threats of lead poisoning. *Indian J Clin Biochem*, 2013; 28(1): 71-73.
10. Njati S Y, Maguta M M, Lead-based paints and children's PVC toys are potential sources of domestic lead poisoning - A review. *Environ Pollut*, 2019; 249: 1091-1105.