

# LETTER

## **Low cost jewellery: low price for a high risk**

### ***Bigiotteria a basso costo: un rischio elevato per un prezzo basso***

Sir,

as already described by Farmakakis et al. (1), toys are the most frequent cause of medical emergencies due to aspiration or ingestion of inedible foreign bodies, followed by coins and jewellery. Moreover, mouthing contaminated jewellery or toys may cause the release of contaminants via contact with saliva, but metals can also be released from toys and jewellery matrices to gastric and intestinal fluids following ingestion.

Children are increasingly likely to mouth non-food items starting from the age of 6 months, and the high behavioural frequency of mouthing hands and objects (1-2 years) begins to moderate when they reach the age of 2-3 years (2), then becomes less significant from the 3<sup>rd</sup> year of age (3).

In 2002 the Consumer and Competition Policy Directorate published the “Research into the mouthing behaviour of children up to 5 years old” (4), classifying the toys and other objects most commonly mouthed, and jewels (such as necklaces) were included in this research.

Children can be exposed to contaminants including potentially toxic elements via different sources, and economical costs and adverse health outcomes of children’s exposure to environmental contaminants are difficult to oversee (5).

Beyond the lead (Pb), recent studies showed also contamination with other toxic elements from various toys and especially from jewellery: cadmium (Cd), copper (Cu), nickel (Ni), arsenic (As) and antimony (Sb) (6).

In October-November 2017 we performed a systematic search for original peer-reviewed papers in the electronic database PubMed (MEDLINE). The key search term was only “low cost jewellery”. We searched for studies written in English, French, Spanish or Italian without any temporal limit.

We considered eligible for the review only articles (original articles, but also Letters to the Editor if containing original data) that reported clear data on: i) the Pb and Cd content identified in the analyzed objects; ii) the content of other metals such as As, Cu, Ni, Sb.

Studies were selected through a 2-stage process. Titles and abstracts from electronic searches were scrutinised by 2 reviewers independently (N.N. and G.T.) and full manuscripts and their citations list were analysed to retrieve additional articles and to select the eligible manuscripts according to the inclusion criteria. The level of agreement between the reviewers was high. Then, each article was further reviewed to identify the manuscripts suitable for our systematic review.

The literature search yielded thirteen publications. The titles and abstracts of these manuscripts were screened, resulting in seven studies not considered potentially eligible to be included in the review (two studies were excluded because they were reviews; five because they were not in line with the aim of the study). After the examination of the full texts we identified six manuscripts, namely those listed in the References as (5), (7), (8), (9), (10) and (11).

The studies were published between 2007 and 2017; they involved a minimum of 13 to a maximum of 139 low cost jewels and they had been carried out in USA, Canada, Czech Republic. The principal results of our review are shown in Table 1.

Table 1 - Main characteristics of the studies included in the systematic review

Author, year	Setting	Samples (N)	Lead content	Other contaminants
Weidenhamer and Clement, 2007 (7)	USA	139	Average lead content/item 44%; >80% (42.5% of samples) >90% (24.1% of samples)  Acid leachable lead: 6/10 > 175 µg (over 6 h) 3/10 >1000 µg	Not reported
Yost and Weidenhamer, 2008 (8)	USA	64	49/64 samples had >50% lead by weight  Accessible lead: 50/64 > 175 µg 31/64 >1000 µg 8/64 > 4000 µg	Not reported
Guney and Zagury, 2014 (5)	Canada	24	22/24 samples had elevated concentrations (defined as 25-100% of the limit value)	Samples exceeding the EU limits: 15/24 Cd 6/24 Pb 6/24 As 15/24 Cu 11/24 Ni 2/24 Sb
Hillyer et al, 2014 (9)	USA	46 + 46 (from bargain discount stores and from retail stores)	- 9/46 from bargain discount stores exceed Consumer Safety Product Commission (CPSC) regulation -1/46 from retail stores exceed CPSC regulation	- As: 15/46 from bargain discount stores and 6/46 from retail stores exceeded the limits - Cd: 4/46 from bargain discount stores and 1/46 from retail stores exceeded the limits
Guney and Zagury, 2014 (10)	Canada		9/16 samples had a high concentration (>100mg/kg-1)	High concentrations for other metals: Cd: 3/16 (>300 mg/kg-1) Ni: 4/16 had a Hazard Index>1 (oral exposure) Cu : various concentrations (not worrying)
Pouzar et al, 2017 (11)	Czech Republic	13	Not analyzed	Surface layer's content (for all samples): Cd (13.4-44.6%) Zn (0.5-39.7%) Cu (25.8-85.4%)  In 11 samples: Ag (0.2-1.6%) In 4 samples: Sn (0.2-04%) In 8 samples: Ni (0.3-13.8%)

In five articles the authors analyzed the Pb content: in a high percentage of cases [up to 91.6% of the sample (10)] the concentrations of Pb exceeded the normal limit. In one case (11), 24.1% of the examined jewels had a Pb content which represented more than 90% of the entire object.

Four articles reported data about other identified contaminants. Cd was the second most common metal: Hillyer et al. (9) reported the most worrying data describing higher concentrations in 15/24 jewels (62.5%). Other contaminants were represented by As, Cu, Ni, and Sb, and their presence was not limited to only paints or coatings.

The exposure to metals such as As, Cd, and Pb represents a significant threat to children's health and their behavioural/intellectual development (12). High concentrations of these metals are linked to hindered brain/sensory motor development (As, Cd, Pb), decreased kidney function (As, Cd), gastrointestinal complications (Cd), bone softening (Cd), and cancer (13).

Pb, Cd, and As may be present in products such as children's toys/toy jewellery for a variety of reasons. Pb is often used as a stabilizer in certain plastics, a paint colour enhancer, or an anti-corrosion agent (14, 15). As restrictions on Pb have increased, Cd has been increasingly substituted (15, 16). So Cd in jewellery is not present as an unwanted contaminant but is rather deliberately used during the production of jewellery articles. Cd is used in all probability in the production of such articles, due to its favourable properties: it is easy to use, resistant to rust and relatively cheap. Similar to Pb, Cd is used to brighten paint colour and stabilize plastics, preventing hydrochloric acid formation that subsequently degrades the polymer (16).

We do not forget that in the past, children's exposure to Pb via the ingestion of low-cost jewellery and "white Pb"-coated pencils (17) resulted in cases with serious acute or chronic adverse effects, including death (18).

Following the death of a Minnesota child who swallowed a highly leaded charm in the early 2006, the Sierra Club petitioned the US Consumer Product Safety Commission (CPSC) to ban children's jewellery containing more than 0.06% Pb by weight. The US CPSC subsequently has given advance notice of a possible ban of children's metal jewellery exceeding 0.06% Pb content (19).

Concluding, the number of non-compliant jewellery articles on the market is deemed to be extremely high (8) and our results encourage us to affirm that also the low-cost jewellery, because of the content of heavy metals, may represent an important risk for children's health. As already published by the Consumer and Competition Policy Directorate (4) and later by Weidehamer et al (7) and by Hillyer et al (9), there is a remarkable risk of significant exposure to metals from contaminated toys/toy jewellery because of mouthing, so a strict control on these products should be encouraged in order to avoid episodes of intoxication, or even deaths.

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