PEDIATRICS

Pediatric Lead Exposure From Imported Indian Spices and Cultural Powders

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WHAT'S KNOWN ON THIS SUBJECT: Lead is a neurotoxin, and elevated BLLs in children are a public health concern. Immigrant children are at risk because of additional exposure to imported culture-specific leaded products. Lead contamination in many imported products has not been characterized.

WHAT THIS STUDY ADDS: We report here lead-poisoning cases from Indian cultural powders or spices. Imported products surveyed contained lead, and chronic exposure could increase the prevalence of elevated BLLs. These results increase leaded-product awareness and aid lead-poisoning prevention.

abstract

BACKGROUND: Significant lead poisoning has been associated with imported nonpaint products.

OBJECTIVES: To describe cases of pediatric lead intoxication from imported Indian spices and cultural powders, determine lead concentrations in these products, and predict effects of ingestion on pediatric blood lead levels (BLLs).

PATIENTS AND METHODS: Cases and case-study information were obtained from patients followed by the Pediatric Environmental Health Center (Children's Hospital Boston). Imported spices (n = 86) and cultural powders ($n = 71$) were analyzed for lead by using x-ray fluorescence spectroscopy. The simple bioaccessibility extraction test was used to estimate oral bioavailability. The integrated exposure uptake biokinetic model for lead in children was used to predict population-wide geometric mean BLLs and the probability of elevated BLLs (>10 μg/dL).

RESULTS: Four cases of pediatric lead poisoning from Indian spices or cultural powders are described. Twenty-two of 86 spices and foodstuff products contained >1 μg/g lead (for these 22 samples, mean: 2.6 μg/g [95% confidence interval: 1.9–3.3]; maximum: 7.6 μg/g). Forty-six of 71 cultural products contained >1 μg/g lead (for 43 of these samples, mean: 8.0 μg/g [95% confidence interval: 5.2–10.8]; maximum: 41.4 μg/g). Three sindoor products contained >47% lead. With a fixed ingestion of 5 μg/day and 50% bioavailability, predicted geometric mean BLLs for children aged 0 to 4 years increased from 3.2 to 4.1 μg/dL, and predicted prevalence of children with a BLL of >10 μg/dL increased more than threefold (0.8%–2.8%).

CONCLUSIONS: Chronic exposure to spices and cultural powders may cause elevated BLLs. A majority of cultural products contained >1 μg/g lead, and some sindoor contained extremely high bioaccessible lead levels. Clinicians should routinely screen for exposure to these products. *Pediatrics* 2010;125:e828–e835

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KEY WORDS

pediatric lead poisoning, childhood plumbism, spices, herbal products, cosmetics, religious powders, lead contamination, Indian, sindoor, culture-specific exposure

ABBREVIATIONS

CDC—Centers for Disease Control and Prevention
BLL—blood lead level
FDA—Food and Drug Administration
IEUBK—integrated exposure uptake biokinetic model for lead in children
PEHC—Pediatric Environmental Health Center
XRF—x-ray fluorescence
NIST—National Institute of Standards and Technology
LOD—limit of detection
SBET—simple bioaccessibility extraction test
XRD—x-ray diffraction
ZPP—zinc-chelated protoporphyrin
CI—confidence interval

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Lead is a neurotoxin that can cause permanent neurocognitive deficits in children.[1–3] The current Centers for Disease Control and Prevention (CDC) blood lead level (BLL) of concern is 10 μg/dL, although a BLL of <5 μg/dL also may result in cognitive deficits.[4–8] A national objective of Healthy People 2010 is to eliminate elevated BLLs in children. As part of this effort, the CDC has worked to identify at-risk populations and nonpaint sources of lead exposure.[3,9] Among those at risk are immigrant children, who are more likely than US-born children to have an elevated BLL through exposure to nonpaint lead sources.[10,11] Culture-specific nonpaint lead sources have been identified, including imported utensils,[12] foods such as Mexican tamarind candy,[13] cosmetics such as kohl[14] and henna,[15] and ayurvedic traditional medicines[16,17] and Mexican digestive remedies.[18]

Culture-specific lead sources have placed South Asian and Indian communities at risk. Woolf and Woolf[19] reported 2 cases of pediatric lead poisoning from imported Indian spices. In addition, a Thai infant suffered lead poisoning from a powder applied to his tongue,[20] and an Indian child developed an elevated BLL from ingestion of sindoor (a powder applied to a woman's scalp as a marriage sign).[21] Recently, the US Food and Drug Administration (FDA) recalled a brand of ceremonial Indian powders because of lead contamination and confirmed cases of lead poisoning.[22]

To date, few studies have systematically investigated the lead content of imported Indian spices and ceremonial powders and considered related risks posed to children living in the United States. The goals of our investigation were to (1) describe recent cases of pediatric lead poisoning caused by contaminated Indian spices and religious powders, (2) survey and assess lead contamination among various commercially available imported Indian spices and ceremonial products sold in stores in the Boston, Massachusetts, area, and (3) predict the prevalence of elevated BLLs in children caused by chronic exposure to these products by using the integrated exposure uptake biokinetic model for lead in children (IEUBK).[23]

PATIENTS AND METHODS

Case-Study Information

Case-study information was acquired through the review of medical charts of patients who were referred to the Pediatric Environmental Health Center (PEHC) at Children's Hospital Boston from 2006 to 2008 for an elevated BLL. The cases represent ~2% of new patient referrals to the PEHC. All patients were asymptomatic. Home environments were assessed for lead by the Massachusetts Department of Public Health via dust wipe and direct sampling of surfaces and by the PEHC via environmental inventory and soil-testing. In all cases, no other significant sources of lead were found.

Collection Methods: Market-Basket Survey

In this article, we use the terms "cultural powder," "religious powder," and "ceremonial powder" interchangeably. Collection and analysis of spices and powders were based on the protocol outlined by Saper et al.[16] Boston-area stores that sell spices and religious powders were identified through an online national directory of Indian grocery stores[24] and a New England area Indian community business directory.[25] In early 2008, 15 randomly selected stores were visited within 20 miles of Children's Hospital Boston. Spices and ceremonial powders were purchased if they were manufactured in India and were (1) spices/foodstuffs (edible, used in food preparation) or (2) religious powders (used in religious or cultural practices, not intended for consumption, not labeled for use as medication). When more than 1 store carried the same brand of a given product, it was only purchased once. The name, manufacturer, manufacturer's location, packaging location, lot number, expiration date, store name, and purchase date were recorded when available. For comparison, 10 types of spices produced by US manufacturers were purchased at a large New England supermarket, although in most cases, the country of origin was not listed.

To assess variability between lots of the same product, all products that contained >10 μg/g lead were repurchased for additional analysis. In addition, 10% of the spices and powders were randomly selected for repurchase and reanalysis.

Heavy-Metal Analysis

Samples were labeled with a numerical identifier only. Four grams of each sample were transferred into x-ray fluorescence (XRF) analytical cups (Premier Lab Supply, Port St Lucie, FL) with 4-μm windows (Spex Certiprep, Metuchen, NJ) after thorough homogenization. Repurchased products received new numerical identifiers, and 2 aliquots of each repurchased product were analyzed.

The concentration of lead in each sample was determined by using a Spectro XEPOS polarized energy-dispersive XRF instrument (Spectro Analytical, Kleve, Germany). Measurement accuracy was determined by using a standard reference material (National Institute of Standards and Technology [NIST] 2709, San Joaquin [California] soil).[26] The measured mean lead concentration for NIST 2709 (18.5 ± 0.9 μg/g; $n = 48$) was consistent with the certified value (18.9 ± 0.5 μg/g). The limit of detection (LOD) is ~1.0 μg/g.

Because many spice samples were below the XRF LOD, total lead concentration was also determined in a subset of spices by using microwave digestion in concentrated nitric acid followed by inductively coupled plasma mass spectrometry (Elan 6100 [Perkin Elmer, Shelton, CT]) analysis. The LOD is ~0.03 μg/g. Average recovery of lead from NIST 1515 (apple leaves) was 88% ($n = 2$).

Bioaccessibility Analysis

For a random subset of samples, lead bioaccessibility (ie, fraction of metal mobilized in a biologically relevant fluid) was estimated by using the simple bioaccessibility extraction test (SBET). The SBET is an in vitro gastric fluid extraction that simulates metal dissolution in the stomach and has been shown to predict in vivo lead absorption in juvenile swine, a model for gastrointestinal absorption in children.[27,28] The SBET was performed by following a previously published protocol.[29] Bioaccessibility was calculated as extracted lead concentration/total lead concentration.

To determine the crystalline phases linked with high-lead sindoor products (>47% lead), x-ray diffraction (XRD) analyses were conducted by using a rotating copper anode RU 300 generator (Rigaku, Tokyo, Japan). Resulting XRD patterns were fit by using Jade software (Materials Data, Livermore, CA) with search/match of the FIZ-Inorganic Crystal Structure Database (http://icsd.ill.eu/icsd/index.html) and Rietveld whole-pattern fitting. XRD analyses provide both phase identification and the general bonding environment of lead. Combining XRD characterization with SBET analysis is an effective and underutilized approach to evaluating the chemical form and relative solubility of lead in various exposure media (soils, spices, religious powders).[30]

IEUBK Modeling

The IEUBK model, Windows version 1.0, build 264 (US Environmental Protection Agency, Washington, DC), is a numerical blood lead predictive model.[23,31] The IEUBK model estimates population-level BLLs on the basis of various lead-exposure sources, uptake via inhalation or ingestion, and biokinetics. Probability distributions are used to estimate variability in BLLs among exposed children.[23] The IEUBK model has been widely used since 1994 and independently validated and verified.[32] Because it has been used to estimate mean BLLs and predict the probability of elevated BLLs in a population of children exposed to lead-contaminated tamarind candy,[33] the model was considered appropriate for the goals, age ranges, and exposure duration for our population of concern.

We used the IEUBK model to estimate the geometric mean BLL for a population and to predict the probability of elevated BLLs caused by intentional or accidental ingestion of lead-contaminated spices or powders. Lead exposure from other environmental sources was held constant, and standard model inputs, comparable to Boston background levels,[26,34,35] were used to incorporate background lead exposure. Diet inputs were calculated from FDA food-monitoring data.[36] For model runs, an alternate exposure function was used to model additional ingestion of spices or powders. Bioaccessibility, based on SBET data, was used as an upper-bound estimate of bioavailability (ie, fraction of lead that is absorbed and reaches the systemic circulation).[28,37]

RESULTS

Case Summaries

Case 1

A 10-month-old Indian boy was referred for an elevated BLL (43 μg/dL), a mean corpuscular volume of 69.7 fL, hemoglobin level of 11.2 g/dL, and hematocrit level of 31.7%. He received 5 days of parenteral chelation with intravenous $Na_2CaEDTA$. His zinc-chelated protoporphyrin (ZPP) level was elevated at 152 μmol/mol of heme (normal ZPP level, based on a hematocrit level of 35%: 25–65 μmol/mol), which suggested chronic lead exposure. The parents described rubbing a religious powder on the patient's forehead since he was several weeks old. They did not add powders to foods. Lead analyses revealed 89 000 μg/g lead in the religious powder and 300 μg/g lead in an eye cosmetic. The parents stopped using the powder, and the child received oral chelation with dimercaptosuccinic acid for 6 months, which reduced the BLL to <21 μg/dL. By 21 months of age, the child's BLL was stable (15 μg/dL), and he required no additional oral chelation therapy.

Case 2

A 9-month-old Indian boy was referred for an elevated BLL (21 μg/dL). The parents described applying an orange powder (orange shringar) to his forehead as a religious tradition. They did not add powders to food. Lead analyses revealed 220 000 μg/g in the powder and 49 μg/g in both holy ash and kumkum. Analyses of family spices and utensils did not detect lead. The parents stopped using the powders, and 4 weeks later the patient's BLL was 17 μg/dL, with a ZPP level of 85 μmol/mol and hemoglobin level of 10.7 g/dL. Two months later, his BLL decreased to 13 μg/dL. No chelation was administered.

Case 3

A 3-year, 9-month-old Indian girl was referred for an elevated BLL (18 μg/dL), a ZPP level of 88 μmol/mol, and a hemoglobin level of 10.9 g/dL. No contaminated herbs, spices, or ethnic remedies were discovered. However, a religious powder ingested regularly by the patient contained 4800 μg/g lead.

TABLE 1 Examples of Cosmetics, Hair Products, and Ceremonial Powders Purchased

Product Name	Brand Name	Uses
Cosmetics and hair products		
Aritha powder	Hesh	Shampoo
Henna	Al-aroosa, Ancient Secret, Ayur, Dulhan	Hand decoration
Kajal	Shingar Ltd, Western Indian Chemical Co	Eyeliner
Hairwash	Meera	Shampoo
Sandalwood	Nirav	Cosmetic, medicinal
Ceremonial powders		
Abil	Bhavani, Nirav	Pooja ceremony
Gulal	MDHD, Swad, Durbar	Pooja ceremony
Kumkum	Shringar, Topaz, Butala Emporium	Bindi
Sindoor	MDHD, Swad, Nirav, Butala Emporium	Marriage symbol

The family discontinued use of this powder, and over the next 8 months, the patient's BLL decreased to 8 μg/dL.

Case 4

A 12-month-old Indian boy was referred for an elevated BLL (28 μg/dL), a ZPP level of 103 μmol/mol, and a hemoglobin level of 9 g/dL. Analyses of spices, herbal remedies, and religious powders revealed that several Indian spices, used daily, contained lead: an herb mix (11 μg/g), brown mustard seed (0.6 μg/g), asafoetida (0.8 μg/g), and turmeric (1.4 μg/g). The family discontinued use of all imported spices, and the patient's BLL declined to 14 μg/dL within 6 months.

TABLE 2 Examples of Spices and Foodstuff Purchased

Product Name	Brand Name
Spices	
Black pepper	Laxmi, Swad, Deep
Cardamom	DEEP
Chili powder	Saras, Noer, Swan
Coriander	MDHD, Periyar, Swad, Swan
Fennel powder	Deep
Fenugreek	Swad
Garam masala	MDHD, Swan
Garlic power	Shalimar
Ginger powder	Himgiri, Swad
Paprika	Swad
Sindav salt	Deep, Swad
Turmeric	Laxmi, Nirav, Swad, Swan
Foodstuff	
Food coloring	Bush, Bhavani, Narmada, Vesco
Dabelli masala	Bombay Magic
Fish curry	MDH
Vada mix	MTD
Chappli kabab masala	Roopak
Vermacelli mix	MTR
Tulsi powder	Bhavani
Karela powder	Swad
Asafoetida	Laljee Godhoo, Ruchi, Swad
Amchur powder	Deep
Hajmola candy	Dabur India Ltd

Religious Powders

Seventy-one religious products manufactured by 28 companies were purchased (Table 1). Forty-three products listed packaging location, and 5 products provided lot numbers. Sixteen products were categorized as cosmetics and hair products for daily use, and 55 were categorized as ceremonial religious powders for daily to monthly use.

Of the 71 cultural products tested, 46 (65%) contained >1 μg/g lead. The mean lead concentration in 43 samples with detectable lead (excluding 3 high-lead sindoor products) was 8.0 μg/g (95% confidence interval [CI]: 5.2–10.8 μg/g), with a maximum of 41.4 μg/g (kajal). Three sindoor products contained >47% lead by weight and were treated separately in the statistical analysis (Table 3). These sindoor lead concentrations are comparable to those in published reports.[21,38] Cosmetics and ceremonial powders had similar lead concentration and ranges (Table 3).

Indian Spices and Foodstuff

Eighty-six food products manufactured by 53 companies were purchased (Table 2). Sixty-three products listed packaging location, and 38 products listed lot numbers. Thirty-eight products were categorized as common spices, used daily in food preparation, whereas 48 were categorized as foodstuff, including spice mixes, food coloring, or other food additives, which may be used less frequently. Of the 86 products tested by XRF, 22 (26%) contained >1 μg/g lead, with a mean lead concentration in these 22 samples of 2.6 μg/g (95% CI: 1.9–3.3) and a maximum of 7.6 μg/g (sea salt). Food products had a lower percentage of samples with detected lead and lower mean lead concentration compared with religious products. Spices and foodstuff contained similar ranges of lead concentration (Table 3).

On the basis of a direct comparison of 10 types of spices (US brands and imported) analyzed by inductively coupled plasma mass spectrometry, imported spices had a mean lead concentration of 0.5 μg/g (95% CI: 0.18–0.72), which was twice the mean lead concentration of US-brand spices

TABLE 3 Mean Concentration, CI, and Range of Lead in Spices, Foodstuff, Cosmetics, Ceremonial Powders, and High-Lead Sindoor With a Detectable Lead Level by XRF

Product	No. of Samples	Samples With Detectable Lead, %	Lead Level, Mean (95% CI), μg/g[a]	Range, μg/g[a]
Spices	38	24	2.6 (1.2–4.0)	1–7.6
Foodstuff	48	27	2.6 (1.8–3.4)	1–6.3
Cosmetics	16	81	7.6 (1.3–13.9)	1–41.4
Ceremonial powders	52	58	8.2 (6.0–10.4)	1–39.9
High-lead sindoor	3	100	559 000 (463 000–655 000)	469 000–638 000

[a] Serial dilutions of NIST 2709 suggest that the LOD (based on the criteria that samples run in triplicate maintain <10% relative SD) is 1.0 μg/g (data not shown). LOD estimates based on serial dilution of NIST 2709 were supported by 15 replicate analyses of NIST 1515 (apple leaves) in which a 20% SD was observed for an expected lead concentration of 0.47 μg/g.

(0.19 μg/g [95% CI: 0.1–0.28]) (Table 4). However, this difference was not significant on the basis of a pairwise *t* test ($P > .1$). The lead concentration in these 10 imported spices was up to fivefold higher than the recommended maximum level in hard candy (0.1 μg/g).[39] In addition, imported spices had a similar range of lead concentrations as spices manufactured in Pakistan (0.02–9.2 μg/g).[40] Although the FDA has no recommended maximum lead concentration for spices, the European Union's recommended limit for dried herbs is 2 to 3 μg/g.[41]

Bioaccessibility

We determined bioaccessibility for a subset of samples by SBET as a reasonable approximation for bioavailability.[28] Spices had a mean lead bioaccessibility of 49% (95% CI: 32–66) (Table 5), which is consistent with previously published data[37,42] and with the default IEUBK value of 50% for lead absorption from food.[37] Religious and cosmetic products and sindoor (with >47% lead) had similar mean lead bioaccessibility (50%–56%) as spices (Table 5). XRD results indicated that Pb_3O_4 (minium, "red lead") is the chemical form of lead in these samples. Minium is commonly used as a pigment in henna and lead paint.[15,43]

TABLE 4 Mean Concentration, CI, and Range of Lead in US-Brand Spices and Indian Brand Spices ($N = 10$)

Product[a]	Lead Level, Mean (95% CI), μg/g	Range, μg/g
US brands	0.19 (0.1–0.28)	0.03–0.41
Indian brands	0.45 (0.17–0.73)	0.12–1.54

[a] Spices tested included garlic powder, black pepper, fennel powder, ginger powder, coriander, garam masala, turmeric, chili powder, paprika, and cardamom.

TABLE 5 Mean Bioaccessibility, CI, and Range of Bioaccessibility of Religious Powders, Spices, and High Lead Sindoor

Product	No. of Samples	Mean Bioaccessibility, % (95% CI)	Range, %
Powders	6	56 (20–92)	20–80
Spices	10	49 (32–66)	22–100
High-lead sindoor	3	50 (38–62)	40–62

IEUBK Modeling

The IEUBK model was used to predict the effects of chronic ingestion of spices or religious powders on population BLLs. For a fixed ingestion rate (μg/day), the geometric mean BLL and percentage of children with an elevated BLL (defined as a BLL of >10 μg/dL) were calculated. When the model was run with default inputs only, the background geometric mean BLL for children aged 1 to 5 years was 3.1 μg/dL. This value is higher than the national geometric mean BLL of 1.9 μg/dL but comparable to that of black children (2.8 μg/dL) and children in low-income households (2.5 μg/dL).[44] The percentage of children with an elevated BLL (0.6%) was lower than the national average (1.6%).[44] Overall, these data suggest that the model can reasonably approximate background BLL for children who live in the United States.

To model increased exposure resulting from spice or accidental powder ingestion, we used a fixed lead-ingestion rate (5 μg/day). Spice-ingestion rates for various lead concentrations are listed in Table 6 and are comparable to those in published reports.[45,46] When the model was run with a fixed ingestion rate of 5 μg/day and 50% bioavailability, the predicted geometric mean BLL for children aged 0 to 4 years increased from 3.2 to 4.1 μg/dL, and the predicted prevalence of children with an elevated BLL increased threefold, from 0.8% to 2.8%. The difference is more dramatic with small increases in ingested amount and bioavailability (Figs 1 and 2); at 5 μg/day and 80% bioavailability, 4.9% of children were predicted to have an elevated BLL, and at 10 μg/day and 50% bioavailability, 6.5% of children were predicted to have an elevated BLL. These results suggest that infants and children can develop lead poisoning by chronic ingestion of contaminated spices and ceremonial powders.

TABLE 6 Ingestion Rate as a Function of Lead Concentration for Lead Ingestion of 5 μg/g

Lead Concentration, μg/g	Daily Ingestion Rate[a]		Weekly Ingestion Rate	
	g	Teaspoons	g	Teaspoons
0.5	10	2	70	14
1	5	1	35	7
5	1	0.2	7	1.4
10	0.5	0.1	3.5	0.7
20	0.25	0.05	1.75	0.35

[a] Mean ingestion rate of spices in g/day for children aged 1 to 3 years, living in India, was reported to be 5 g/day, with a range of 3 to 10 g/day, as reported by the National Nutrition Monitoring Bureau.[45,46]

DISCUSSION

Our analyses demonstrate the risk of lead poisoning associated with contaminated ceremonial powders and rituals that involve the external application of these powders to young infants. Of particular concern are (1) the extremely high lead concentrations found in some readily available sindoor powders (47%–64% lead), (2) the moderate lead concentrations found in other cultural powders (up to 40 μg/g), (3) the young age at which parents commence such practices, and (4) the chronic nature of the exposure (up to several times per week). Although the powders are not meant for consumption, we speculate that infants may be inadvertently exposed by hand-to-mouth transference of topically applied powders or by the hands of parents who handle the powder and then prepare foods for the infant's consumption. Infants may also be exposed to these products in utero, through breastfeeding, inhalation of aerosolized particles, or dermal absorption.[12] As predicted by IEUBK modeling, chronic exposure can have a dramatic effect on BLL. For instance, ingesting 20 μg of high-lead sindoor increases lead exposure by 10 μg/day and the probability of elevated BLL by eightfold.

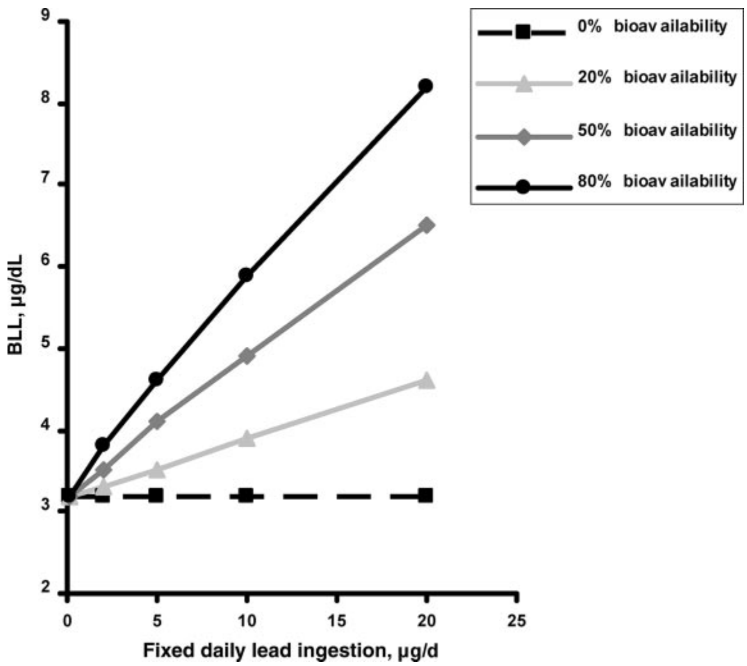

FIGURE 1
The IEUBK model was used to predict mean geometric BLLs in children aged 0 to 4 years with varying exposures. In this simulation, daily lead ingestion and bioavailability were varied, and resulting BLLs are shown.

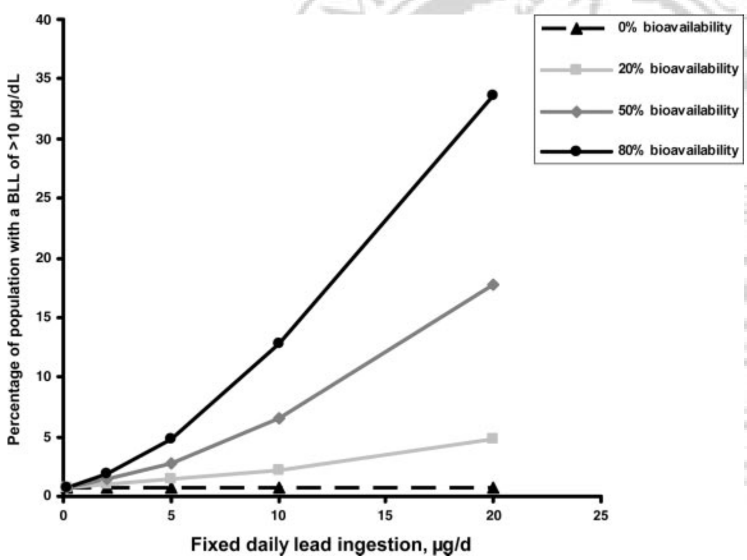

FIGURE 2
The IEUBK model was used to predict the prevalence of BLLs of $>$10 μg/dL in a population of children aged 0 to 4 years with varying exposures. In this simulation, daily lead ingestion and bioavailability were varied.

Ingestion of 250 mg of sandalwood, an amount comparable to pediatric soil ingestion through hand-to-mouth activities,[47] increases exposure by 5 μg/day and the probability of elevated BLL by threefold. Although previous studies have shown risks to children from remedies, foods, and spices meant for consumption,[16–19,48] lead poisoning from contaminated products intended only for external application has not been fully appreciated. Such items include cosmetics, such as kohl,[14] and we now extend the product list to include Indian powders intended for use in religious practices.

We also found that under certain circumstances, exposure to imported Indian spices may increase the prevalence of elevated BLL. IEUBK modeling predicted that chronic ingestion of spices that contained our highest measured lead concentration (7.6 μg/g) may result in elevated BLLs. Therefore, a risk for lead poisoning exists if there is sufficient lead contamination or a high daily dose. This risk is not theoretical, as indicated by our case report of lead poisoning from chronic ingestion of imported spices with similar lead concentrations (1–11 μg/g).

There are several limitations of our study. First, although we analyzed more than 150 products, our samples did not represent all types of Indian-manufactured products. Second, there may be lot-to-lot variability in lead concentration depending on manufacturing and packaging practices and on natural spice-plant accumulation of lead. Third, regional variation in Indian product availability and distribution may limit the applicability of the study to other locations. Fourth, family usage patterns will affect the overall cumulative exposure and risk of injury. We did not acquire end-user information regarding these products. Nevertheless, to our knowledge, our study represents the first attempt to investigate a variety of cultural products and to carefully consider their potential effects on pediatric BLL.

CONCLUSIONS

Our investigation of Boston-area stores that sell Indian spices and religious powders revealed a ready availability of lead-contaminated items. Similar products can also be purchased on the Internet. Furthermore, we were able to purchase highly contaminated items that were previously banned or recalled by the FDA. The high prevalence, availability, chronic and widespread use,[49] and potential toxicity of these products pose a public health risk. Clinicians should be aware of these and other imported hazards and inquire about their use during routine health supervision visits. Furthermore, per CDC and American Academy of Pediatrics recommendations, clinicians who work with South Asian communities should perform targeted BLL screening on new immigrants and routinely administer lead-exposure risk-assessment questionnaires (provided by state departments of health[50,51]), modified to include these hazards.[52,53] Because of the high lead concentrations found in some sindoor samples, import, sale, and labeling of these items should be carefully monitored, and low-lead sindoor (<5 μg/g) could be suggested as a safer alternative. Closer inspection and testing of other religious products is warranted.

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