

Lead residue levels in raw milk from different regions of Iran

M. Tajkarimi ^{a,*}, M. Ahmadi Faghieh ^b, H. Poursoltani ^a, A. Salah Nejad ^a,
A.A. Motallebi ^{c,1}, H. Mahdavi ^d

^a *Iran Dairy Industries Company, No. 57, West Ghobadian St. Valie Asr Ave., Po Code 1969633431, Tehran, Iran*

^b *Heavy Metal Lab Services, North Kargar St., P.O. Box 11365-3486, Tehran, Iran*

^c *Iranian Fisheries Research Organization, No. 259, West Fatemi St., Po Code 141556116, Tehran, Iran*

^d *Animal Researches Institute, P.O. Box 1483, Karaj, Iran*

Received 4 January 2007; received in revised form 23 May 2007; accepted 29 May 2007

Abstract

During February 2004, 97 samples of raw whole milk were collected from milk tankers arriving at 15 dairy plants in different Iranian regions and analyzed by the atomic absorption spectroscopy. The mean recovery of the analytical method at 10, 20 and 40 ng/ml was $85 \pm 5\%$. The mean level of lead content obtained from 97 samples was 7.9 ng/ml, with a range from 1 to 46 ng/ml and a standard deviation of 8.8. Fewer than 10% of samples exceeded 22 ng/ml; 60% of the samples were between 5.7 and 1.1 ng/ml. The daily intakes of lead in milk based on the results have also been estimated. Three sets of the samples, from Isfahan, Tehran and West Azerbaijan seemed to show a higher level of contamination and a need for further studies especially because of the two newly established infant formula milk plants in two of the regions under study.

© 2007 Elsevier Ltd. All rights reserved.

Keywords: Heavy metals; Lead residue; Milk and milk products; Food contaminants

1. Introduction

Many dangerous elements or compounds, such as dioxins, pesticides, metals, and metalloids, accumulate along the food chain. In this way, the food chain becomes the main gateway for persistent toxicants to enter higher organisms. Furthermore their concentrations in the environment grow with the increase of urban, agricultural, and industrial emissions. The almost ubiquitous presence of some metal pollutants, especially Cd and Pb, facilitates their entry into the food chain and thus increases the pos-

sibility of them having toxic effects on humans and animals. Many reports indicate the presence of heavy metals in milk, and we need to assess the levels of heavy metals in food (Caggiano et al., 2005; Fayed, Zidan, Abou-Arab, & Magdoub, 1995; Licata et al., 2004; Raghunath, Tripathi, Khandekar, & Nambi, 1997). Lead residues in milk are of particular concern because milk is largely consumed by infants and children (Jeng, Lee, & Lin, 1994; Tripathi, Munot, Shouche, Meyer, & Goel, 2005), and the determination of lead level in milk is particularly attended by international organizations (Codex, 2003).

This study was the first multi regional study in Iran, which tried to find the variation of the milk contamination in different areas with different levels of industrial activity and soil sources.

The lead concentrations in different types of food from various countries have been analyzed to estimate national intake levels. The aim of this study was to determine the

* Corresponding author. Present address: Department of Population Health and Reproduction, School of Veterinary Medicine, One Shields Avenue, University of California, Davis, CA 95616-8743, United States. Tel.: +1 530 754 9187; fax: +1 530 752 4278.

E-mail address: mtajkarimi@ucdavis.edu (M. Tajkarimi).

¹ Tel.: +98 2166945577.

occurrence of lead residues in raw milk in some Iranian regions by means of atomic absorption spectrometry, using a validated method. Two of the regions under study in Isfahan and Khorasan have infant formula milk plants under construction. It seems that the raw milk provided for this plant from the state should have some specific control and assessment programs to avoid the high level of contamination in the raw milk which is going to be used in this way. The study should particularly emphasize the lead levels in raw milk in these areas.

2. Materials and methods

2.1. Sampling sites

Ninety-seven 500-ml samples of raw milk were collected from tankers arriving at processing facilities in the 15 areas named in Table 1. These areas are characterized by different elevations and ecological features. Clean, acid-washed polyethylene bottles were used to contain the samples.

2.2. Sampling protocols

All of the samples were held at 4 °C and arrived at the analytical laboratory within 48 h after their collection. The sampling areas in this study were chosen based on the distribution in 14 Iranian states of the Iran Dairy Industry Company's (Pegah) plants, with a mean distance of 400 km from each other, which produce a relatively high portion of commercial milk products in Iran. The total milk collection by this company in 2004 was about 1,100,000 metric tons. Samples of raw milk were taken with raw milk jar samplers from the raw milk tankers, arriving from industrial dairy farms and milk collecting centers,

which were representative of the traditional dairy farms, and transported at 2–4 °C in an icebox. All of the milk samples were collected based on the Iranian national standard milk sampling method INS No. 419.

2.3. Trace element analysis

They were then held at room temperature (28 °C) for 48 h to reduce the pH below 4.6 and separate the casein and fat. Each sample was centrifuged at 1000 rpm for 10 min, supernatant mixed with 5 ml 65% HNO₃ and heated to 90 °C, after which 20 ml of de-ionized water was added.

A GTA 110 atomic absorption spectrophotometer AA220 (Varian Co.) was used to measure lead levels. The lead absorbance was measured at 6 mA of lamp current, 0.5 nm slit width and the peak height mode of the wavelengths used was 283.3 nm.

As a standard solution for recovery tests, 1000 µg/ml of lead solution (Aldrich Co. catalog No. 20/723-3) was diluted with 1% HNO₃ to obtain 10, 20 and 40 ng/ml, and it was also done for milk samples to prepare the spiked samples. The mean recoveries of acid-diluted lead from these three selected concentrations were 85 ± 5% and for milk-spiked samples was 80%. The instrument detection limit was 0.01 ng.

2.4. Data analysis

We carried out an explorative statistical analysis of the concentration values measured in the different kinds of samples, and we compared our data with other measures presented in the literature. The explorative parameters are *N*, sample number; *m*, mean value; *r*, range; *s*, standard deviation. These were used to point out some variations in metal patterns observed in the sampling.

3. Results and discussion

Fig. 1 shows a summary of the explorative analysis and a comparison between our results and the concentrations measured in similar samples from various sites. There were significant differences between values. The mean, median and about 90% of the samples were less than the newly established Codex standard: 20 ng/ml (Table 2); but the large variance and some high levels of contamination on one hand, and the limited sample size on the other hand, raise questions as to the true contamination levels, especially in Isfahan, Tehran and west Azerbaijan regions (Table 1); the indicated regions seem to be more industrialized than other regions, especially Tehran and Isfahan. The high levels of lead in milk may result from industrial air pollution in these regions. These two regions, especially Isfahan state, are more important because of the new infant formula plant being established in this state. It seems that there should be more research in regard to lead

Table 1
Lead residues (ng/L milk) in samples from various factories

City	Number of samples	Mean	Standard deviation	95% Confidence interval	
				Lower limit	Upper limit
Golpaygan	8	5.4	4.2	1.3	7.0
Gorgan	9	1.9	1.9	0.7	3.2
Hamadan	5	7.9	5.2	0.6	9.7
Isfahan	6	23.4	17.0	3.4	30.6
Kerman	5	1.5	0.4	0.1	0.8
Khoramabad	11	2.7	1.7	0.7	2.7
Khorasan	10	14.4	5.0	1.9	8.0
Mashad	3	2.4	2.0	0.0 ^a	4.4
Orumieh (West Azerbaijan)	6	12.7	9.6	1.9	17.2
Rasht	2	4.7	1.0	0.0 ^a	2.4
Shiraz	4	2.3	1.8	0.0	3.6
Shoosh	4	2.4	1.4	0.0	2.8
Tabriz	5	2.7	4.1	0.5	7.8
Tehran	9	16.8	7.9	2.7	13.0
Zanjan	10	7.1	6.6	2.5	10.6

^a Original value of lower bound falls under zero and not meaningful.

Download English Version:

<https://daneshyari.com/en/article/4560293>

Download Persian Version:

<https://daneshyari.com/article/4560293>

[Daneshyari.com](https://daneshyari.com)