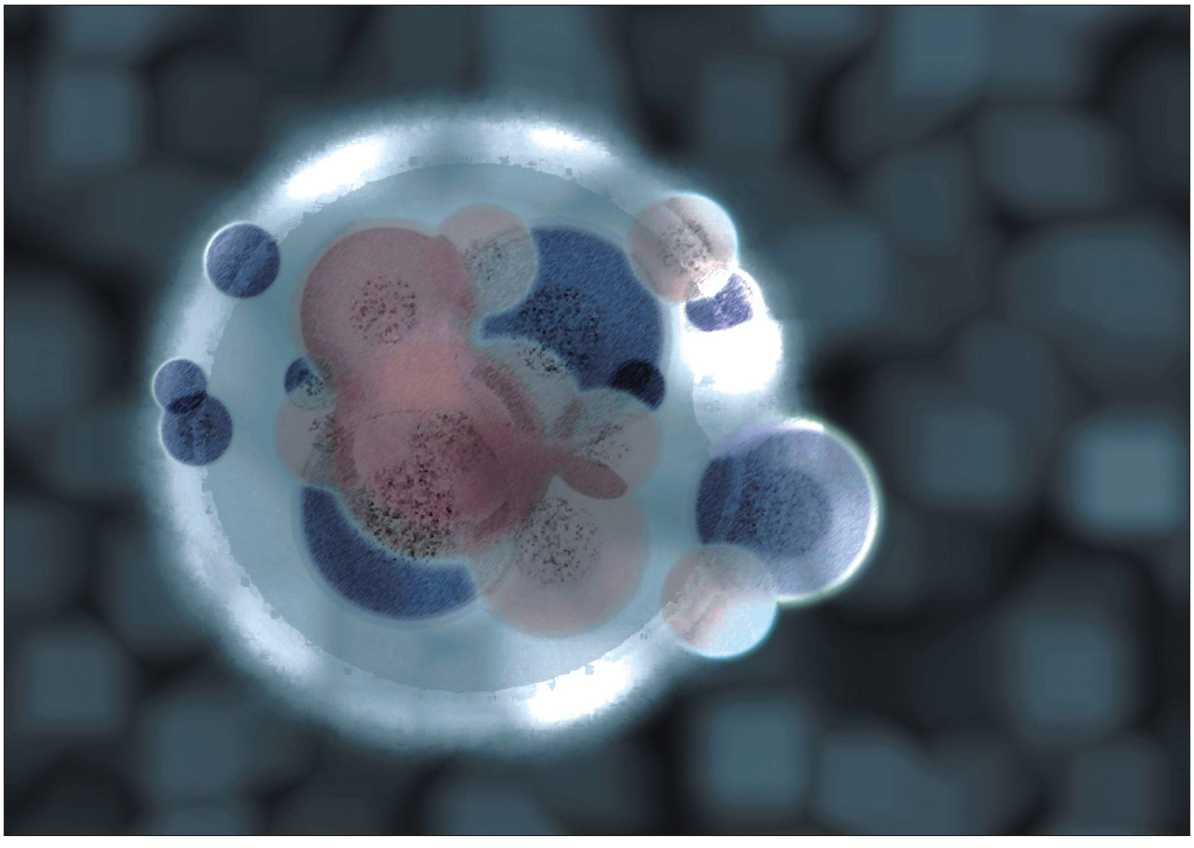

Journal of Biological Sciences

ISSN 1727-3048

science alert

ANSInet
an open access publisher
http://ansinet.com

OnLine Journal of Biological Sciences 1 (5): 412-413, 2001

Determination of Lead and Cadmium Level in Powdered Milk in Quetta (Pakistan) by Atomic Absorption Spectrometry

[1]Talat Zamir and [2]S. Altaf Hussain
[1]Chemistry Department, University of Balochistan, Quetta, Pakistan
[2]University Grants Commission, Islamabad, Pakistan

Abstract: The samples of different brands of powdered and infant formula milk were collected from Quetta local market and Atomic Absorption Spectrophotometer was used for the determination of toxic metals e.g. lead and cadmium. The concentration of lead and cadmium were found to be within the safe limits as recommended by the WHO. The intake of lead is quite higher than cadmium from whole cream milk and infant baby formula.

Key words: Lead, cadmium, toxic levels, infant milk, powdered milk

Introduction

Rapid industrialisation, use of agricultural chemicals and automobile exhaust fumes have increased the toxic heavy metals in the environment and effected all the global air, water and food. Human population directly effected through the food chain. In this context, the increase in lead and cadmium concentration attains the attention of the world scientist. Lead is known for its devastating effects on brain development (Bryee-Smith and Stephenes, 1982) while cadmium causes renal problems, anaemia, reproductive failure and other complications (Murthy and Rhea, 1971). The concentration of lead in milk is a matter of special concern because it is a major dietary constituent for infants and children. The large-scale production and consumption of dry milk powder, makes it desirable to analyse the quantity of lead and cadmium concentration in milk, so the daily intake of these toxic metals can be estimated.

Determination of trace quantities of lead and cadmium were carried out all over the world using various analytical techniques (Narres *et al.*, 1985). Atomic absorption spectrophotometry is considered better for time saving, high sensitivity and specificity (Koops and Westerbeek, 1978).

Milk is the basic food of infants, which normally fulfils all nutritional requirement during early growing age. The use of milk containing trace elements like lead and cadmium are extremely dangerous for whole community and are responsible for a number of diseases. The present large-scale production and utilization of dry milk make it desirable to measure the amount of lead and cadmium in commercialised milk. In this study the atomic absorption spectrometric technique is employed for the determination of heavy toxic metals lead and cadmium in different brands of powdered and infant formula milk available in the local market.

Materials and Methods

The measurements were carried out with atomic absorption spectrometer. Hallow-cathode lamps of lead and cadmium were used as a radiation source. Air-Acetylene gas mixture was used to achieve reasonably stiff flame. The absorption signals were recorded at 217 nm with a silt width 0.7 nm.

Sample Collection: Whole cream milk of different brands, (lead-soldered canned and paper bags) and different baby formula milk (lead-soldered cans) samples were purchased commercially at random from different shops of Quetta during 1991. Before analysis, samples of the same brands were thoroughly mixed to get homogenous and representative samples. Three replicate determinations were made for each sample and the mean values of the absorption signals were used. Lead and cadmium was determined by a procedure described by Khalid *et al*. (1987), in which exactly 0.5 g of powdered and infant formula milk were taken in duplicate in a flask fitted with a condenser, with the addition of 6 ml conc. nitric acid and then heated at 80°C for half an hour. After cooling the mixture, 3.5 ml of perchloric acid (70%) was added and heated again at 250°C with occasional shaking till white fumes evolve. The solution was cooled down in a 25 ml measuring flask and volume was made up to mark with deionised water. Cadmium chloride monohydrate and lead nitrate is used for standard solutions. The calibration curve was constructed by appropriate dilution of above mention standards. Each time fresh samples were prepared before use.

Results and Discussion

In view of the worldwide interest concerning contamination of the environment with heavy metals, the samples of the milk have been examined to determine the lead and cadmium concentration. Milk is a major dietary source for infants and children. It is reported that human breast milk contains 12 μg/lit lead (Lamm and Rossen, 1974) and 77 μg/lit cadmium (Pinkerton *et al.*, 1976). The daily permissible intake (DPI) of lead and cadmium in children is 5 μg/kg/day and 1 μg/kg/day respectively (WHO, 1972).

The concentration of lead and cadmium was determined in ten brands of milk of whole cream powdered and infant formula milk. The results are summarized in Table 1-4. The concentration of lead and cadmium in different brands of whole cream powdered milk sample (P-1, P-6) range from (0.2-0.3 ppm) and (0.005-0.008 ppm) respectively. These values were found to be within the safe limits as recommended intake of these metals by WHO. The concentration of lead and cadmium in infant formula milk ranges from (0.1-0.2) ppm and (0.003-0.005) ppm respectively. The concentration of lead and cadmium is almost comparable in both milks.

The daily intake of lead and cadmium by adults through milk is estimated on the basis of 250 ml consumption of milk per person per day, which is tabulated in Table 5. For this

Table 1: Concentration of lead in powdered milk. ± Shows the standard error of the samples

Sample No	Concentration (ppm)
P-1	0.2 ± 0.03
P-2	0.2 ± 0.05
P-3	0.3 ± 0.04
P-4	0.2 ± 0.02
P-5	0.2 ± 0.02

Average concentration = 0.22 ± 0.03

Table 2: Concentration of lead in Infant formula milk. ± Shows the standard error of the samples

Sample No	Concentration (ppm)
I-1	0.1 ± 0.01
I-2	0.2 ± 0.03
I-3	0.1 ± 0.02
I-4	0.2 ± 0.01
I-5	0.2 ± 0.01

Average concentration = 0.16 ± 0.02

Table 3: Concentration of Cadmium in Powdered milk. ± Shows the standard error of the samples

Sample No	Concentration (ppm)
P-1	0.006 ± 0.0003
P-2	0.005 ± 0.0006
P-3	0.008 ± 0.0007
P-4	0.008 ± 0.0006
P-5	0.007 ± 0.0009

Average concentration = 0.0078 ± 0.004

Table 4: Concentration of Cadmium in Infant formula milk. ± Shows the standard error of the samples

Sample No	Concentration (ppm)
I-1	0.005 ± 0.0007
I-2	0.005 ± 0.0007
I-3	0.005 ± 0.0012
I-4	0.003 ± 0.0003
I-5	0.004 ± 0.0009

Average concentration = 0.0044 ± 0.0008

Table 5: Daily Intake of Lead and cadmium through milk

	Intake of	
Type of milk	Lead mg	Cadmium mg
Whole Cream	0.55	0.0018
Infant baby formula	0.038	0.001

estimation, the average concentration of lead and cadmium in both milk varieties were used. The results showed that the intake of lead through whole cream and infant baby formula are quite higher than the cadmium intake but all these values are much lower than the tolerance level of 0.429 mg of lead and 0.055-0.07 mg of cadmium (WHO, 1972). Atomic Absorption Spectrometric techniques were used to estimate the concentration of these toxic heavy metals (lead and Cadmium) in processed milk samples. This data will help to develop the baseline levels and the degree of contamination. These studies also indicate that breast fed infants receive less amount of lead and cadmium than those fed on processed milk.

References

Bryee-Smith, O. and R. Stephenes, 1982. Lead and brian function. Dev. Med. Child Neural, 24: 90-91.

Khalid, N., S. Rahman, R. Ahmed and I.H. Qureshi, 1987. Determination of lead and cadmium in milk by electrothermal atomic absorption spectophotometry. Int. J. Environ. Anal. Chem., 28: 133-141.

Koops, J. and D. Westerbeek, 1978. Determination of lead and cadmium in pasteurized liquid milk by flameless atomic absorption spectrophotometry. Neth. Milk Dairy, 32: 149-169.

Lamm, S.H. and J.F. Rossen, 1974. Lead concentration in milk fed to infants. Paediatrics, 53: 137-141.

Murthy, G.M. and U.S. Rhea, 1971. Cadmium, copper, iron, lead, manganese and zinc in evaporated milk, infant products and human milk. J. Dairy Sci., 54: 1001-1005.

Narres, H.D., C. Mohl and M. Stoeppler, 1985. Metal analysis in difficult materials with platform furnace zeeman-atomic absorption spectroscopy: 2. Direct determination of Cadmium and lead in milk. Zeitschrift Lebensmunters Forschun A, 181: 111-116.

Pinkerton, C., D.I. Hammer and K. Bridbord, 1976. Human milk as a dietary source of cadmium and lead. Trace Substances, 4: 4-6.

WHO., 1972. Evaluation of certain food additives and the contaminants mercury, lead and cadmium. WHO Technical Report Series No. 505, World Health Organization, Geneva, Switzerland.