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Lead and Cadmium Elements Detected in Milk Samples from Local Markets in Baghdad

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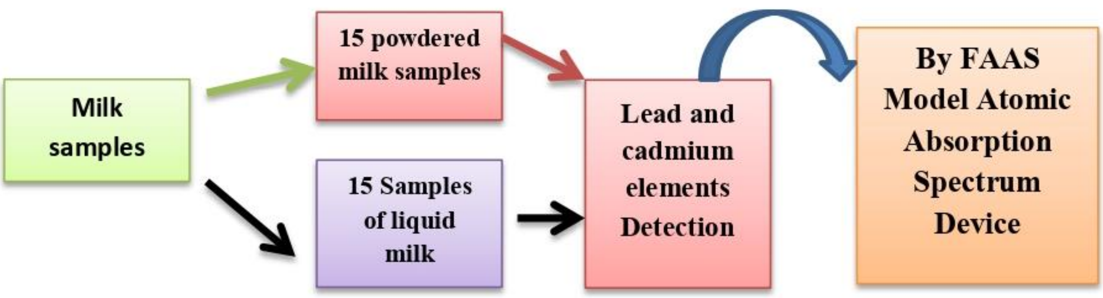
ABSTRACT

Thirty samples of milk for local brands imported from various local markets in Baghdad province (with an average of 15 powder samples and 15 liquids) were examined. All the samples were analyzed using the Atomic Flame Absorption Scale (7000 _ AASF) to identify concentrations of lead and cadmium elements. All results were reported with lead above the permissible limits, most of which showed the presence of cadmium being within the permissible limits. Lead and cadmium levels in samples examined in powdered milk were respectively (0.3778, 0.3699, 0.4719, 0.1817, 0.1582, 0.5582, 0.2837, 0.4327, 0.4405, 0.4562, 0.2758, 0.1268, 0.8619, 0.4444, 0.3542, 0.0061, 0.0001, 0.0006, 0.0111, 0.0101, 0.0511, 0.0051, 0.0098, 0.0009, 0.0011, 0.0069) (PPM); averages of lead and cadmium were assessed for powdered milk samples respectively (0.386+0.181) and all results were reported in liquid milk with lead, mostly above permitted limits. Most of the samples tested were reported to be cadmium, all within permitted limits and lead and cadmium levels in samples examined in liquid milk were reported. All the results showed the concentration of lead > cadmium and all the items studied and there were no moral differences between the samples studied for the single element, but there were moral differences between the elements studied and the values of the averages..

GRAPHICAL ABSTRACT



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Introduction

Milk and its derivatives are one of the main components of the human diet due to its contribution to protein and minerals [1]. Milk and its derivatives are cheap and easily accessible [2]. Milk mainly contains important nutrients, proteins, vitamins, carbohydrates, fats and minerals [3]. The serious health problem in general occurs when milk is contaminated with heavy metals among other contaminated compounds as a result of the various disturbances it causes to consumers, especially children [4]. Chemical pollutants in milk are mainly sourced from the environment as well as technological treatments or unhealthy packaging stages [5]. One of the causes of food pollution is the environment; heavy metals are absorbed from various pollutants to the bodies of different organisms across the food chain [6]. Preservatives also play a prominent role in canning and packaging food [7]. The presence of heavy metals in food, provided by milk, is a negative indicator of environmental pollution in milk production areas [8]. Heavy metals are among the many pollutants that pose a serious threat to human health. Some are classified as toxic and non-essential, such as cadmium and lead [9]. These are priority pollutants of first, second, seventh and seventeenth degree food [10]. It is dangerous, even if it is found with a low-key concentration [11]. Due to its cumulative rate, lead is a factor harmful to fertility and the fetus and causes organ damage through prolonged or repeated exposure. It may cause cancer and damage to breast-feeding children [12]. Prolonged exposure to lead leads to memory deterioration and reduced comprehension, especially when exposed to extra-permissible doses of reference doses [10]. Younger age groups are more sensitive than adults to food pollutants due to their high cumulative rate of absorption by the digestive system, incomplete brain barrier and high food consumption for body mass [13]. Cadmium has long-term effects, having the ability to cause cancer, damage organs, damage to fertility or the fetus and suspected genetic defects [14]. Exposure to cadmium is associated with the effect of carcinogenic tissue and organs such as breast, stomach, intestines, prostate, testicles, lungs and esophagus [15].

Materials and Methods

Sampling

Samples were collected from March to April 2021 from different parts of Baghdad, among which are the commercial markets represented by Shorja, Jamila Industrial, shops, malls, school shops and other areas, fact. 30 samples of homemade and imported milk and two varieties, including 15 powdered milk samples, 15 Samples of liquid milk were among the most consumed species on the market (Table 3 and 4). All samples examined were analyzed using the Atomic Flame Absorption Scale (7000-AASF) to identify concentrations of lead and cadmium elements.

Preparing samples

Samples were taken from each product and preserved in 10 mL sterile polyethylene tubes to avoid contamination for liquid samples. The powder samples were placed in polyethylene bags measuring 10×10 cm and were sterile to avoid contamination, and the samples were recorded sequentially. They were kept in proper cooling and taken to the examination centre as soon as possible

Quality assurance

The equipment was washed to avoid contamination with the element being analyzed. The pots and glass utensils were thoroughly cleaned with water distilled with ionic water, soaked in hot HNO_3 diluted nitric acid at a concentration of 10% for 24 hours, rinsed several times with ionized water and dried to ensure that they were free of minerals [16].

Incineration and digestion

Solid samples

Five grams of each powder sample was weighed with an air-insulated sensitive balance and placed in an eyelid inside the 50 mL incineration oven for 5 hours. Each sample was then digested by adding a combination of HCl at a concentration of 10 mL and water, removed by 1:1 and continuous stirring and then placed over hot plat until the solvent evaporates and then we nominated each sample with Millipore filter paper 0.45. Then, it was cooled and placed with a 50mL volume bottle. We complemented the size with a mixture of HCl hydrochloric acid and distilled water of 1:9 to the mark [17].

Liquid samples

5 mL of each liquid sample was measured and a combination of HNO_3 concentrated nitric acid and hydrogen peroxide (H_2O_2) hydrogen peroxide acid was added and then placed on hot plat accompanied by continuous stirring until digestion was complete and the solvent would evaporate, then the sample was cooled and filtered with filtration paper and then placed in a 50 mL volume bottle and complemented by distilled water [17].

Sample examination

All samples were examined in the Atomic Absorption Laboratory at the Market research center and consumer protection /Baghdad University/Al-Jadriya complex and were examined by the FAAS Model Atomic Absorption Spectrum Device (7000-AASF) from Shimadzu of Japan as prescribed (Table 2) [18].

Statistical analysis

Averages and standard deviation of the data obtained were calculated. One-way variance analysis (LSD/ANOVA) was employed to identify moral differences at probability level (0.05=P).

Table 1: Samples of powder and liquid

Product	Genre
Powder	Dialak, Sama Milk, Shirin, Reno, Encore, Mahmoud, Shirleyt, Janat Milk, Milak, Dano, Bock, Nido, Shepherd, Fresh, Splendour of the South.
Liquid	Damran, Meehan, Pinar, icim, Soya, Classico, KDD, Mori, Nada, Al marai, Revel, Coco, Rafidain, Boffin, Erbil.

Table 2: Examination specifications

Item	Gas used	Slit width	Amperia	Wavelength
Lead	Acetylene	10 cm	0.40 MA	228.8 nm
Cadmium	Acetylene	10 cm	0.40 MA	283.3 nm

Table 3: Shows the values of lead and cadmium (PPM) in powdered milk samples

Product name	Mobilization	Origin	Cadmium	Lead
Dialac	Viet Nam	New Zealand	0.0009	0.3778
Sama Milk	New Zealand	New Zealand	0.0001	0.3699
Shirin	Uae	New Zealand	0.0061	0.4719
Reno	New Zealand	New Zealand	NS	0.1817
Encore	Saudi Arabia	New Zealand	0.0001	0.1582
Mahmoud	UAE/Dubai	Turkey	0.0006	0.5582
Shirleyt	India	India	0.0111	0.2837
Millak	Ireland	Ireland	0.0101	0.4327
Janat Milk	Ireland	Ireland	0.0511	0.4405
Dano	Denmark	Denmark	0.0051	0.4562
Bock	Denmark	Denmark	0.0009	0.2758
Nedo	Uae	Uae	0.0098	0.1268
Shepherd	UAE/Um Al, Qayoun	UAE /Um Al, Qayoun	0.0009	0.6819
Fresh	Oman	Oman	0.0011	0.4444
The South is amazing	Jordan	Jordan	0.0069	0.3542
Total			0.1058	57.939

NS: Undetected

Table 4: Lead and cadmium values (PPM) in liquid milk samples

Product name	Mobilization	Origin	Cadmium	Lead
Damraran	Iran	Iran	0.4719	0.0008
Meehan	Iran	Iran	0.1739	0.0001
Pinar	Turkey	Turkey	0.3464	0.0009
icim	Turkey	Turkey	0.4797	NS
Soya	Viet Nam	Viet Nam	0.1739	0.0115
Classico	Germany	Germany	0.1895	0.0001
KDD	Kuwait	Kuwait	0.2837	0.0008
Mori	Syria	Syria	0.2523	0.0008
Nada	Saudi Arabia	Saudi Arabia	0.1739	0.0009
AL Marai	Saudi Arabia	Saudi Arabia	0.3533	NS
Rival	Iraq	Iraq	0.2815	0.0011
Coco	Iraq	Iraq	0.3386	0.0011
Al Rafidain	Iraq	Iraq	0.4228	0.0013
Boffin	Iraq	Iraq	0.3455	NS
Erbil	Iraq	Iraq	0.4033	0.0009
Total			0.0205	4.6902

NS: Undetected

Table 5: The values of averages, standard deviation and range of studied sample compositions

Category milk	Item	SD + Mean Range	P. Value	Highest concentration fewer concentration	Samples more than allowed	Number of samples studied
powder	Lead	0.386 + 0.181 0.127 - 0.862	0.938	0.8619 0.1268	15 %100	15
	Cadmium	0.007 + 0.013 0.0 - 0.0511	0.623	0.0511 NS	1 %6.6	15
Liquid	Lead	0.0013 + 0.0028 0.0 - 0.011	0.999	0.4797 0.1739	15 %100	15
	Cadmium	0.312 + 0.105 0.174 – 0.479	0.249	0.0115 NS	0 %0	15

Results and Discussion

Heavy metal levels from lead, cadmium for milk samples of three powder, liquid and condenser varieties were reported in most samples in our current study.

As can be seen in Table 3, the results showed lead levels found in powder milk by 0.8619-0.1268, average concentrations by 0.38818, standard deviation by 0.1652 ppm higher and less concentrated, respectively, and ratios were higher than lead 0.02 ppm by the European Chemical Agency and the Agency for the Registration of toxic substances and diseases [10, 12].

In Iraq, a study of eleven samples of powdered milk from local markets was 2.6-0.2 ppm higher and less valuable respectively and with an average concentration of +0.73-0.12 ppm higher than those of our current study [19] and lower than for a study in Turkey with the value of lead ranged from 0.061-0.015 ppm. In Egypt the average samples ranged from 0.054-0.27 ppm [20] was higher than those in our current study, and there was convergence in the results for most of the 0546 samples when we reached a mechanism in this study with a study conducted in Egypt where lead concentrations ranged from 0.4086-0. ppm higher and lower value, respectively [21].

Cadmium concentrations, as presented in Table 3, were 0.0009-0 (ppm) higher and less concentrated respectively, average concentration by 0.0004 and standard deviation by 0.0004 within the allowable limits of 0.05 (ppm) [10, 14]. Cadmium concentrations in our current study in most samples were lower than the results of a study in Iraq for cadmium concentrations in powdered milk from Iraqi markets [22], where cadmium concentrations ranged from 0.3-0.027 and an average of 0.14-0.01 ppm higher and lowest concentration, respectively. In the Pakistani city of Bayashor, a study reported cadmium concentrations averaged 0.0170 ppm and converged with the average of some sample concentrations for our study [23].

In some samples from our current study, the convergence of a study in Egypt ranged from cadmium concentrations to 0.104-0.008 ppm higher and lower values, respectively [21]. In all results in our current study, we noted moral differences between lead and cadmium, and there are no moral differences between all samples of the same item and the difference in the origins; one of the worrying sources of human health is heavy metal pollution [24]. Cadmium is either inhaled or swallowed from contaminated food, medicines or supplements that act as a source of barely lumium contamination [21]. All sample results for lead were 100% more than that allowed and unlike cadmium in our current study.

As displayed in Table 4, lead levels ranged from liquid milk concentrations to 0.4797-0.1739 ppm higher, less concentration respectively, average concentration of 0.2829 and standard deviation of 0.1157, higher than permitted limits [10, 12]. The results of our study in most samples were higher and more closely approached in terms of origin than the study of tanning in Iraq on canned and encapsulated liquid milk and lead-based 0.595-0.084 ppm higher and lower values, respectively [25], and higher than the results of a study on milk in Iran [19, 26]. Lead affects all age groups, especially economically disadvantaged children or those suffering from malnutrition and in the worst cases it can cause death, but if they survive, they have a behavioral disorder called Becca, which is the craving for non-food items, because their bodies absorb more lead due to the absence of other nutrients [27].

According to Table 4, liquid milk varied in cadmium concentrations by 0.0011-0 ppmp higher and lower values, respectively, average concentration by 0.0004 and standard deviation of 0.00044, which is within the permissible limits, and less than what was reported in Pakistan on liquid milk with an average concentration of 0.0325 ppm [23]. In another study in Iraq, the highest was 0.72-0.055 ppm, higher and lower, respectively [22]. Heavy metals are toxic when food is contaminated as a result of their ability to deposit proteins in the human body, inhibiting the enzymes responsible for breathing and affecting the nervous system [28]. The results of all samples showed lead 100% more than what allowed, unlike cadmium in our current study. Although the ratios in cadmium concentrations are low, it is a toxic ingredient; heavy metals are transmitted through equipment, equipment, synthesizers and tools used in food processing [29], or by preservatives in food preservation [7]. The results in our study are clear evidence of the presence and contamination of heavy metals in spent milk.

Table 5 shows the concentration of average powdered milk varieties>s liquid as well as deviations and tides, but there are no moral differences between the same element between these varieties, which is due to the evaporation and treatment processes in which milk goes through where the concentration of elements increases, as confirmed by the study [23, 25].

Lead > Cadmium in all the items studied was found to be due to the scarcity of cadmium concentration by nature, but despite its low proportion found with other compounds, it was a highly toxic element that causes effects through prolonged or repeated exposure [14]. There have been studies that have shown that trakizasals and cadmium have anthropogenic sources in addition to other sources [29]. Other factors that help spread such pollutants are product defects, whether imported or local, or the phenomenon of marketing deception, and the demand for the purchase of the imported product and virtue on the local product; this is the desire of the Iraqi consumers [30]. There are many other sources mentioned that can spread these pollutants and despite the health measures, contamination of these minerals must occur.

Conclusion

We investigated lead and cadmium elements in local milk imported in local markets and compared it with global and local determinants, since they cause health problems for different age groups, especially fragile age groups, and more especially children.

Recommendations

1. Raising awareness in various health institutions about the existence and danger of these pollutants in food, especially milk and products and all the inputs that participate in the manufacture of food.
2. Activating the role of the competent authorities by taking the necessary and firm measures about the existing pollutants in such important products from entering imported food or entering the raw materials to make these foods and emphasizing the selection of the imported product conforming to the appropriate specifications.
3. Monitoring factories regularly for the production of food, milk and milk products and local milk production places.
4. Spreading health awareness of consumers on these pollutants in all media and publishing publications in this regard even in educational institutions.

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Authors' contributions

All authors contributed toward data analysis, drafting and revising the paper and agreed to responsible for all the aspects of this work.

Conflict of Interest

We have no conflicts of interest to disclose**.**

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