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Quantitative Analysis of Lead, Cadmium, Heavy Metals and Other Toxic Elements in Some Human Breast Milk samples

N.A. MANSOUR[1], NABIL M. HASSAN[1], S.A. ABD EL AAL[2,*] and M.H. EBRAHEM[1]

[1]Physics Department, Faculty of Science, Zagazig University, Zagazig, Egypt
[2]Central Laboratory for Elemental and Isotopic Analysis, NRC, Atomic Energy Authority, Cairo, Egypt

*Corresponding author: E-mail: elaal11@yahoo.com

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Human breast milk is the most important food source for infants and can be a pathway of maternal excretion of toxic elements. Breast milk contains both essential and nonessential trace elements. Cadmium and lead are nonessential and potentially toxic heavy metals even at very low concentrations. Cadmium, lead, heavy metal ions and other poisonous trace elements (macro and micro element contents) levels in 32 human breast milk samples were measured using inductively coupled plasma optical emission spectrometer (ICP-OES). The samples were collected from 32 healthy lactating women who were living in three different locations of the greater Zagazig region of Egypt (Zagazig, Belbees and Abokabeer). The mean levels for cadmium and lead concentrations were 0.025 ± 0.024 mg/L (range 0.001-0.061 mg/L), 1.185 ± 1.739 mg/L (range 0.011-5.339 mg/L), for Zagazig, 0.009 ± 0.010 mg/L (range 0.002-0.016 mg/L), 0.348 ± 0.154 mg/L (range 0.117-0.496 mg/L) for Belbees and 0.012, 0.122 ± 0.102 mg/L (range 0.030-0.322 mg/L) for Abokabeer, respectively. Cadmium and lead concentrations were significantly higher in Zagazig region than those in Belbees and Abokabeer regions due to industrial pollution and exhaust fumes from leaded petrol. There was also a significant increasing in the concentrations of cadmium and lead in breast milk of women active/passive exposed to smoking (samples Z_1 and Z_3) compared to non exposed ones even in the same location. The estimated intakes of cadmium, lead and barium of breast-fed infants in this study were in some cases higher than the recommended value by UNEP/FAO/WHO, which pose a threat to their health. This implies that a comprehensive study should be conducted to determine the reasons of the high levels of cadmium, lead, heavy metal ions and other poisonous elements in women's breast milk.

Keywords: Lead, Cadmium, Poisonous elements, Human breast milk, ICP-OES, Egypt.

INTRODUCTION

Studies have proved that as pollutants have built up in the environment, they have even invaded the most natural of all sources of nourishment such as human breast milk[1]. Research shows that the concentration of heavy metals in affected people is proportional to their exposure rate to the metals[2]. The toxic wastes release from industry and domestic activities increased the levels of pollutants in most metropolises. Emissions from vehicles contain a variety of toxic chemicals such as lead from the burning fuel from cars and cadmium from vehicular tyres. These toxic chemicals accumulate in the nearby soils, in the surface of leaves of plants grown along the highways, on surface of waters, foodstuffs sold along the highways and in the hairs of individuals who are actively engaged in commercial activities. Lead and cadmium may form chemical complexes and get mobilized into ground water and finally into the food chain, eventually into the human system[2]. When metals enter the body of living organism, even in trace amounts, they may be metabolized and may accumulate if not excreted. During the process of accumulation they may attain levels which may be toxic to the organism[3]. These metals are able to bind well with fats in human bodies building up measurable concentrations and eventually working their ways into the mother's breast milk when the body calls on fat supplies during lactation[4]. Owing to its unique nutritional and immunological characteristics human breast milk is the most important food source for infants. Breast milk can, however, also be a pathway to maternal excretion of toxic elements such as lead and cadmium[5].

The absorption of mineral elements including toxic ones is higher in infants than older children and adults[6]. These toxic substances impact severely and rapidly on the newly born central nervous system. Cadmium is regarded as an indicator of carcinogenic processes. It also impairs kidney functions[7]. Moreover, a relationship between the presence of cadmium in food, calcium and iron metabolism disturbances was demonstrated. Cadmium is a metal to which babies are exposed continuously, since its source may be water, air, food and cigarette smoke[6]. Studies proved that this element accumulates in babies' organs during their fetal lives to much higher degree than in their mother's organs[8]. Cadmium's half-life in the human organs is $T_{1/2} = 30$ years which explains why exposing children to this element is particularly hazardous[6]. A drafted report by UNICEF/UNEP states that 'exposing children to risk of contact with lead leads to impaired functioning of the nervous system which is manifested primarily in the disorder of motor functions and also in behaviour problems or physical hyperactivity'[9]. It is toxic to the developing brain and at high levels results in numerous poisoning symptoms. In addition, at the low doses common today in many countries, lead has subtle effects on neurological functions, including learning, memory and attention span. The infant brain is developing rapidly before the other organs, so that lead concentrated in it leading to death[6].

This study provides an important tool for the research needs of pediatricians, toxicologists as well as epidemiologists from environmental and health care institutions in this developing country. Human milk is one of the roots of elimination for mother's burden and also a source of exposure to infants[10]. Some of these metals are stored in the mother's bones and are extracted from her to provide calcium for the development of the children's bone and as a result these metals enter the maternal blood and breast milk during pregnancy and lactation, exposing the fetus and infants to risk[11,12]. Heavy metals particularly cadmium, lead and barium have been detected in breast milk in many countries around the world. World Health Organization[13] has indicated that the mean and range of metals detected in breast milk around the world are: arsenic 0.3 ppb (0.1-0.8), cadmium 0.1 ppb (0.1-3.8), lead 5.0 ppb (0.0-41.1) mercury 2.7ppb (0.64-257.1) and manganese 18.0 ppb (7.0-102.0). In some countries the metals have been found to exceed the recommended limits[11,14,15]. In many areas of the world lead (Pb) has been found in breast milk between 5-20 ppb[16]. The sources of lead exposure are numerous; ceramic and pottery glazed with lead, electronic works welding and soldering, jewelry making and repairing, certain hair dyes, auto mobilere pairs, *etc.*[17]. The presence of cadmium has been detected in breast milk as 0.28 μg/L. Cadmium in materials and components of vehicles and in electrical and electronic equipment are some sources. Cadmium levels in breast milk have also been associated with cigarette smoking. Arsenic has not been thoroughly studied in breast milk but is however known to cause cancer in humans[18,19].

The objective of this study was to determine lead, cadmium, heavy metals and other poisonous trace elements levels and their concentrations in human breast milk of healthy lactating women who were living in Zagazig, Belbees and Abokabeer in Egypt. The level concentrations of these elements in human breast milk were measured with inductively coupled plasma optical emission spectrometer (ICP-OES).

EXPERIMENTAL

Thirty two breast milk samples were collected from healthy lactating mothers from Zagazig, Belbees and Abokabeer in Egypt. About 5 mL of each breast milk sample was collected manually in labeled sterile polyethylene glass free tube. The nipple areas were cleaned with water before expressing the milk; the midstream flow was collected. The tubes were sealed immediately and kept at 4 ºC. This study was performed in the laboratory of (ICP-OES). Sampling and analytical were validated considering the referred issues described in several studies[20-23].

Samples were measured using prodigy high dispersion inductively coupled plasma optical emission spectrometer (Teledyne Leeman ICP-OES USA), by Central Laboratory for Elemental and Isotopic Analysis, Nuclear Research Center, Atomic Energy Authority, Cairo, Egypt under the operational conditions of ICP-OES as shown in Table-1.

TABLE-1
OPERATIONAL CONDITIONS OF ICP-OES

ICP spectrometer	Leeman Prodigy Prism ICP-OES (USA)
RF power	1.2 KW
Coolant gas flow	20 L/min
Auxiliary gas flow	0.3 L/min
Nebulizer gas flow	36 psi
Solution uptake rate	1 mL/min
Mg II/Mg I ratio (Robustness)	6
Replicates	3
Integration time	10 s

RESULTS AND DISCUSSION

This work presents an analyses of macro and micro element maintain in human breast milk in a comparison with the newest literature data as shown in Tables 2-5. Calcium contents of the mother's milk varied in most of the studies between 9-102 mg/L. The amount of calcium increased during lactation, but none affected by calcium level of the serum, the vitamin supply, age and smoking. Average magnesium concentration of the mother's milk is 15 mg/L, which is not affected by age, vitamin D supply, lactation and diabetes and even the magnesium supply increases the first day only the magnesium contents of the milk. Sodium contents of the mother's milk is from 60-470 mg/L, potassium contents from 170-607 mg/L, in the mature milk. Some of the micro elements occur bonded in protein in the milk, which increase the efficiency of the absorption. Iron contents of mother's milk were found in extreme cases between 5.707–172 mg/L, which is not affected by the environment, the mother's nutriment, the iron intake and the contraceptive preparations. Its absorption from the mother's milk is extra ordinarily favourable, therefore even a low iron contents are sufficient to satisfy the needs of the babies. Copper contents of the mother's milk vary between 0.118–0.984 mg/L. The effect of lactation on the copper contents is controversial and it appears that the copper contents are not influenced by either the nutriment or the copper intake. Its major part if bonded to protein, therefore its absorption is favourable. Zinc contents of the mother's milk were measured to be between 0.144–7.415 mg/L, it is difficult to specify an average value due to variations of order of magnitude. Similarly, there are extreme values obtained for the manganese contents 0.04–0.872 mg/L, which can be explained by the different manganese intake of the mothers, or by extreme manganese

TABLE-2
ANALYTICAL RESULTS OF LEAD, CADMIUM, POISONOUS AND HEAVY METAL ELEMENTS CONCENTRATIONS IN BREAST MILK HUMAN SAMPLES WERE COLLECTED FROM ZAGAZIG, EGYPT

Element/Wave longitude (nm)	Element concentration within samples (mg/L)										Average
	Z_1	Z_2	Z_3	Z_4	Z_5	Z_6	Z_7	Z_8	Z_9	Z_{10}	
As/189.042 nm	1.058	0.253	0.216	0.469	-	-	0.170	-	0.248	-	0.402±0.337
Ba/233.527 nm	0.373	0.299	0.299	0.123	0.063	0.064	0.260	0.162	0.091	0.043	0.177±0.120
Be/313.042 nm	0.018	0.078	0.073	0.012	0.007	0.015	0.042	0.048	0.016	0.017	0.033±0.026
Cd/214.441 nm	0.061	0.043	0.031	0.005	0.001	0.009	-	-	-	-	0.025±0.024
Co/228.615 nm	0.052	0.185	0.162	0.016	-	0.016	-	-	0.057	-	0.081±0.074
Cu/327.396 nm	0.985	0.723	0.369	0.313	0.180	0.372	0.581	0.650	0.118	0.524	0.481±0.264
Fe/259.940 nm	172.000	109.282	58.968	50.633	11.866	44.864	97.440	112.097	48.093	42.748	74.799±47.108
Pb/220.353 nm	5.339	0.366	1.319	0.695	0.011	1.124	-	-	0.106	0.520	1.185±1.739
Li/670.784 nm	0.061	0.120	0.811	0.021	0.003	0.014	0.009	0.007	0.010	0.008	0.106±0.250
Mg/279.553 nm	36.246	23.834	26.202	18.60619	9.884	21.526	22.772	28.067	26.389	11.913	22.544±7.731
Mn/257.610 nm	0.873	0.519	0.384	0.253	0.055	0.206	0.498	0.545	0.280	0.196	0.381±0.236
Ni/231.604 nm	0.382	0.431	0.375	0.046	0.017	0.087	0.400	0.567	0.128	0.090	0.252±0.198
Na/589.592 nm	317.421	470.287	265.542	160.635	93.255	140.283	401.602	180.555	251.165	127.733	240.848±124.644
Sr/460.733 nm	0.567	0.423	0.269	0.165	0.164	0.163	1.537	0.645	0.181	0.162	0.428±0.430
Zn/206.200 nm	7.415	3.145	1.153	1.954	1.002	1.831	5.094	1.279	4.740	1.354	2.897±2.169
Cr/267.716 nm	1.982	1.165	1.336	0.243	0.017	0.659	0.172	0.217	0.137	0.270	0.620±0.657
K/766.491 nm	556.809	472.673	385.635	304.092	193.583	303.652	400.615	606.914	369.912	298.696	389.258±126.488
Al/396.152 nm	35.782	9.669	10.195	16.393	2.090	5.443	24.539	37.219	8.888	4.734	15.495±12.773
V/310.230 nm	0.903	0.960	0.755	0.490	0.328	0.665	1.841	2.117	0.682	0.748	0.949±0.576
Ca/393.366 nm	102.021	35.587	31.505	37.400	14.269	38.178	73.274	63.329	24.183	25.780	44.553±26.889

TABLE-3
ANALYTICAL RESULTS OF LEAD, CADMIUM, POISONOUS AND HEAVY METAL ELEMENTS CONCENTRATIONS IN BREAST MILK HUMAN SAMPLES WERE COLLECTED FROM BELBEES, EGYPT

Element/Wave longitude (nm)	Element concentration within samples (mg/L)										Average
	B_1	B_2	B_3	B_4	B_5	B_6	B_7	B_8	B_9	B_{10}	
Ba/233.527 nm	0.018	0.028	0.018	0.061	0.018	0.071	0.017	0.030	0.020	0.062	0.034±0.022
Cd/214.441 nm	-	0.016	-	-	-	0.002	-	-	-	-	0.009±0.010
Cu/327.396 nm	0.110	0.223	0.275	0.180	0.218	0.225	0.130	0.228	0.289	0.179	0.206±0.057
Fe/259.940 nm	11.030	11.137	11.428	23.376	12.420	8.814	12.030	12.167	13.428	22.376	13.820±4.925
Pb/220.353 nm	-	0.312	-	0.486	0.117	-	-	0.333	-	0.496	0.348±0.154
Mg/279.553nm	11.121	9.870	12.631	12.463	11.697	10.963	10.121	9.990	11.631	11.983	11.247±1.007
Mn/257.610nm	0.049	0.056	0.062	0.073	0.056	0.070	0.058	0.066	0.073	0.080	0.064±0.010
Ni/231.604 nm	-	0.027	0.500	0.029	0.030	0.108	-	0.029	0.511	0.030	0.158±0.216
Na/589.592 nm	60.398	112.509	113.545	137.852	71.014	82.669	62.398	114.509	114.556	138.872	100.832±29.480
Sr/460.733 nm	0.084	0.204	0.191	0.192	0.155	0.128	0.079	0.235	0.191	0.194	0.165±0.053
Zn/206.200 nm	0.518	0.689	1.075	0.804	0.388	0.478	0.586	0.699	1.079	0.815	0.713±0.236
Cr/267.716 nm	0.029	0.073	0.017	0.090	0.054	0.034	0.032	0.077	0.020	0.091	0.052±0.029
K/766.491 nm	204.434	217.155	230.407	235.902	240.362	169.543	214.434	219.155	232.407	236.914	220.071±21.197
Al/396.152 nm	1.730	2.674	1.954	3.327	2.181	1.257	1.980	2.774	1.987	3.433	2.329±0.702
V/310.230 nm	0.268	0.297	0.104	0.346	0.248	-	0.259	0.307	0.115	0.362	0.256±0.092
Ca/393.366 nm	13.463	14.019	15.353	15.196	18.026	12.866	12.663	14.019	15.353	15.196	14.615±1.574

burden of the environment. Out of the other micro elements, we analyze the chromium, nickel, cobalt, molybdenum, selenium, iodine and silicon maintained in mother's milk, while among all toxic trace elements, we focus on the concentration of cadmium, lead, mercury and barium in human breast milk as given in Tables 2-4. Amount of latter ones in the mother's milk is affected by smoking, the polluted urban air, exhaust gas of the motor vehicles, the polluted environment and by the number of amalgam fillings. Cadmium contents of the mother's milk were measured to be between 0.001–0.06 mg/L. Even more extreme values were measured for the lead, as its concentration ranged from a couple of tenth to 5.339 mg/L. Lead contents were increased mainly be the polluted urban air, however, its amount decreased after the unleaded fuels have been widely used. Rossipal and Krachler[24] examined content of 19 trace elements of 79 milk samples taken from 46 healthy mothers on days 1–293 of the lactation. Barium, beryllium, bismuth, cadmium, cesium, lanthanum, lithium, rubidium, antimony, tin, strontium, thallium content was determined not only in the course of lactation, but also during the nursing. It was established that concentration of such toxic elements like barium, beryllium and lithium was considerably higher in the ripe milk and it appears that bismuth, strontium does not change during the lactation. Concentration of barium, cesium, strontium decreases the suckling, which can mean even a difference of 60 %, which that must be taken into consideration when collecting the mother's milk samples. Also in this study we determined toxic element of transitional and ripe milk mothers, aluminum and arsenic. The aluminum concentration was measured to be 1.257-37.219 mg/L and arsenic

TABLE-4
ANALYTICAL RESULTS OF LEAD, CADMIUM, POISONOUS AND HEAVY METAL ELEMENTS CONCENTRATIONS IN BREAST MILK HUMAN SAMPLES WERE COLLECTED FROM ABOKABEER, EGYPT

Element/Wave longitude (nm)	Element concentration within samples (mg/L)												Average
	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}	A_{12}	
As/189.042 nm	0.163	0.208	0.019	-	-	0.521	0.020	0.116	-	-	0.242	0.121	0.176±0.161
Ba/233.527 nm	0.013	0.067	0.019	0.037	0.009	0.148	0.012	0.079	0.027	0.007	0.106	0.023	0.046±0.045
Cd/214.441 nm	-	0.012	-	-	-	-	-	-	-	-	-	-	0.012
Cu/327.396 nm	0.164	0.280	0.146	0.118	0.113	0.259	0.218	0.327	0.182	0.076	0.238	0.196	0.193±0.075
Fe/259.940 nm	11.653	12.992	10.989	27.844	13.344	87.919	11.809	15.316	13.568	5.708	15.360	15.156	20.138±21.947
Pb/220.353 nm	0.030	0.031	0.229	0.236	0.065	0.113	0.039	0.061	0.057	0.053	0.230	0.322	0.122±0.102
Li/670.784 nm	0.001	0.036	0.003	0.003	0.013	0.010	-	0.037	-	-	3.798	-	0.488±1.338
Mg/279.553nm	12.999	12.807	7.867	6.801	5.575	27.028	9.184	16.605	11.855	6.434	14.815	9.834	11.817±5.918
Mn/257.61 nm	0.055	0.090	0.052	0.131	0.053	0.441	0.060	0.104	0.072	0.027	0.118	0.090	0.108±0.109
Ni/231.604 nm	0.019	0.132	0.026	0.051	0.034	0.114	0.035	0.102	0.033	0.011	0.183	0.022	0.063±0.055
Na/589.592nm	109.684	142.759	65.305	91.839	102.783	190.738	78.939	107.965	109.514	135.032	177.712	94.445	117.226±37.860
Sr/460.733 nm	0.165823	0.168	0.153	0.116	0.077	0.118	0.174	0.219	0.199	0.098	0.188	0.125	0.150±0.043
Zn/206.200 nm	0.303	0.582	0.350	0.743	0.165	1.543	0.861	0.517	0.941	0.144	0.265	0.622	0.586±0.400
Cr/267.716 nm	0.027	0.043	0.096	0.046	0.039	0.141	0.014	0.066	0.046	0.108	0.073	0.044	0.062±0.037
K/766.491 nm	255.042	253.974	220.496	225.161	193.286	419.975	234.488	310.985	248.798	210.370	282.917	218.546	256.170±60.891
Al/396.152 nm	1.853	2.093	1.741	3.821	2.309	17.859	2.097	2.481	2.365	1.268	11.031	2.407	4.277±5.004
V/310.230 nm	0.217	0.258	0.303	0.472	0.449	0.243	0.289	0.265	0.184	0.416	0.292	0.373	0.313±0.093
Ca/393.366nm	16.828	13.768	12.800	22.770	9.236	46.029	14.943	14.000	18.974	10.761	18.635	16.767	17.959±9.592

TABLE-5
ANALYTICAL RESULTS OF CADMIUM AND LEAD ELEMENTS CONCENTRATIONS IN HUMAN BREAST MILK SAMPLES REPORTED INTERNATIONALLY AND COMPARED WITH THE PRESENT WORK

Country	Cd (mg/L)	Pb (mg/L)	Reference
Croatia	0.05±0.04	0.9±0.4	23
Sweden	0.05±0.04	0.9±0.4	23
Turkey	2.8	14.6	32
Iran	2.44±1.47	10.39±4.72	33
Saudi Arabia	1.73	31.671	34
Zagazig, Egypt	0.0251±0.0239	1.1848±1.7394	Present study
Belbees, Egypt	0.0087±0.0103	0.3485±0.1545	Present study
Abokabeer, Egypt	0.0115	0.1221±0.1024	Present study

concentration to be 0.019-1.058 mg/L. Coni *et al.*[25] analyzed some trace elements of healthy mothers in Torino and their absorption. For the mother's milk samples the following trace element concentrations were obtained: barium, bismuth, lithium, strontium and thallium. Beyond determination of the micro elements it was also examined to what protein fractions the materials of interest were linked in the milk. Wappelhorst *et al.*[26] determined antimony, cerium, gallium, lanthanum, niobium, ruthenium, silver, thorium, titanium and uranium content of milk of 19 mothers living in Germany and examined the absorption of the food-stuff, the transfer into the mother's milk. Based on micro element content of the food stuff and the milk it was calculated in what ratio the micro element present in the food stuff transferred into the milk. The calculated transfer factor for silver was 5.1, for cerium 16.1, for gallium 19.1, for lanthanum 13.8, for niobium 20.7, ruthenium 4.1, for antimony 13.2, for thorium 20.2, for titanium 5.6 and for uranium 21.3. The transfer factors significantly differed from each other in case of the individuals. These differences were explained by the differences in the milk production and in the absorption of the elements both depending on the entities. Average silver content of the mother's milk was measured to be 0.334 µg/kg, cerium content to be 0.030 µg/kg, gallium content to be 0.027 µg/kg, lanthanum content to be 0.043 µg/kg, niobium content to be 0.023 µg/kg, ruthenium content 0.180 µg/kg, antimony content to be 0.041 µg/kg, thorium content to be 0.028 µg/kg, titanium content to be 0.080 µg/kg and radium content to be 0.022 µg/kg. Sharma and Pervez[27] did not find a close relationship between the concentration of arsenic in the blood and mother's milk. Arsenic content of milk of mothers aged 20–25 years, living in polluted area was 0.9 µg/dm^3 and that of mothers aged between 40–45 years was 5.2 µg/dm^3. In similar age groups, in case of mothers living far away from industrial areas, in unpolluted environment the arsenic content ranged between 0.1–0.9 µg/dm^3, In Zagazig region, the arsenic content ranged between 0.170–1.058 mg/L but not detected in Belbees and Abokabeer due to the decrease of pollution (Tables 2 and 3). Three toxic elements *viz.*, cadmium, lead and barium show high concentration in Zagazig region more the other two region Belbees and Abokabeer as shown in Fig. 1. This is due to the increase of industrial pollution and exhaust fumes from leaded petrol rather those regions but all the present data is less than literature data.

Toxic elements in breast milk raise the important issues for pediatric practice, for the practice of public health and for the environmental health research community. There is insufficient information on the nature and levels of contaminants in breast milk as well as a lack of consistent protocols for collecting and analyzing breast milk samples, lack of toxic kinetic data and lack of data on health outcomes that may be produced in infants by exposure to chemicals in breast milk. These is a gap in information about the exactly concentration of those toxic elements so the risk assessment can be verified and make difficult the formulation of evidence-based health guidance as reviewed[28]. Human milk acceptable and recommended values to toxic metals are not established and though they are not available. There is a need to conduct exposure assessments with prospective studies to take into account the

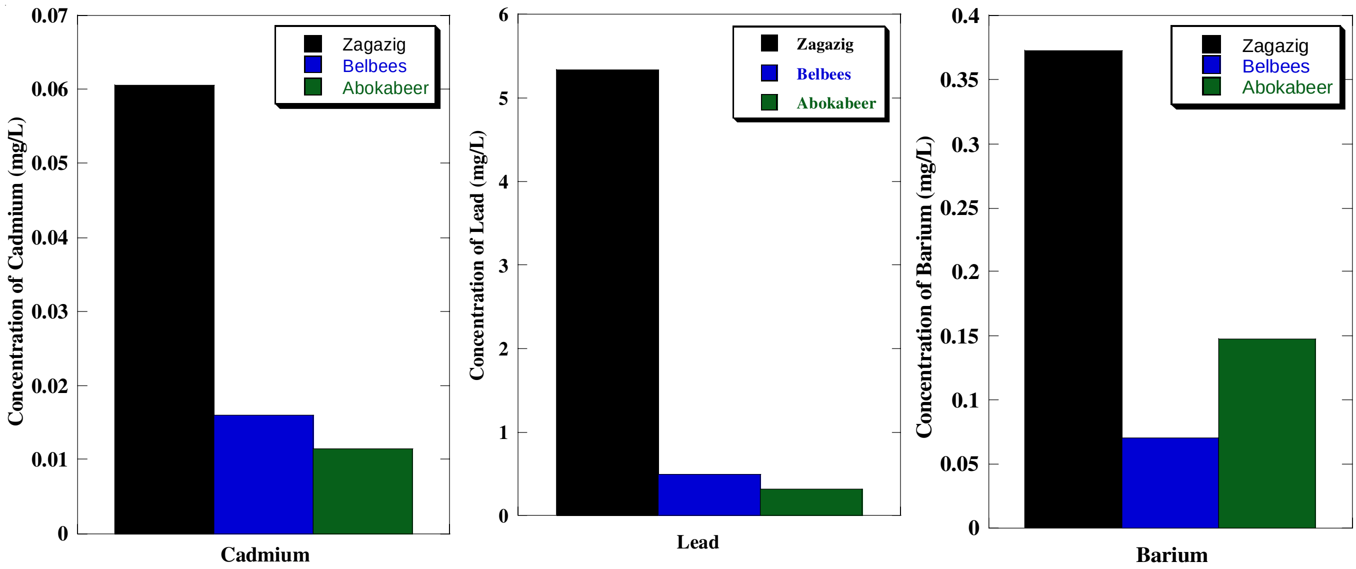

Fig. 1. Variation of cadmium, lead and barium concentrations with location

health impact in nursing infants[29]. Several studies were reviewed with lead concentrations in breast milk samples over the guidelines for drinking water (> 10 μg/L lead)[22]. Another author remarked a study on Malasian non exposed women with an average lead levels in breast milk of 43.5 μg/L[30]. This first approach study to develop analytical methods for chemicals in breast milk have been of wide interest in Uruguay because these preliminary matrix data allow correlating them with other biomarkers. In further research, blood and milk Pb and Cd levels could be performed in order to evaluate potential health risks, regarding the Uruguayan wide experience on children's environmental lead exposure and the smoking habits of nursing mothers[31]. Feasible analytical methods are now available for lead and cadmium in breast milk and in this research line, exposure to other toxic metals from different sources, can also be able to be measured in breast milk. The results of this study will lead into the consideration of chemicals in breast milk as an invaluable tool in environmental risk assessment. Breast milk is baby's basic food stuff for his first year of life or longer and special attention to the potential effects of the presence of chemicals in this matrix have to be paid in Uruguay.

Conclusion

The results of this study revealed the presence of cadmium and lead in all collected samples obtained from healthy women in Zagazig, Belbees and Abokabeer regions in Egypt. This gives an indication that infants are likely to be exposed to high levels of those toxic heavy elements. Cadmium, lead and barium concentration are varied from region to other due to the level of industrial pollution and petroleum exhausts. They are higher in Zagazig than Belbees and Abokabeer. But for the important basic elements of the human breast milk such as iron, magnesium, sodium, potassium and calcium are very high in Zagazig due to good nutrition than in Belbees and Abokabeer. The present data of all studied region show low level than the published data of other studied region in literature. Infants of mothers exposed passively to smoking are receiving about 60 % more of lead and 40 % more of cadmium levels than infants of non-exposed mothers. In view of all potential consequences of advanced lead and cadmium intoxication, it is necessary to point out the importance of an early diagnosis before morphological changes have been developed.

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