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DETERMINATION OF HEAVY METALS IN EGYPTIAN INFANTS FORMULAS, WEANING FOODS AND SOME BREAKFAST FOODS.

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ABSTRACT

Concentrations of fourteen trace elements were determined by the Association of Official Analytical Chemists Methods, in some commercial infant formulas, weaning food, and breakfast foods samples, collected from different supermarkets and pharmacies in Cairo, Egypt from 2007 to 2008. The average concentrations of the macro, micro and heavy metals, detected in samples on the basis of dry weight, were 0.67 mg kg^{-1} for cadmium, 1.84 mg kg^{-1} for chromium, 8.21 mg Kg^{-1} for copper, 33.86 mg Kg^{-1} for Zinc, 15.5^{1} mg Kg^{-1} for Aluminum, 112.14 mg Kg^{-1} for Iron, 0.047 mg Kg^{-1} for silver, 0.0 mg Kg^{-1} for mercury and arsenic, 0.22 mg Kg^{-1} for tin, 0.03 mg kg^{-1} for lead, 18.09 mg Kg^{-1} for manganese, 0.89 mg Kg^{-1} for nickel and 0.068 for sodium.

The results demonstrated that low concentrations of most of heavy metals were found in baby foods and breakfast foods samples under investigation. The levels of lead and arsenic were within acceptable levels for infants consumption as recommended by the Egyptian Standards, while copper concentrations were within the maximum residual levels recommended. The mean lead concentration was 0.032 mg kg^{-1} slightly higher than the limit of lead in infant formulas of EC Regulation (0.02 mg kg^{-1}).

The effect of dry yeast on the concentrations of heavy metals for examined infants formulas were studied.

Keywords: Infants formulas, Heavy metals and toxic elements.

INTRODUCTION

Heavy or toxic metals are trace metals with a density at least five times that of water. As such they are stable elements (meaning they cannot be metabolized by the body) and bio- accumulative (passed up the food chain to humans). These include: mercury, nickel, lead arsenic cadmium, aluminum, platinum and copper. Heavy metals have no function in the body and can be highly toxic. (Bratter and Schramel, 1983).

The danger posed to human health by this form of contamination comes mainly from food and stems from the ability of this element to enter the natural alimentary chains, to accumulate in progressively larger quantities at each trophic stage, and to reach highly toxic concentrations in the tissues of organisms that play a role in the human diet (Purves, 1985).

Toxic heavy metals, such as mercury, cadmium and lead, are associated with many serious diseases and health problems. Cancer, heart disease, cardiovascular problems, birth defects, skin disorders, nervous system related numbness, and mental and neurological disorders represent only a few of the health problems associated with toxic heavy metal poisoning. The effects of heavy metal toxicity studies confirm that heavy metals can directly influence behavior by impairing mental and neurological function influencing neurotransmitter production and utilization and altering numerous metabolic body processes. Systems in which toxic metal elements can induce impairment and dysfunction include the blood and cardiovascular detoxification pathways (colon liver kidneys skin) endocrine (hormonal) energy production pathways enzymatic gastrointestinal immune nervous (central and peripheral) reproductive and urinary, (Paul and Larry, 1989).

Cadmium (Cd) levels were determined by (Eklund and Oskarsson, 1999), in 59 baby food samples, including milk- based, cereal and milk,-based and soy-based formulas, recommended from performed by zeeman graphite furnace AAS, after dry ashing, with parallel determinations of certified reference samples. Mean Cd levels were found to range from 1.10 to 23.5 mug/kg fresh wt concentrated formula.

Contents of metals (pb, cd, cu, zn) in various types of milk and infant foods in India were measured and the daily intake of heavy metals by various age groups of infants were studied by (Tripathis et al, 1999). Heavy metal contents varied among the milk types analysed, but were generally higher in samples with higher fat contents. Cd concentrations low (mean 0.07-0.10 mug/1) in all milks samples. Mean concn of metals were approx. one order of magnitude higher in baby foods than in milk samples. Daily intakes of pb, cd, zn and cu were estimated as approx. 1.1mug/kg, 0.01mug/kg, 0.8 mg/kg and 0.06 mg/kg. respectively. Values for cd and pb were well below recommended tolerable levels.

Lead exposure and childhood, in African countries are discussed by (Nriagu et al, 1996). Pb poisoning is fraction of the in African population, principal sources of exposure including house paint, leaded gasoline, mining operations, polluted water, contaminated food, cosmetics and medicaments. Childhood exposure to pb is also as a result of high concn. Human milk (approx. 5mug/g in Nigeria and Zaire), Pb- soldered cans and containers used for baby foods and transfer of pb in dust onto foods.

Petronijevic et al (1985) reported that samples of Juvitana baby foods made in India according to Yugoslavian recipes were analysed; types based on fruit, vegetables and meat were evaluated. Data are given for levels of heavy metals, (cd, pb, Hg, Cu, Mn, Zn and As).

Suzuki et al (1983) showed that 13 cereal- 11 vegetable- and 11 fruit-based commercially available baby foods were analysed by Atomic absorption spectrophotometer (AAS) and differential pulse polarography for pb, Cd, As and Sn, the foods being in dry wet or liquid forms, packaged in bags, bottles or cans. Levels found in the individual foods are tabulated. Only a few foods contained As, and its occurrence seemed to be related to incorporation into the foods of a sauce prepared from a seaweed. Cd was most frequent found in rice-based foods, while pb and Sn occurred mainly in canned fruit products. No relationship was found between packaging material and metal levels in the foods.

Seventy one commercial samples of baby foods packed in glass jars and sold in sao Paulo city were analysed by (Iura et al, 1982) for pb contents by AAS. Tabulated results showed contents of 0.02-0.37 mg/kg (max. in chicken with creamed vegetables), with a median of 0.11 and 90 percentile of 0.20 mg/kg. All samples were within Brazilian legal limits.

Sanchez- Saez et al (1980) reported that pb contents were determined by AAS in (i) 29 infant milk formulae, (ii) 34 cereal- and vegetable- based dried infant foods (for use from 3-4 months), and (iii) 25 baby foods, (for use in early mixed feeding). Mean pb contents were (i) 0.191, (ii) 0.211 and (iii) 0.144 p.p.m. when (i) and (ii) samples were reconstituted before analysis, pb concn. were <0.20 p.p.m in 100% of samples tested. 92% of (iii) samples contained <0.20 p.p.m. pb.

This study was conducted to determine concentrations of heavy metals in Egypt baby foods and to assess infants exposures to metals, and to determine the effect or dry yeast on toxic metals contaminate baby foods.

MATERIALS AND METHODS

Apparatus:

All glassware was soaked over night in 10% (v/v) nitric acid, followed by washing with 10% (v/v) hydrochloric acid, and rinsed with deionized water and dried before tested by Inductively Coupled Plasma (ICP), Optima 2000.

Reagents:

All reagents used were of analytical reagent grade (Merck, Germany). Standard stock solutions of mercury, chromium, copper, manganese, zinc, aluminum, iron, silver, arsenic, cadmium, lead, tin, nickel and sodium were prepared from Merck and were diluted to the corresponding metal solution. The working solution were freshly prepared by diluting an appropriate aliquot of the stock solutions using deionized water for diluting elements solutions.

Sample preparation and digestion:

One hundred and twenty five samples of baby and breakfast foods (about 0.5 kg each) in Egyptian markets were used for this study.

After opening, each can content was homogenized thoroughly in a food blender with stainless steel cutters. A sample were then taken and digested promptly as follows:

A 0.5 g sample of baby and breakfast foods are weight in a 250 ml beaker, Add 25- 30 ml of conc HNo3. Cover with a watch glass and let stand at room temperature for 2 hr. Place beaker on a hot plat and heat very slowly (exothermic reaction). After initial reaction subsides (35 min) heat at 70 C° for 3 hr. Cool solution and then add 2 ml of 70 % H Clo4 and heat until a clear solution is obtained when the ashing process is completed, HClo4 is removed by evaporation. The residue is then treated with 5-ml of conc HCl and the acid refluxed in the beaker. An equal volume of H2o is added with subsequent evaporation to dryness. This process is repeated. Finally 1.0 ml of conc HCl is added and the mixture warmed briefly; then 15 ml H2O is added, heating is continued for 15 min. Cool solution and transfer to 25 ml volumetric flask, and make up to volume with H2O. (Baetz and Kenner 1973 and 1974).

All standards and samples has been analysed by ICP- Perkin Elmer, Optical Emission spectrometer, optima 2000 DV.

Adding of dry yeast to infants foods:

The rations of 5% and 10% of yeast were used for incubation at 37C° for 15 and 30 min with samples under investigations. (dry yeast was purchased from local market).

RESULTS AND DISCUSSION

There is an established need for determinations of heavy metals in different biological and environmental materials and in foodstuffs, as well as for monitoring purposes in occupational hygiene, etc. Long-term exposure to low levels of toxic metals can be important, especially in relation to children, (Biddle, 1982).

The concentrations (on the basis of dry weight of samples) of heavy metals found in many types of infants and breakfast foods samples were determined in Table (1).

Fourteen trace elements (Pb, Cd, Sn, Al, As, Cr, Hg, Ag, Fe, Cu, Mn. Ni, Zn, and Na) were tested in the samples under investigation.

The concentrations of lead in baby foods were detected in the range of 0.015 to 0.055 mg kg^{-1} with an average value of 0.0032 mg kg^{-1} This average are slightly above the limit of lead in (EC Regulation 466 L, 2001) for infants foods (0.02 mg Kg^{-1}).This value much lower than maximum residual level of 1.0mg Kg^{-1} recommended by (Egyptian Standards, 2005) for the lead in baby foods.

All investigated samples were free of arsenic (As) and mercury (Hg) elements as shown in the same table.

On the other hand, in 52% of the samples, copper (Cu) element was found with values exceed the maximum residual level of 5.0 mg kg^{-1} recommended by (Egyptian Standards, 2005) for the copper in baby foods. The highest level of copper was found in grinded mixed cereal as a breakfast meal product for children, with a level of 35 mg kg^{-1}. Concentrations of copper in baby foods samples were detected with an average value of 8.2 mg kg^{-1}.

Tests showed that all values for total iron (Fe) were under the level of 200 mg kg^{-1} (beginning of toxicity limit), except two samples (vegetables with wheat and milk, and fruits with wheat and milk) which showed the highest concentrations of iron (228.5 and 239.1 mg kg^{-1}).

Concentrations of zinc (Zn), silver (Ag), Aluminum (Al), chromium (Cr), and tin (Sn) were determined as seen in the same table. Therefore, their mean concentrations were found within the natural amounts in all investigated samples. Only one sample (fruit with wheat and milk) was contaminated by high level of aluminum (AL) element, which recorded as 196.6 mg kg^{-1}. This concentration was approximately 4.3 times higher than that recommended to beginning of aluminum toxicity in foods. Cereals and fruits based infant formula showed higher aluminum levels than the animal types that may due to using of agriculture fertilizations. There are no regulatory limits for aluminum in Egypt.

Table (1): levels of Heavy metals in baby and breakfast foods collected from Egyptian markets (mg Kg^{-1})

Sample type	Heavy metals									Macro and micro elements				
	Pb	Cd	Al	As	Cr	Hg	Ag	Sn	Ni	Fe	Cu	Mn	Zn	Na
R+V+M	0.052	0.926	0.935	ND	4.694	ND	0.011	0.063	1.52	398.5	8.354	20.22	26.18	0.1575
W+M	0.0317	0.782	0.492	ND	1.752	ND	0.093	0.074	1.22	45.31	10.15	28.19	38.69	0.0493
MF+R	0.032	1.002	0.896	ND	2.184	ND	0.041	0.041	1.03	78.9	12.84	26.84	41.52	0.0833
R+V	0.022	0.971	1.624	ND	1.914	ND	0.022	0.142	1.02	63.37	14.31	11.35	48.55	0.975
R+P+M	0.026	0.753	1.906	ND	1.704	ND	0.0113	0.106	0.52	71.5	11.68	10.1	43.12	0.0433
R+O+M	0.051	1.933	2.007	ND	1.68	ND	0.094	0.117	0.62	188.3	20.05	29.85	32.9	0.0634
R+C+M	0.032	1.336	0.78	ND	1.829	ND	0.055	0.088	0.71	165.4	20.01	29.07	39.14	0.1059
MF+W+W	0.031	0.924	0.89	ND	2.258	ND	0.012	0.103	0.81	38.39	10.7	11.2	23.13	0.0838
MV+W+M	0.03	1.18	2.1	ND	1.686	ND	0.042	0.491	0.91	68.89	14.86	16.8	38.95	0.0763
H+W+M	0.012	0.791	1.21	ND	1.267	ND	0.013	0.52	0.81	43.59	9.068	32.8	18.24	0.0328
R+V	0.023	0.91	5.16	ND	1.411	ND	0.021	0.68	1.04	13.57	6.41	3.39	13.24	ND
W	0.014	0.82	0.44	ND	1.621	ND	0.026	0.69	0.073	104	1.21	2.76	14.27	ND
MF	0.023	0.74	8.93	ND	1.811	ND	0.056	0.71	0.91	119	1.43	159	38.96	ND
W+V+M	0.05	0.376	6.92	ND	1.71	ND	0.081	0.08	0.45	124.6	1.989	9.932	57.21	0.015
F+W+M	0.035	0.455	196.6	ND	1.62	ND	0.042	0.07	0.73	115.6	1.902	6.22	53.57	0.012
H+W+M	0.055	0.361	3.225	ND	2.68	ND	0.031	0.04	0.41	99.07	1.447	5.406	54.28	0.031
V+R+M	0.04	0.36	19.06	ND	1.5	ND	0.064	0.09	1.07	79.5	2.533	5.395	13.73	0.082
F+W+M	0.026	0.297	29.59	ND	1.41	ND	0.091	0.9	1.12	228	5.422	9.684	30.47	0.91
V+W+M	0.027	0.379	31.24	ND	1.42	ND	0.092	0.071	0.92	239.1	3.162	9.405	11.54	0.083
V+R	0.027	0.208	4.319	ND	1.31	ND	0.045	0.082	0.70	85.06	2.209	7.445	43.34	0.041
Ce+M+F	0.015	0.352	35.39	ND	2.86	ND	0.061	0.091	1.72	95.61	1.665	6.225	47.08	0.061
GC	0.037	0.221	9.543	ND	2.061	ND	0.089	0.081	1.35	55.82	35.91	3.449	69.51	0.028
DF	0.045	0.349	7.115	ND	1.51	ND	0.031	0.091	0.64	39.7	4.264	2.57	18.54	0.097
Ce+NUTS	0.035	0.24	7.938	ND	1.16	ND	0.026	0.08	0.68	224.45	1.109	2.603	9.177	0.091
Corn flaks	0.034	0.214	9.424	ND	1.12	ND	0.032	0.072	0.63	18.33	2.53	2.434	21.35	0.091
Mean	0.032228	0.6752	15.50976	ND	1.84688	ND	0.047292	0.22	0.89	112.1424	8.20856	18.09352	33.86748	0.0683

- ND = Not detected
- CR= Rice, V= Vegetables, M= Milk, W= Wheat, MF = Mixed fruits, P= protein, O= orange, C= chocolate, MV= Mixed vegetables, H= honey, DF + Dried fruits, CE + CE = cereal, GC = grinded cereal).
- N = number of samples.

For nickel, the mean concentration found was 0.89 mg Kg^{-1}. The maximum level of 1.72 mg Kg^{-1} was found in a sample of cereal and fruits with milk.

The highest concentration of manganese was 159.0 mg kg^{-1}. This level was approximately 4.0 times higher than that detected in non toxic samples. The highest level was found in fruits samples.

The mean concentration of cadmium found in baby foods samples was 0.67 mg kg^{-1}. The highest level found was 1.93 mg kg-1 in samples contained rice. On contrary, (EC Regulation 466/2001) sets limits on the cadmium metal between 0.05 to 0.2 mg kg^{-1}, while limit for cadmium in rice is 0.2mg kg^{-1}.

The present study showed that concentrations of cadmium, lead and copper found in baby foods samples were higher than those reported by (Ogorevc et al, 1987) who showed that detection limits for cd, pb and cu in baby foods were 0.003, 0.004, and 0.008 mg kg^{-1}, respectively.

The lead and cadmium concentrations detected in this study was approximately 10 times higher than that found in the previous studies. On the other hand, the lead concentration detected in this study was closed similar to that found by (Capar et al, 1982), who reported that the levels of lead in infants foods were ranged from 0.15to 0.05 mg kg^{-1}. the main route of intake for most of these elements is from foods. Some of these elements are essential nutrients, while others have no known beneficial health effects. However, all elements may be harmful if eaten is excessive amounts.

Reilly, (1977) suggested that cadmium may be enter food from rust-proof plating, especially galvanized surfaces, as commercial zinc contains less than or equal to > 1% cd, and pb may enter food from solder on equipment, from enamels and glazes on pottery, from leaden pipe work, inks, tap water and from paper and foil. Aluminum may enter food from, anti acids, cookware, bleached flour, aluminum foils, cans, and baking powder. On the other hand copper may contaminated of food from copper water pipes, and nutritional supplements (especially prenatal vitamins).

This study demonstrated that low concentrations for chromium, lead, tin, zinc, arsenic, silver, manganese, and sodium, were found in baby foods and breakfast foods collected from Egyptian markets.

The levels for lead, and arsenic detected in samples were within the minimum residual levels recommended by the (Egyptian Standards, 2005), while, copper concentrations were within the maximum residual levels recommended (>5 mg kg^{-1}) this may be due to a rapid increase in the population and the cross contamination baby food industry during the process.

The effect of dry yeast an baby formulas contaminated by heavy metals:

The effect of dry yeast on the concentrations of heavy metal for examined infants formulas were presented in tables (3,4 and 5). The indicated data showed that the addition of dry yeast (5% and 10% for 15 and 30 min) to infants foods was more effective for reducing some elements such as aluminum and cooper, which showed a decrease in the levels of 196.6and 35.91 mg kg^{-1}, in fruit with wheat and milk, and grinded cereals, to 15.61 and 2.4 mg kg, respectively.

The results showed a decrease in the concentrations of some toxic heavy metals most commonly encountered and damaging to health. The study findings agree with (Khrycheva and Palagina, 1974), who reported that the addition of the preparation of trace elements (Mn, B, Cu, Co, Mo and I) to the cultivation medium during yeast growth increased the yield rate of the biomas. That may be explain the reduction of some heavy metals in the investigated samples.

However, some chelating agents and nutrients that assist in the mobilization of metals and toxins used to bind up the heavy metals. Yeasts contain many nutrients such as lipoic acid methionine, l-cysteine, Antioxidant, and essential vitamins (B5-6-12), which has an effective powerful ingredient for detoxifying the foods (HEALL, 2000).

It must be notify that dry yeast may be become source of some Heavy metals in foods such as copper as seen in table (2).

Generally the survey was done to assess infants, exposures to metals in Egypt and to indicate the Egyptian standards regularly monitors the concentrations of metals in infants food which regulate only three heavy metals (Arsenic, lead, and copper). It would require infants food processors in Egypt to greater care in the sourcing of the ingredients used in their products.

The present work suggested that using of clean dry yeast as a nutrient additional may to decrease some heavy metals especially, copper and aluminum in infants foods.

Table (2): Levels of heavy metals in dry yeast (mg Kg^{-1})

Heavy metals	Heavy metals				Macro and Micro elements			
	Al	Cd	Pb	Ni	Cu	Fe	Mn	Zn
Dry yeast	13.95	8.871	0.048	0.86	12.56	129.3	2.930	111.7

N= number of samples (5)

Table (3): Levels of Heavy metals in baby and breakfast foods without dry yeast treatment (mg Kg^{-1})

Sample type	Heavy metals			Macro and Micro elements			
	Al	Cd	Pb	Cu	Fe	Mn	Zn
V+W+M	6.92	0.37	0.05	1.98	124.6	9.93	57.21
F+W+M	196.6	0.45	0.03	1.9	115.6	6.22	53.57
M+W+M	3.22	0.36	0.055	1.44	99.07	5.40	54.28
V+R+M	19.06	0.36	0.04	2.53	79.5	5.39	13.73
F+W+M	29.99	0.29	0.02	5.42	228	9.68	30.47
V+W+M	31.2	0.37	0.02	3.16	239.1	9.40	11.54
V+R	4.319	0.20	0.027	2.2	85.06	7.44	43.34
C+M+F	35.39	0.35	0.015	1.66	95.6	6.22	47.08
GC	9.54	0.22	0.037	35.91	55.8	3.44	96.51
DF	7.11	0.34	0.045	4.26	39.7	2.57	18.54
Ce+ Nuts	7.93	0.24	0.035	1.10	24.45	2.6	9.17
Corn Flaks	9.45	0.21	0.034	2.53	18.33	2.43	21.35

Table (4): The effect of using 5% dry yeast for 15 and 30 min on the heavy metals concentrations of baby and breakfast foods (mg Kg-1)

Sample type	5% yeast / 15 min.							5% yeast / 30 min.						
	Al	Cd	Cu	Fe	Mn	Pb	Zn	Al	Cd	Cu	Fe	Mn	Pb	Zn
V+W+M	7.31	0.19	1.65	116.4	3.49	0.028	66.13	6.21	0.24	3.0	123.7	5.03	0.01	72.04
F+W+M	14.1	0.347	1.72	115.5	5.07	0.038	51.76	18.77	0.07	1.82	574.4	4.55	0.03	37.42
H+W+M	23.8	0.22	16.16	159.7	8.28	0.03	106.7	14.51	0.04	1.66	125.9	5.04	0.03	82.2
V+R+M	32.9	0.28	3.0	87.14	3.74	0.04	18.89	19.28	0.08	2.63	89.68	4.51	0.051	23.7
F+R+M	29.9	0.35	3.4	2.36	2.73	0.03	13.45	25.19	0.023	3.33	206.5	8.07	0.043	16.89
V+W+M	28.2	0.33	2.68	219	8.21	0.02	17.4	27.93	0.058	3.74	247.6	9.51	0.054	18.72
V+R	5.34	0.23	1.91	70.8	6.21	0.04	52.21	5.31	0.03	2.75	254.8	6.58	0.049	56.66
Ce+M+F	7.9	0.28	1.98	94.6	4.9	0.02	53.21	9.58	0.07	2.723	42.47	2.66	0.064	11.26
GC	5.3	0.37	1.5	67.14	0.81	0.04	6.89	3.71	0.08	1.37	41.14	2.77	0.039	9.63
DF	6.6	0.17	8.8	338.6	1.03	0.01	20.96	5.39	0.07	2.71	41.83	3.81	0.031	9.98
Ce+Nuts	9.6	0.19	1.35	28.44	1.96	0.03	8.23	4.85	0.032	1.68	33.53	3.34	0.08	10.46
Corn flaks	5.66	0.25	1.44	17.35	0.97	0.02	10.62	1.08	0.12	1.41	15.88	2.11	0.04	9.9

Table (5): The effect of using 10% dry yeast for 15 and 30 min on the heavy metals concentrations of baby and breakfast foods (mg kg-1).

Sample type	10% yeast / 15 min.							10% yeast / 30 min.						
	Al	Cd	Cu	Fe	Ma	Pb	Zn	Al	Cd	Cu	Fe	Mn	pb	zn
V+W+M	5.93	0.12	2.35	115.2	4.49	0.026	62.8	3.68	0.15	1.83	144.6	4.95	0.02	76.26
F+W+M	15.86	0.15	2.02	120.4	3.97	0.24	74.2	17.9	0.27	2.26	143.0	4.26	0.37	76.44
H+W+M	6.51	0.24	1.78	114.4	4.8	0.04	78.1	1.94	0.25	1.9	117.5	4.80	0.05	80.07
V+R+M	21.5	0.006	2.75	104.6	5.31	0.031	80.8	22.1	0.17	3.4	91.8	44.36	0.03	22.21
F+R+M	28.3	0.13	2.98	233.2	8.42	0.03	20.44	30.5	0.22	5.11	225.6	9.32	0.05	22.58
V+W+M	25.4	0.28	3.34	225.7	9.29	0.03	20.44	21.3	0.22	5.11	225.6	9.32	0.05	22.58
V+R	5.42	0.21	2.41	90.2	5.8	0.04	71.2	1.62	0.230	2.931	82.87	6.44	0.04	63.32
Ce+M+F	5.8	0.18	2.62	117.5	14.2	0.03	91.2	1.34	0.16	2.81	126.4	13.13	0.03	82.17
GC	10.95	0.25	2.33	121.7	11.47	0.04	82.1	10.36	0.18	2.48	144	11.59	0.04	79.04
DF	7.41	0.28	3.12	133	8.41	0.04	42.6	10.8	0.188	3.65	144	6.49	0.04	19.53
Ce+Nuts	2.97	0.19	1.64	22.1	2.32	0.03	11.73	10.9	0.128	2.65	31.59	3.49	0.04	13.53
Corn flaks	2.49	0.19	1.94	20.2	2.51	0.03	8.47	2.68	0.15	1.46	14.42	2.24	0.026	12.29

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تقدير العناصر الثقيلة الضارة في بعض اغذية الرضع و الاطفال وأغذية الافطار في جمهورية مصر العربية

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تم تقدير بعض العناصر الثقيلة وبعض عناصر الميكرو والماكرو (١٤ عنصر) في أغذية الرضع والأطفال وأغذية الإفطار والتي تم تجميعها من محافظة القاهرة بجمهورية مصر العربية خلال الفترة من عامي ٢٠٠٧،٢٠٠٨.

- ومن العناصر التي تم تقديرها الكادميوم- الرصاص-الألومنيوم- النحاس- الزئبق- القصدير- المنجنيز- الزنك- الفضة- الحديد- الزرنيخ- الكروم- النيكل والصوديوم.
- اوضحت النتائج المتحصل عليها أن معظم العناصر الثقيلة كانت في حدودها الأمنة والمسموح بها في أغذية الأطفال وكانت بنسبة الرصاص والزرنيخ في الحدود التي أوصت بها هيئة المواصفات القياسية المصرية وهي أقل من ١ جزء في المليون.
- كانت متوسط النحاس ٨,٢١ ملجرام/ كجم والزنك ٣٣,٨٦ ملجرام/ كجم والألومنيوم ١٥,٥ ملجرام/ كجم والحديد ١١٢,١٤ ملجرام/ كجم، والكادميوم ٠,٦٧ ملجرام/ كجم و صفر لكل من الزرنيخ والزئبق.
- بينما كانت المشكلة متمثلة في عنصر النحاس والذي كان أعلى من النسبة المسموح بها في مصر وهي ٥ جزء في المليون في ٥٢% من العينات المختبرة.
- أوضحت الدراسة أن متوسط نسبة عنصر الرصاص كان ٠,٠٣٢ ملجرام/كجم وهي أعلى قليلا من النسبة الموصى بها في الحدود الأوروبية القياسية وهي ٠,٠٢ ملجرام/ كجم إلا أنها كانت في الحدود المسموح بها بجمهورية مصر العربية.
- أوضحت الدراسة أنه يمكن إضافة خميرة الخباز النظيفة الجافة للتخلص من بعض العناصر الثقيلة حيث أدى إضافة إلى تقليل نسبة النحاس والألومنيوم في أغذية الأطفال.