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Heavy Metals as Contaminants in Local and Imported Dairies & Dairy Products

Mohamed A. Gaset

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Authors affiliation
Department of Environmental Studies, High Institute Jerpoly , Tripoli, Libya
Mohamed.rikt@gmail.com

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ABSTRACT

An evaluation of the contamination of some milk & milk products with heavy metals in Misrata city north of north of Libya has been conducted. The metals of Mercury, Cadmium, Lead, Cupper, Cromium, Nikel, Zinc, Manganese, Iron contents in dairy samples were determined by using Atomic Absorption Spectrometer (AAS) The results showed that heavy metals Hg, Cd, Pb, Cu, Cr, Ni, Zn, Mn & Fe in Fresh milk are 0.002, 1.62, 0.19,0.15,0.20, 0.25,0.59,0.25,0.79 µg/L respectively and in Pasteurized fresh milk are 0.005,1.67, 0.20,0.16,0.22, 0.56,0.38, 0.28 ,0.87 µg/L respectively and in Sterilized milk are 0.005,1.58, 0.15,0.20, 0.25,0.56,0.37, 0.26, 0.99µg/L respectively ,and in Yoghurt (plain/flavored) 0.007,1.97, 0.16, 0.19, 0.35, 0.54, 0.56,0.37,0.59 µg/kg respectively and in Soft cheese are 0.004,2.16, 0.58, 0.71, 0.46, 0.65, 0.85,0.27,0.77 µg/kg respectively, and in Ricotta cheese are 0.003,1.65, 0.14, 0.29, 0.55,0.45 ,0.75,0.46,0.67 µg/kg respectively, and in Butter are 0.002,0.77, 0.65, 0.19,0.77,0.45,0.96,0.45,0.69 µg/kg respectively ,and in fermented milk are 0.00, 0.00,0.17,0.28,0.63,0.67,0.77,0.37,0.67 µg/L respectively and in ice cream are 0.005, 0.42, 0.18,0.29,0.17 ,0.88,0.74, 0.49,0.69 µg/kg respectively and in formula milk are 0.00,0.00, 0.15,0.49, 0.38, 0.29, 0.37,0.48,0.41 µg/kg respectively, where the highest Hg was in yoghurt samples (0.007)while the highest level of Cd was in soft cheese (2.16 µg/kg)and the highest level of Pb was in butter (0.65 µg/kg) and the highest level of Cu was in formula milk(0.49 µg/kg)and the highest level of Cr was in butter(0.77 µg/kg) and the highest level of Ni was in ice cream (0.88 µg/kg) and the highest level of Zn was in butter (0.96 µg/kg)and the highest level of Mn was in ice cream (0.49 µg/kg)Finally the highest level of Fe was in sterilized milk (0.99 µg/kg µg/L)by results of this study we are recommending to check levels heavy metals in all imported dairy products especially butter ,ice cream and formula milk because babies might be subject to over doses of some toxic heavy metals, might affect their health.

المعادن الثقيلة كملوثات في الألبان ومنتجات الألبان المحلية والمستوردة

محمد احمد قزيط

تقييم التلوث بالعناصر الثقيلة في الالبان وبعض منتجاتها في مدينة مصراتة شمال ليبيا . عناصر الزئبق , الكادميوم , الرصاص , النحاس , الكروم , النيكل , الخارصين , المغنسيوم , الحديد قيس محتواها في عينات الالبان باستعمال مطياف الامتصاص الذري و اظهرت النتائج ان كمية العناصر الثقيلة,Hg, Cd, Pb, Cu ,Cr Ni ,Zn ,Mn, Fe بالحليب الطازج 0.002, 1.62, 0.19, 0.15, 0.20, 0.25, 0.59, 0.25, 0.79, على التوالي وبالحليب المبستر 0.005, 1.67, 0.20, 0.16, 0.22, 0.56, 0.38, 0.28, 0.87, على التوالي وبالحليب المعقم 0.005, 1.58, 0.15, 0.20, 0.25, 0.56, 0.37, 0.26, 0.99µg/L على التوالي والزبادي (سادة/منكه) 0.007,1.97, 0.16, 0.19, 0.35, 0.54, 0.56,0.37,0.59 µg/kg على التوالي والجبن الطري 0.004,2.16, 0.58, 0.71, 0.46, 0.65, 0.85,0.27,0.77 µg/kg على التوالي, والريكوتا 0.003,1.65, 0.14, 0.29, 0.55,0.45 ,0.75,0.46,0.67 µg/kg على التوالي, والزبدة 0.002,0.77, 0.65, 0.19,0.77,0.45,0.96,0.45,0.69 µg/kg على التوالي ,والمخمرات 0.00, 0.00,0.17,0.28,0.63,0.67,0.77,0.37,0.67 µg/L على التوالي والايس كريم 0.005, 0.42, 0.18,0.29,0.17 ,0.88,0.74, 0.49,0.69 µg/kg على التوالي والحليب المجفف 0.00,0.00, 0.15,0.49, 0.38, 0.29, 0.37,0.48,0.41 µg/kg على التوالي, حيث اعلى تركيز للزئبق في الزبادي (0.007) بينما اعلى تركيز للكادميوم في الجبن الطري (2.16 µg/kg) واعلى تركيز للرصاص في الزبدة (0.65 µg/kg) واعلى تركيز للنحاس في الحليب المجفف (0.49 µg/kg) واعلى تركيز للكروم في الزبدة (0.77 µg/kg) واعلى تركيز للنيكل في الايس كريم (0.88 µg/kg) واعلى تركيز للخارصين في الزبدة (0.96 µg/kg) واعلى تركيز للمغنسيوم في الايس كريم (0.49 µg/kg) واخيرا اعلى تركيز للحديد في الحليب المعقم (0.99 µg/kg µg/L) بناء على نتائج هذه الدراسة نوصي بالتحقق من مستويات المعادن الثقيلة في جميع منتجات الألبان المستوردة خاصة الزبدة والايس كريم والحليب المجفف لان الاطفال قد يتعرضون لجرعات زائدة من بعض المعادن الثقيلة السامة, قد تؤثر على صحتهم.

0.99, على التوالي وبالزبادي(طبيعي / منكه) 0.007, 1.97, 0.16, 0.19, 0.35, 0.54, 0.65
0.37, 0.59, ملجم /كجم على التوالي وبالجبنة الطرية 0.004, 2.16, 0.58, 0.71, 0.46, 0.65
0.85, 0.27, 0.77, ملجم /كجم على التوالي وفي جبنة الريكوتا 0.003, 1.65, 0.14, 0.29, 0.55
0.45, 0.75, 0.67, مكجم /كجم على التوالي وفي الزبدة 0.002 0.77, 0.19, 0.65, 0.77 ,
0.69, 0.45, 0.96, 0.45,مكجم /كجم على التوالي وفي الحليب المخمر 0.000 0.28, 1.17 ,
0.67, 0.67, 0.37, 0.77, 0.67, 0.63,مكجم /كجم على التوالي وفي الجيلاطي 0.005 0.42 ,
0.69 , 0.49, 0.74, 0.88, 0.17, 0.29, 0.18,مكجم /كجم على التوالي وفي الحليب المجفف
0.00,0.00, 0.15, 0.49, 0.38, 0.29, 0.37, 0.48 , 0.41 مكجم /كجم على التوالي , بينما كان الزئبق الاعلى في عينات الزبادي وكان الكادميوم الاعلى في غينات الجبنة الطرية وكان الرصاص هو الاغلى في عينات الزبدة وكان النحاس هو الاغلى في عينات الحليب المجفف وكان الكروم هو الاعلى في عينات الزبدة وكان النيكل هو الاغلى في عينات الجيلاطي وكان الخارصين هو الاعلى في عينات الزبدة وكان المنجنيز هو الاعلى في عينات الجيلاطي وكان الحديد هو الاعلى في عينات الحليب المعقم ومن خلال نتائج هذه الدراسة ننصح بفحص مستويات العناصر الثقيلة في جميع منتجات الالبان المستوردة خصوصا الزبدة والجيلاطي والحليب المجفف لحماية الرضع من التسمم بالعناصر

INTRODUCTION

Heavy metals are chemical elements have big molecular weight like Mercury, Cadmium, Lead, Cupper, Cromium, Nickel, Zinc, Manganese, and Iron. With more than fifth double in specific density (5 gm/cm^3) compared with water (1 gm/cm^3), have bad effect in eco-systems like plants, animals and air that consumed by humans and caused diseases (Kraz, 2001; Shrek, 2002) An evaluation of the contamination of some milk & milk products with heavy metals in Misrata city north of north of Libya has been conducted. (Shagan, 2009) The metals of Mercury Hg, Cadmium Cd, Lead Pb, Cupper Cu, Cromium Cr, Nickel Ni, Zinc Z, Manganese Mn, Iron Fe contents in dairy products. Most of heavy metals have danger effect on human's health if present at over recommended levels because of their toxicity and rancidity when reacted with UFA (FAO/WHO, J,1996). Heavy metals contaminate milk products by air like Pb, Hg from drain gases of cars and trucks then absorbed by plants and animals and transmute to human body caused metallic toxicity and cancer to human (Shagan, 2009, Kraz, 2002)

MATERIALS AND METHODS

Samples Collection

Dairy samples selected randomly from supermarkets in Misrata city north of Libya dated on February – October 2018 then put in standard containers ant carried to the laboratory (Table 1)

Al samples put in specific containers and took to chemistry laboratory to test trace of heavy metals (ppm) by Atomic Absorption Spectroscopy (AAS) TYPE AA660IF in wave length (213.86 – 253.70 nm) as recommended by (Zigtat,1998, Kraz,2001)

Table 1 Dairy samples

No	Package	Company	Sample
1	1 Lt	Food Processing Co.	Fresh milk
2	1 Lt	Food Processing Co.	Pasteurized .Fresh milk
3	1 Lt	MERQAP, Libya	Ster. Fresh milk
4	1 Lt	Naseem, Libya	cultured milk
5	170 ml	Naseem, Libya	Yoghurt
6	170 ml	Naseem, Libya	Yoghurt _ Banana
7	170 ml	Naseem, Libya ا	Yoghurt _strawberry
8	170 ml	Naseem, Libya	Yoghurt _Pineal
9	70 g	Naseem, Libya	Ice cream + cacao
10	1 kg	Food processing	Soft cheese
11	200 g	Netherlands	Butter
12		Denmark	Philadelphia Cheese
13		Germany	Ricotta Cheese

RESULTS AND DISCUSSION

The results showed that heavy metals Hg,Cd,Pb,Cu,Cr,Ni, Zn,Mn,Fe in Fresh milk are 0.002, 1.62, 0.19,0.15,0.20, 0.25,0.59,0.25,0.79 µg/L respectively and in Pasteurized fresh milk are 0.005,1.67, 0.20,0.16,0.22, 0.56,0.38, 0.28 ,0.87 µg/L respectively and in Sterilized milk are 0.005,1.58, 0.15,0.20, 0.25,0.56,0.37, 0.26, 0.99µg/L respectively ,and in Yoghurt (plain/flavored) 0.007,1.97, 0.16, 0.19, 0.35, 0.54, 0.56,0.37,0.59 µg/kg respectively and in Soft cheese are 0.004,2.16, 0.58, 0.71, 0.46, 0.65, 0.85,0.27,0.77 µg/kg respectively, and in Ricotta cheese are 0.003,1.65, 0.14, 0.29, 0.55,0.45 ,0.75,0.46,0.67 µg/kg respectively, and in Butter are 0.002,0.77, 0.65, 0.19,0.77,0.45,0.96,0.45,0.69µg/kg espectively ,and in fermented milk are 0.00, 0.00,0.17,0.28,0.63,0.67,0.77,0.37,0.67 µg/L respectively and in ice cream are 0.005, 0.42, 0.18,0.29,0.17 ,0.88,0.74, 0.49,0.69 µg/kg respectively and in formula milk are 0.00,0.00, 0.15,0.49, 0.38, 0.29, 0.37,0.48,0.41 µg/kg respectively, where the highest Hg was in yoghurt samples (0.007)while the highest level of Cd was in soft cheese (2.16 µg/kg)and the highest level of Pb was in butter (0.65 µg/kg) and the highest level of Cu was in formula milk(0.49 µg/kg)and the highest level of Cr was in butter(0.77 µg/kg) and the highest level of Ni was in ice cream (0.88 µg/kg) and the highest level of Zn was in butter (0.96 µg/kg)and the highest level of Mn was in ice cream (0.49 µg/kg)Finally the highest level of Fe was in sterilized milk (0.99 µg/kg µg/L From results we noted high contamination of dairy products with heavy metals were Pb , Hg and Fe that come from vessels , marine and steel welding workshops drains, while most of other heavy metals found in imported dairy products due to weak quality control of food products in sea / air ports and don't apply ISO standards.

Table 2 Heavy metals in studied samples

Milk / dairy product.	Heavy metals (ug/g dry wt)								
	Hg	**Cd**	**Pb**	**Cu**	**Cr**	**Ni**	**Zn**	**Mn**	**Fe**
Fresh milk	0.002 1.11	1.62 0.11	0.19	0.15 0.49	0.20 1.09	0.25 0.52	0.59 9.32	0.25 4.53	0.79 3.27
Pasteurized Fresh milk	0.005 0.21	1.67 0.09	0.20	0.16 8.68	0.22 0.26	0.56 0.16	0.38 9.68	0.28 7.24	0.87 35.18
Sterilized milk (Judi Domty)	0.005 0.92	1.58 0.32	0.15	0.20 1.43	0.25 0.15	0.56 0.32	0.37 14.45	0.26 2.10	0.99 3.84
Yoghurt (plate/sweet)	0.007 0.53	1.97 0.08	0.16	0.19 0.58	0.35 0.64	0.54 0.72	0.56 5.39	0.37 1.48	0.59 2.94
Soft cheese	0.004 0.44	2.16 0.12	0.58	0.71 2.44	0.46 0.42	0.65 0.26	0.85 18.29	0.27 1.88	0.77 2.34
Ricotta cheese	0.003 1.37	1.65 0.17	0.41	0.29 1.52	0.55 6.28	0.45 0.31	0.75 32.13	0.46 5.29	0.67 6.23
Butter	0.002 0.31	0.77 0.017	0.65	0.19 0.11	0.77 1.16	0.45 0.05	0.96 1.16	0.45 1.60	0.69 2.74
Fermented milk	ND	ND	0.17	0.28 0.29	0.63 3.07	0.67 0.11	0.77 4.39	0.37 1.15	0.67 3.74
Ice cream	0.004 0.20	0.42 0.04	0.18	0.29 0.30	0.71 0.52	0.88 0.11	0.74 4.89	0.49 4.02	0.69 1.51
Formula milk	ND	ND	0.15	0.49 2.10	0.38 0.65	0.29 0.11	0.37 2.73	0.48 1.76	0.41 4.59

RECOMMENDATIONS

1- Quality control of all local dairy plants.
2- ISO standards of all imported dairy products.
3- Check heavy metals in all consumed dairy products
4- Improve scientific searches in food hygiene
5- Renew Libyan dairy standards

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