

Some Heavy metals elements in milk powder samples collected from Baghdad markets

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Abstract:

powder milk is an important foodstuff and beneficial to human health.

Thirty random milk powder samples of different trade marks (Rawan® limit full milk powder), (Dielac® milk powder) and (Fresh instant milk powder) were collected from different outlets in Baghdad capital of a IRAQ, They were analyzed by Atomic Absorption Spectrophotometer for the concentrations of following heavy metals, lead (Pb), iron (Fe), aluminium (Al), Cadmium (Cd), and manganese (Mn)]. This study appeared that the concentrations of heavy metal Fe samples is above the allowed limit in (Rawan® limit milk powder). However, the concentrations of about thirty percent of the samples of Fe in (Dielac full cream milk powder) is above the allowed limits. The concentration of Pb in (Fresh instant full cream milk powder) is above the permissible limit. All the examined samples found free of Cd. Air, water and plants considered as a main contamination of the milk powder by heavy metals. So, it is necessary for warning from the toxic effects for these heavy metals for children and adults.

Key words: Milk powder, Heavy metals and Iron.

العناصر الثقيلة الموجودة في بعض نماذج الحليب المجفف التي جمعت من بعض اسواق بغداد

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الخلاصة:

يعتبر الحليب المجفف من الاغذية المفيدة لصحة الانسان والشائعة الاستعمال لاستخدامها لتصنيع مختلف انواع منتجات الالبان

ثلاثون نموذج من الحليب المجفف لعلامات تجارية (الديلاك و الروان و فريش) جمعت عشوائيا من منافذ بيع مختلفة من العاصمة بغداد و تم تحليلها بواسطة جهاز الامتصاص الذري الطيفي وذلك لتعيين تراكيز العناصر الثقيلة التالية : الرصاص ، الحديد ، الالمنيوم ، الكاديوم والمنغنيز .

تبين من خلال هذه الدراسة ان تركيز الحديد في نماذج (الديلاك) و(الروان) اعلى من الحد المسموح به بينما تركيز الرصاص في نموذج(فريش) ايضا اعلى من الحد المسموح ايضا، اما العناصر الاخرى فتقع ضمن الحدود المسموحة . لذا يعتبر استهلاك الحليب المجفف عامل اخر من عوامل التلوث الغذائي بالعناصر الثقيلة بالاضافة الى المصادر المباشرة لتلوث الاغذية كالهواء والماء والنباتات . لهذا من الضروري التحذير من التاثيرات السامة لهذه العناصر الثقيلة على الاطفال والبالغين .

Introduction:

Mercury (Hg), arsenic (As), silver (Ag) chromium (Cr), copper (Cu) zinc (Zn) iron (Fe) lead (Pb) cadmium (Cd), and the platinum group elements are heavy metals. Cow's powder milk is an important foodstuff and beneficial to human health. The milk powder is one of the most dairy products

popular due to the long life and it produced different products of the milk like, infant milk formula, evaporated, condensed milk, ice cream and cheese^[1].

Usually, to meet nutritional requirements many essential elements are usually added to milk powder during manufacture^[2]. The

excess useful metals which added to the milk must be controlled because it plays an important role in nutrient of the human. [3].

The food is the main source of the metals for human body. However, some of heavy metals have been retained when consumed and other pass directly through feces and some of them are absorbed and then excretion by kidney, bile excretion and sweat glands Pb, Fe, AL, Cd and Fe are the most important of these elements [4].

The heavy metals which found in water, air and soil due to the industrial processes so, these metals are taken by animals and plants and find their ways into food cycle [5].

The food and the water which consumed by lactating cow is the main pollution by heavy metals for the milk powder [6] due to the exposure of Raw milk to contamination during its manufactures production [7]. Fe and Mn are part of a small number of the metals found in the human body are believed to be essential metals [8]. These above metals are essential for health as nutrients and metabolism excessive exposure to these heavy metals may be hazardous [9]. It is not easy because of the very small range between the normal concentration of metals and toxic effect [10].

New research is recommended that the determination of heavy metals in milk powder should be added to the parameters of main quality for milk powder that are microbiological and chemical characteristics. [11]. In some developing countries heavy metals determination in milk powder is scare [12].

heavy metals usually found as a aggregated forms in the food which represent high toxic risk for their long-term toxicological exposed effects, this toxicity of excessive levels of these metals, such as, mercury (Hg), cadmium (Cd), lead (Pb) and, chromium (Cr) are known studied [13].

Manufacturing process and contamination during the manufacturing processes of

dairy products are responsible for containing of heavy metals in dairy milk [14].

Materials and Methods

Collection of samples:

Thirty randomized milk samples were collected from different areas in Baghdad Collected samples were labeled and taken to the laboratory for determination their concentrations.

Preparation of samples:

(0.3) gram of samples were transferred in digested tubes (screw capped) for washing by hydrochloric acid. From each sample two tubes were prepared, and all tubes were identified for examination.

Analysis of the prepared samples:

For determination of Pb, Cd, and Fe, the first tube of each prepared sample was digested according to Tsoumbaris & Papadop 1994 [15]. While, for determination Al and Mn, the procedure was carried out on the second tube according to Dabeka & McKenzie 1992 [16]. All filtered samples were analyzed for their metal contents according to methods of Medina et al. 2008[17] by using “perkia-Elmer Atomic Absorption Spectrophotometer model d 2380, USA, 1998”. Instrumental analysis of Pb, Cd, and Fe were conducted by air acetylene” Flame Atomic Absorption Spectrophotometer (FAAS”). While for determination of Al and Mn,” Graphite Furnace Atomic Absorption Spectrophotometer (GFAAS)”. was used.

Statistical analysis

Statistical analysis of data was obtained by using the statistical package for social science (SPSS) version and Microsoft Excel (2007) software. descriptive statistics for all data of each test were expressed as mean \pm SD, Stedent ' s t- test was used to evaluate the significance of

differences between concentration levels of each metals in three types of milk powder .

Results and Discussion

Table (1) was summarized results obtained from this research study and correlated of our findings with these results of surveys.

The statistical analysis of obtained data found that The concentration of heavy metal Fe in (Rawan[®] milk powder) samples in this study were above the permissible limit, while thirty percent of Fe in (Dielac[®] milk powder) samples were also above the permissible limit, The concentration of Pb in (Fresh instant full cream milk powder) samples is above the permissible limit according to WHO/FAO, Joint Expert Committee on Food Additives WHO Technical Report Series, 1972, 1974c, 1982, 1987 and 1989. and FAO/ WHO, Joint Expert Committee on Food Additives, 1999^[18].

The examined milk powder samples according to present study were contaminated with heavy metals with

different amounts of these metals. Higher concentration of heavy metals in milk powder may have been arisen from contamination during handling, exposure and processing involve boiling in steel or Aluminium-ware ^[19].

Increased concentration of Pb in milk attributed to contamination due to excessive exposure of lactating cows to environmental Pb from exhausted gases of cars, and consumption of contaminated feeding stuffs and water, ^[20]. or during the manufacturing process of milk powder ^[21] Moreover, raw milk may be contaminated from metallic Pb from Pb soldered cans ^[22]. Milk powder usually contain very low concentration of Cd or free of it (as in present study) except when diary animals consumed contaminated feeds and water ^[23]. may be attributed to migration of these elements from packaging materials into the milk powder ^[24].

Table-1: shows the concentrations in examined milk powder samples

| Metals samples | Pb (μ /g) Mean \pm SD | Fe (μ /g) Mean \pm SD | Al (μ /g) Mean \pm SD | Cd (μ /g) Mean \pm SD | Mn (μ /g) Mean \pm SD |
|--|------------------------------------|------------------------------------|------------------------------------|------------------------------------|---------------------------------|
| Dielc (Full cream milk powder) Newsland | 0.2 \pm 0.08498 | 2.93 \pm 1.09245 | 0.27 \pm 0.17192 | 0.0 \pm 0.0 | 0.035 \pm 0.05798 |
| Rawan (Full cream milk powder) United arab Emirate | 0.15 \pm 0.1 | 5.83333 \pm 2.16506 | 0.3222 \pm 0.16976 | 0.0 \pm 0.0 | 0.0778 \pm 0.05069 |
| Fresh (Instant full cream milk powder) Sultanate Oman | 0.5620 \pm 0.1320 | 2.16 \pm 0.94892 | 0.2560 \pm 0.09264 | 0.0 \pm 0.0 | 0.04 \pm 0.5676 |
| Allowed limit mg/kg ^[22] | 0.3 | 2.7 | 0.5 | 0.05 | 0.1 |

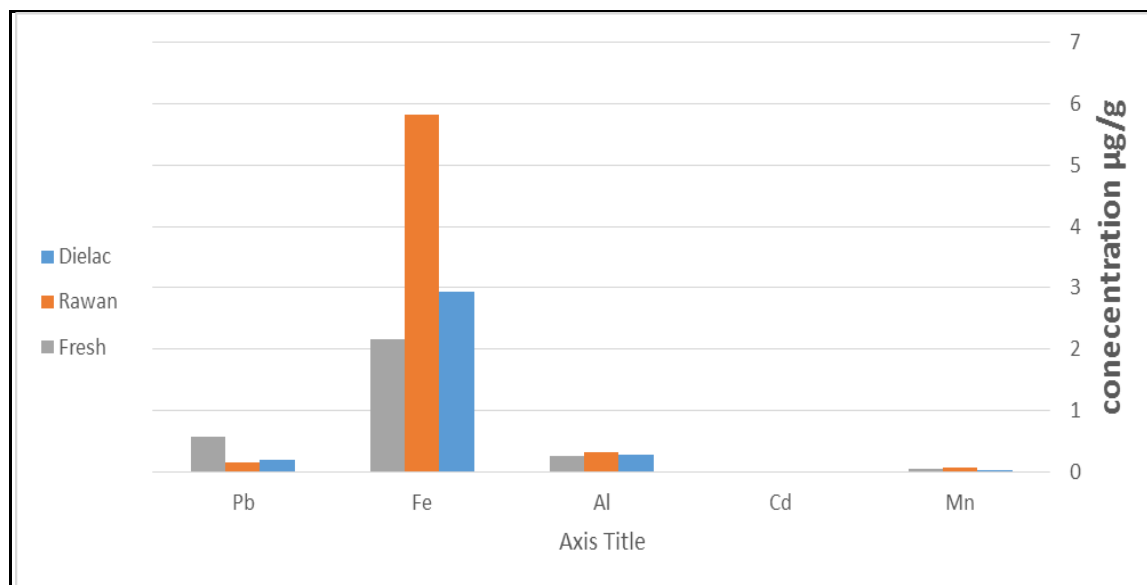


Figure-1: shows the concentrations of selected heavy metals in some milk powder samples

The exposure to lead has irreversibly affects development in newborn infants' nervous system, causing decreased learning disabilities. Chronic exposure to Pb & Cd is associated with kidney failure in adults (25). excessive Cd and Pb in their diet particularly those born premature are more susceptible, have decreased renal function, their developed and damaged kidneys. Al is toxic material for the nervous system and long-term of Al-containing diet to infants impaired mental development at 18 months [26]. The excessive Al in the blood is selectively incorporated into the bones of infants, result in an osteomalacia bone structure [27]. The only way to excreted Al from blood by kidneys, and severe renal diseases can result in accumulation of Al in the blood. the increasing of concentration level Cd and Pb potentially exacerbated damage of kidneys [28].

Gastrointestinal (GI) disorders stomatitis, diarrhoea, hemoglobinuria causing a rust-red colour to stool tremor, ataxia, paralysis, depression vomiting and convulsion,, and pneumonia are general signs have been reported associated with cadmium, lead, arsenic, mercury, zinc, copper and aluminium poisoning when

volatile vapours and fumes are inhaled. The nature of effects could be toxic (carcinogenic, mutagenic neurotoxic, or teratogenic. [29].

Pb has very high toxic effects of the heavy metals, and the inorganic lead are absorbed through gastrointestinal tract by food and water, and respiratory tract by inhalation [30]. The most seriously effect of lead toxicity is teratogenic effect. Lead poisoning also causes inhibition of the synthesis of haemoglobin; dysfunctions in the kidneys, joints and reproductive systems, acute and chronic damage to the central nervous system (CNS) and peripheral nervous system (PNS), cardiovascular system and [31]. Other effects include damage to the gastrointestinal tract (GIT) and urinary tract resulting in bloody urine, neurological disorder and causes serious and permanent brain damage. While inorganic forms of lead, typically affect the CNS, PNS, GIT and other biosystems, [32]. poor development of the grey matter of the brain in children, thereby resulting in poor intelligence quotient (IQ) [33]. Its absorption in the body is increased by Zn & Ca [34].

determination Fe & Mn in the food are very important because the deficiency or excess of these heavy metals could increase several clinical disorders public health problems, as cancer of respiratory system, anemia, impaired reproductive performance, heart failure gastrointestinal disturbances, skin disorder, depression of growth, fatigue, decreased immunity and even death [35].

Concentrations of the Iron in the body tissues must be precisely regulated because excessive iron leads to tissue damage because of free radical's formation, metabolism disorder of iron are among the most common diseases and encompass a wide range of diseases with clinical manifestations, from anemia to iron increased possibly to neurodegenerative diseases [36].

Increased Iron in blood deposits in the skin cause darkening area of the skin, also deposition of iron in the testicles and pituitary gland cause shrinkage of the testicles and impotence, in pancreas cause a decrease in insulin production resulting in diabetes, in the heart muscle causes cardiomyopathy and lead to heart failure as well as abnormal heart rhythms. Iron accumulation in the liver causes liver cirrhosis and an increased risk of developing liver cancer. also increased iron in the blood deposits in the joints leading to damage it [37 -38].

Conclusion:

In this study revealed that the concentration of Iron is above the allowed limit in (Rawan® milk powder) samples, while the concentration of about thirty percent of Iron in (Dielac® milk powder) samples are above the allowed limit. The recommended limits of heavy metals for milk powder are lead the concentration of Pb in (Fresh instant milk powder) samples are above the allowed limit. The concentrations of other heavy metals that examined in this research were within or below the allowed limit, So the consumption of milk powder can be

considered as additional source of contamination by some heavy metals beside the direct sources of water , air and plants, It is necessary to warn about the toxic effects of these toxic elements on both child and adult.

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