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Review Article

An Overview of the Heavy Metal Contamination in Milk and Dairy Products

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Abstract

Nowadays, many food products are manufactured industrially in large quantities. Milk and its products are one of the most important and prominent products that can be mentioned. Heavy metals are considered as the most important contaminations due to the industrialization of countries and have the influence on its existence in milk and dairy products. In current review article, the toxicity of different heavy metals on human health, their sources in milk and other dairy products by emphasizing on methods and regulatory limits for heavy metals in milk are represented. The study also focuses on the prevalence of heavy metals in milk samples reported at the Iranian and some of other countries in Asia, South America, USA and Africa and even a few cases in Europe. In addition to introducing contamination in products, it deals with various aspects of heavy metals pollution factors such as season, locality, animal feed, analytical instrumentations. Discussing on contaminating factors detailed to describe ways to reduce heavy metals in milk and its products or prevent them from entering those contaminations.

Keywords: Pollution; Heavy Metals; Milk; Dairy Products; Food Safety

Introduction

The toxicity of heavy metals to humans and animals is the result of exposure to long term and lower contamination in our environment, including in the air we breathe, water, food, and so on [1]. Heavy metals are referred to any metal element that has a relatively high density and low toxicity. It contains lead (Pb), mercury (Hg), copper (Cu), cadmium (Cd), zinc (Zn), arsenic (As), chromium (Cr), iron (Fe) and their actual volume is more than 6 grams per cubic meter [2]. Due to the increase in industrial activity, the pollution from heavy metals has grown widely throughout the world since the late 19th and early 20th centuries [3]. Heavy metals cause serious health problems therefore accurately determining their residues is concerned seriously. Heavy metals in the body may cause side effects such as nervous system disorders, renal failure, genetic mutations [4], types of cancers, neurological disorders, respiratory disorders, and cardiovascular, immune system weakening and infertility [4]. Lead causes central nervous system disorders, anemia, damage to the kidneys, liver, heart and blood vessels, the immune system, the genital system, the digestive tract, and the development of cancer and various cancers [2,3,5]. Lead can also cause encephalitis and hepatitis [5]. Cadmium accumulates in tissues like the liver and kidneys, causing anemia, an increase in blood pressure [6]. Cadmium is carcinogenic especially in the lungs and prostate and cause the tumor develops. Cadmium causes kidneys, bones, lungs, liver, heart, and vessel disease [5]. Nickel causes a variety of cancers of the blood, brain and bone, local infections [5]. Disruption of the biological activity of cells, delayed growth, decreased hematuria and interfering in iron absorption were by reason of Nickel poisoning [7]. Nickel salts, after entering the bloodstream, cause respiratory troubles and affect the heart. Contact with Nickel causes skin inflammation (Peng., *et al.* 2007). The amount of toxicity associated with factors such as pathway, amount of use, solubility, metal oxidation status, maintenance percentage, duration of application, age, sex and the frequency of use, absorption rate and efficacy of excrement mechanisms [8]. Heavy metals by different types and methods enter the food chain. Sewage, waste generated from manufacturing activities, dust, and heavy metals in food, are common ways. Polluted soil also has a great impact. Therefore, considering the numerous complications and the possible presence of these metals in milk and its products is necessary to pay major attention to the presence of heavy metals in milk and its products as a high-consumption group in the food industry, which is the main objective of the article. Therefore, is used a lot of times in sentences which are sequential. Consider using different words. This sentence does not make sense. Rewrite. Factors are used a lot of times.

Review of heavy metals in milk and its dairy products

Contamination of heavy metals in milk

Milk and its products are very diverse and there are numerous elements that can be detected, many of them are essential and very primary. These metals are involved in decisive activities, such as cofactors in enzymes. The amount of metals in non-contaminated milk is remarkably accurate, but their content may vary considerably through the production and packaging process. Also, metals that can contaminate cows and other environments, such as lead, cadmium, chrome, Nickel, and cobalt, can disrupt milk at different levels and cause serious problems [9]. Heavy metals are introduced into the plants by absorbing them through the roots [9-11]. Contaminated soils can pollute groundwater and aquifers with these agents. Therefore, the plant is contaminated and after plant ingestion, the plants entry in human body and animals. In a recent study, it has been shown that contamination is transmitted from the soil to the plant and therefore contaminated with water and plants. Consequently, their concentration in the body of their pets and their peripheral products, such as raw milk, increases and causes toxicity. The toxic impacts of these factors depend on different factors, such as plant processes and the amount of raw materials used and some other factors which be mentioned later in current study [12,13]. The presence of heavy metals in dairy products may be due to contamination of the primary milk of the cow, which may be due to exposure to the environment or the consumption of food and water due to exposure to cow's livestock. In addition, raw milk may be contaminated during its production [14]. Cadmium, lead and mercury are very dangerous to humans and are considered as a major threat to food in terms of industrial use. Animals use metals when grazing in the pasture and feeding with contaminated concentrations. However, in the case of cows, the transfer of minerals to milk is very variable. Pollutants are transferred to the air as a result of various industrial activities. Pollution of various industrial environments in the soil, water, food and heavy metals causes them to join the food chain and create a great threat to human and animal health [15]. Toxins such as lead, and cadmium are typically airborne pollutants and are transported to the air due to various industrial activities. The pollution of various industrial environments in the soil, water, food, and plants with these metals make them in the food chain. Lead and cadmium residues in milk and dairy products are of particular concerns because they are largely consumed by newborns and children. Food is the main source of lead and cadmium in the general population (90% of all cadmium in non-smokers), although inhalation can play an important role in very infected areas. Lead and cadmium are associated with carcinogenic elements and are associated with a number of diseases in the cardiovascular system, kidneys, nervous system, blood and skeletal system [15]. The level of toxic metal is an important component of the safety and quality of milk and dairy products. Metals are widely distributed in the environment and have two main roots: human activities and geological fields. They are in soil through fertilizer or after atmospheric atmospheres and from natural weathering erosion. Different ways to dispose of animals include urine, feces, and milk contamination. Also, staining metals in milk may come from other foods to our foods: (i) water used in processing and cooking; (ii) equipment, containers and containers used for food processing; and (iii) packaging, Store, and cooking can contribute to the transmission of contamination [16]. By virtue of the environmental pollution in the world, many studies have been done to examine the ways of transporting heavy metals to milk which are shown in table 1. Lead can enter the body through animal feed, water, and inhalation. Studies on milk produced in clean areas and adjoining areas of motor vehicles show that lead in the milk is acceptable from both regions and is relatively low. Livestock feeding with leaded fodder shows that much of the lead is not fed to milk by dairy cows. In fact, the cow's body acts as an effective biological filter and pushes the lead brought by the food into the bone tissue rather than into the milk. In the case of cadmium, one of the most important ways to enter significant amounts of this metal is through inhalation of contaminated air. In the case of milk, it is an important source of feed or livestock feed that has been used as a fertilizer for the treatment of residue. The concentration of Cd in animal milk is reported to increase with an increase in animal age [17]. However, some studies have shown that cadmium concentrations in cows' milk that are fed into industrial areas along highways or animals fed with heavy metals contaminated with food are much higher than those that grow in clean areas [17]. Mercury due to the proper function of the cow's body as an effective biological filter, the amount of mercury in cow's milk is rarely found at levels above the limit. For these reasons, it can be concluded that the milk and its products are healthy in this look, and these products have little to do with the introduction of mercury into the human body [17]. Concerning the effect of timing on the concentration of heavy metals, a total of 120 samples of dairy products (milk, milk powder, and sterilized milk) were collected from Egypt and divided into three groups. All units were stored at room temperature (17.5 - 31.5°C) for 210 days. All groups were evaluated using atomic absorption spectrophotometer (first group on day 0, the second group in 60 days and group III in 210 days) to determine the level of toxic heavy metals as Pb, Cd, Al, and Sn for determining the storage efficiency in the distribution of these metals in dairy products has been investigated. The evaluation of toxic heavy metals in some dairy products and the effect of storage on its distribution showed that storage time affects the amount of each metal [16]. Different methods are used to determine the elemental factors of heavy components, which include flame atomic absorption spectroscopy, monolayer voltammetry pulse, potentiometric, capillary electrophoresis, plasma emission spectroscopy, inductively linked plasma spectrometry, injection flow spectrometer; Atomic Fluorescence Spectroscopy is an induction plasma mass spectrometer. The analysis of heavy metals in milk due to the high concentration of organic matter in the matrix of the acid digestion method is preferred, which is also known as wet, while less dry digestion has also been accepted. Heavy metals in milk are characterized by a number of techniques Includes particle emissions from x-ray, semi-infrared spectroscopy, potentiometric method, titration capillary electrophoresis. The usual method for measuring heavy metals in milk by developing countries is a flame atomic absorption spectrophotometer. The benefits of spectrophotometer absorption are low cost, approximately quick detection and easy preparation operations. Of course, inductively coupled plasma is also utilized and also studding by mass spectrometer, which detects more sensitivity of the elements than the usual one, but because of its high costs, it is most used in developed countries [18].

Researchers	**Studied Sample(s)**	**Country**	**Elements**	**Test Method**	**Result**
Castro-González., *et al*. 2017 [19]	cow's milk and cheese produced	Mexico	Ni, Cr, Cu, Zn, Pb and As	inductively coupled plasma optical emission spectroscopy (ICP - OES)	The mean Pb level of 0.03 mg kg-1, which is above the Codex Commission standards. As a mean of 0.12 mg kg-1 in milk Mean As and Pb levels in milk were below the Mexican standard. Milk whey and ranchero cheese had mean Pb levels of 0.07 and 0.11 mg kg-. As was higher in Oaxaca and ranchero cheese at 0.17 and 0.16 mg kg-1. Therefore, cow's milk cheese is damaged from irrigated areas with sewage with Pb and As and may present a health hazard.
Oliveira., *et al*. 2017 [20]	raw milk	Brazil	Pb	graphite furnace atomic absorption GF-AAS	Pb concentrations ranged from 2.12 to 37.36 μg l-1. Proposed methodology without pretreatment of the raw milk and external standard calibration is suitable
Mohibe., et al. 2016	Cow Milk	Bangladesh	Pb, Cd	FAAS	heavy metal content in dairy and domestic cow milk was Cr > Fe > Cu>Mn > Cd > Pb, Cr > Fe > Mn > Cu > Cd > Pb and Fe > Cr > Mn > Cu > Cd > Pb.
Miedico., et al. 2016 [21]	milk of sheep and goat	Italy	(Pb, Cd, Hg, As, U, Cr, Sr, Be, Ni, Al, Sn, T and Fe, Cu, Mn, Zn, V, Se, Co and Mo	Inductively coupled plasma mass spectrometry (ICP-MS)	There is no evidence of health problems regarding the consumption of sheep and goat milk.
Shahbazi., *et al*. 2016 [22]	Milk, yogurt, cheese	Iran	Pb, Cd, Cu, Se, Zn	VoltaI metric	The ranges of mean Pb, Cd, Cu, Zn and Se were: raw milk 14.0, 1.11, 427, 571, 2.19 μg kg-1, in pasteurized milk 9.59, 1.0, 378, 447, 1.78 μg kg-1, in cheese 14.5, 1.25, 428, 586, 1.68 μg kg-1, in yoghurt 7.54, 0.99, 399, 431, 1.23 μg kg-1 and in doogh 7.2, 0.84, 320, 369, 0.99 μg kg-1, respectively. The concentrations of the metals below the levels were internationally authorized and 32 were not concerned about the health of milk and dairy consumption in Iran.
Pérez-Carrera., *et al*. 2016 [23]	raw milk from cows, Ground water.	Argentina	As, Cd, Cr, Ni, Pb, and Se	ICP-OES	As: a correlation between in water and in milk was observed. Cd, Cr, Ni, Pb, and Se: High Concentration in milk samples from farms that use deep wells,

Ismail., *et al.* 2015 [24]	Milk	Pakistan	Cd, Co, Pb, Cu, Ni	AAS	Mean concentrations were 0.001, 0.061, 0.014, 0.738 and 0.028 mg/kg. The results showed that Cu and Pb in the milk of investigated areas may harm consumers and exceed the standard codex.
Najarne-zhad., *et al.* 2015 [25]	Raw buffa-lo, cow and ewe milk samples	Iran	Cd, pb	FAAS	Mean concentration of Pb and Cd in buffalo milk samples was 0.018 ± 0.001 and 0.003 ± 0.001 mg/kg, mean concentration of lead and cadmium in cow milk samples was 0.007 ± 0.001, and 0.001 ± 0.001 mg/kg, and in ewe these mean values were 0.010 ± 0.001 and 0.002 ± 0.001 mg/kg, In buffalo milk were significantly higher than in cow and ewe milk. Also, heavy metals in ewe milk was significantly higher than in cow milk.
Nejatolahi., *et al.* 2014 [26]	Raw Cows' Milk	Iran	Pb	AAS	The mean of lead was 96.25 ng / ml in the range of 1.3 to 23.2 ng / ml and the standard deviation was 4.31. The concentration of lead in 5% of milk samples was higher than the standard
Meshref., *et al.* 2014 [15]	Milk, dairy products	Egypt	Pb, Cd, Zn, Cu, Fe	AAS	Pb, Cd, Zn, Cu and Fe concentrations in milk and dairy products ranged from 0.044-0.751, 0.008-0.179, 0.888-18.316,0.002-1.692 and 1.3208-45.6198 ppm respectively. Pb Concentration in all samples is more than the maximum allowed by codex standard
Rezaei., *et al.* 2014 [27]	Dairy products (pasteur-ized milk, yogurt, yo-gurt drinks, cheese)	Iran	Cd, Pb, As, Hg, Se, Al	ICP-SFMS	Cd, Hg and Pb in products of dairy were 168.25± 92.2 (30.6 - 356.5), 5.9 ± 4 (1.1 - 16), 3.2 ± 1.95 (0.4 - 8.1), 4.55 ± 2.6 (0.6 - 10.6), 23.15 ± 10.4 (6.8 - 50.2) and 15.4 ± 8.53 (3.1 - 40.2) µg/kg, Lead(Pb) in the samples was higher than the European Union and Iran's national standard (20 µg/kg). Statistical analysis showed that, except for As in pasteurized milk and cheese, there was no significant difference between products due to heavy metal content.
Suturović., *et al.* 2014 [28]	Milk, Fer-mented milk prod-ucts	Serbia	Cd, Pb, Cu	Potentiometric	The Cd, Pb and Cu in milk were in the range of 2.13-4.82, 54.3-95.2 and 112.2-124.7 lg/kg, whereas in the fermented milk products in the range of 6.30-24.1, 210.1-463.6 and 260.0-320.7 lg/kg. All samples of analyzed milk were correct, but two samples of fermented milk products had cadmium and lead content higher than the limit. Potentiometric with constant inverse current in the analysis stage makes direct determination of cadmium possible
Najarne-zhad and Akbarabadi, 2013 [25]	Raw cow and ewe milk	Iran	Pb, Cd, Hg	AAS	The Mean concentration of pb, cd and Hg in milk of cow in samples was 12.9 ± 6.0, 0.3 ± 0.3 and 3.1 ± 0.3 ng g-, and mean values milk of ewe were 14.9 ± 7.8, 1.6 ± 1.2 and 3.1 ± 0.3 ng g-1, Statistical analysis showed that lead and cadmium concentrations in ewe milk were significantly higher than cow's milk

Rey-Crespo., *et al*, 2013 [29]	Organic milk	Spain	Co, Cr, Cu, Fe, I, Mn, Mo, Ni, Se Zn) and (As, Cd, Hg and Pb)	ICP-MS	Toxic metal in milk were in general very low and no statistically significant differences were observed between organic and conventional milk.
Tona., *et al.* 2013 [30]	Cow milk, goat milk, butterfat, soft cheese, yogurt	Nigeria	Pb, Cd	AAS	The range of 0.0025 to 0.0061 (ppm) of Pb concentration in samples was 0.0125 to 0.0175 ppm Pb in dairy products at the maximum level (MRL). Milk and milk products contained heavy metals residues of Pb and Cd. Residues of Cd were above the maximum residue limits in the soft cheese and goat milk samples
Abdulkhaliq., *et al.* 2012 [31]	cow's milk (liquid and dry), dairy products (yoghurt, white cheese labaneh), hen's eggs	Palestine	Cd, Pb, Fe, Cu	GF-AAS	Mean of metals (μg/g) in milk analyzed ranged 0.022-0.057 for Cd, ND-0.93 for Pb, 0.62-0.85 for Cu and 3.2-12.91 for Fe. The concentration of cadmium and lead, especially in powdered milk samples, is significant. The lowest concentration of metals is found in white cheese and liquid milk
Derakhshesh and Rahimi, 2012 [32]	Cow and goat milk	Iran	Pb	GF-AAS	The mean and standard deviation concentration of lead in raw cow milk were 13.45 6.41. permitted level in codex (0.02 μg/l). The data were in normal range, but the lead concentration in 11% of cow's milk samples was higher than the maximum
Dizaji., *et al.* 2012 [33]	Milk	Iran	Pb, Cd	AAS	There is a significant difference between the concentration of lead and cadmium in raw milk samples from different regions. In all samples, the measured cadmium content was lower than the FAO / WHO standard. However, only 28% of the samples measured lead content was below the FAO / WHO standard.
Licata., *et al.* 2012 [34]	goat; ovine	Italy	Fe, Zn, Pb, Cr, Ni, Cu, As, Se, Cd)	ICP-AES	Lead levels were below the maximum limits as set by the EC in almost all samples tested. The highest values were those of Zn followed by Fe, Cu and Se.
Póti *et al.*,2012 [35]	milk of ewes	Hungary	Cd, Pb, Cr	ICP-OES	The concentrations of lead, cadmium and chromium were 0.023 mg, 0.012 mg and 0.290 mg/ wet weight kg in milk samples, Samples were higher than the of the EU regulation so necessary control the heavy metal contents in primary food
Ismove *et al.* 2011 [36]	Goat milk	Russia	Co	FES	The toxic elements in milk do not exceed the maximum permitted concentration and exceed the permitted limits for Cd, Cr, Fe and Al and low levels of Co in the feed.
Ataro., *et al.* 2008 [37]	Cow milk	South of Africa	Cd, Pb, Sr, Mn, Cr	ICP-MS	V, Cr, Mn and Sr were detectable in all the samples and their concentrations ranged from 23.4 to 42.0, 186 to 371, 109 to 299 and 1880 to 3150 ng/g, Cd was not detected in any of the samples. Pb concentrations in milk samples collected from these farms ranged from 8.00 -19.7 ng/ Surfaces, Cr, Mn, Sr, Cd and Pb showed by using the new method that is in accordance with the certified documentation.
Birghila., *et al.* 2008 [38]	milk products	Romania	Al, Mn, Pb, Ni, Cd, Cr, Sb, Cu, Si, Fe, Sn, Mg, Zn, Mo	ICP-AES	Detection limit was range from 0.4 to7.03 ng/g.

Tajkarimi., *et al.* 2008 [39]	Milk	Iran	Pb	AAS	The mean of lead was 7.9 ng/ml, with a range from 1 to 46 ng/ml and a standard deviation of 8.8. Three sets of samples from Isfahan, Tehran, and West Azarbaijan seemed to have higher levels of pollution and the need for further studies.
Caggiano., *et al.* 2005 [40]	Fodder, milk, dairy products	Italy	Cd, Pb, Cr, Hg, Mn	GF-AAS	The high concentration of heavy metals in milk and dairy products is less significant than forage specimens. Significant differences in contamination levels in samples collected during the year Different courses (winter or summer).
Pavlovic., *et al.* 2004 [41]	Raw Cows' Milk	Croatia	Pb, Cd	Electro-thermal atomic absorption	Pb (0.27 ± 0.06 mg/kg DM) and Cd (0.037 ± 0.007 mg/g DM) contents were not correlated (R = 0.11). There was a significant effect on the levels of Pb and Cd in cow's milk with farms
Tokuşoglu., *et al.* 2004 [42]	Milk, dairy products	Turkey	Pb, Cd, Cu	Simultaneous differential pulse polarographic	The linear domain ranges were 0.00-674.28 íg/L for Cd (R^2 =0.9999), 0.19-2.94 mg/L ($p < 0.01$) for Pb (R^2= 0.9997), and 0.41-133.46 íg/L for Cu ($p < 0.01$) (R^2 = 0.9999). Studies have shown that this method is a quick, repeatable and accurate method, and that elements in milk and dairy products can be used to analyze complex formulations in milk and dairy industry.
Ikric., *et al.* 2003 [43]	Cows' Milk	Croatia	Pb, Cd	FAAAS	The amount of heavy metals was less than tolerable (lead less than 100 micrograms and cadmium less than 10 micrograms)

Table 1: Overview of the contamination of heavy metals in milk and its products.

Heavy metals pollution in camel milk

Camel milk is considered as an important source of lactation in desert areas and contains many nutrients that are useful for human health and can provide a significant share of the daily needs of humans for various nutrients, especially amino acids [44]. In addition to the nutritional value of camel milk, it appears that this kind of milk has potential medicinal properties. For a long time, camel milk has been used for medical purposes, such as metabolic and autoimmune diseases, and scientific data can contribute to the treatment of diabetic disease [45]. The physical and chemical properties of camel milk are largely dependent on the quantity and quality of forage and the amount of water consumed daily [46]. However, this foodstuff, like other dairy products, can be exposed to chemical risks and pollutants that are the most important chemical contaminants of heavy metals. From the nutritional point of view, the content of milk and dairy products can provide essential ingredients (Iron, Copper and Zinc) in low doses and unnecessary or toxic elements such as lead, cadmium, etc., even at low concentrations, which can lead to metabolic disturbances or serious consequences if there are unnecessary elements [47]. The toxicity of excessive levels of some of these elements, such as chromium (Cr), cadmium (Cd), lead (Pb), etc., is well known (Tunegova., *et al.* 2016) and the presence of these metals, especially cadmium, lead and Nickel in the material Over-standard food influences to a variety of diseases, including neurological disorders, cancer, and genetic disorders [47]. Camel milk, like other dairy products, can be exposed to chemical risks and pollutants, which are the most important chemical contaminants of heavy metals, which is revealed in table 3. When livestock is exposed to high concentrations of heavy metals such as Cadmium, Nickel, Mercury, Arsenic, these metals concentrate in milk, and when they are eaten up by consumers, they will cause serious health problems [48]. Hence, the presence of metal residues in milk has been of particular concern because milk is widely consumed by newborns and children. Therefore, the determination of the residual concentrations of toxic metals in milk may be a direct indicator of the health status of the milk as well as an indirect indicator of the environmental contamination the milk is produced in (pahohi, 2017). Nowadays, the probability of contamination with fuel of cars and agricultural machines and haze of industrial factories in samples can be the main source of pollution of heavy metals, a sample of this correlation in 2011 showed that high concentration of lead in camel milk for the reason of Industrial and feeding animals in those areas and the existence of roads full of haze [49]. Regarding the factors affecting pollution, some studies have shown that camel species do not affect the level of lead, while the seasonal agent is important and influential, so that the level of lead in camel milk in the spring has the lowest levels of lead compared to other seasons have been reported [50] and the content of heavy metals is related to forage, water, and soil contamination (table 2). As has been observed in a research in 2009, the relationship between the contamination of heavy metal arsenic in the camel's fermented milk associated with the feed composition the animal food has been infected and the pollution index is based on the distance to source pollution, wind, farm topography (soil type, vegetation type), etc [51].

Researchers	Studied Sample(s)	Country	Elements	Test Method	Result
Ahmad., *et al.* 2017 [48]	Camel milk, Cattle, Buffalo, Goat	Pakistan	Cd, Ni, Cr, Mn, Zn, Fe	AAS	The results showed that the camel had high concentrations of Zn (mg/kg 0.021 ± 5.150), Mn (0.004 ± 0.094 mg/kg) and Fe (0.530 ± 1.580 mg/kg). In milk of buffalo, high concentrations of harmful metals include Cu (0.010 ± 0.223 mg/kg) and Cd (0.186 ± 0.186 mg/kg) while in goat milk, high nickel (0.045 mg/kg 15.15) And chromium (0.045 mm/kg 1.152) were detected The results showed that cow's milk contains more Zn, Mn and Fe compared to Buffalo.
Soltan., *et al.* 2017 [44]	Camel milk, sheep milks	Saudi Arabia	Pb, Ni, Co, Zn, Mn, Fe, Cd	AAS	The average concentration (ppm) for Pb in camel milk samples from Riyadh and Qassim 0.54 and 0.59 and sheep milk samples was 0.68 and 0.88 and average of nickel camel milk protein in Riyadh and Qassim 1.51 and 2.1 respectively, while sheep milk samples was 0.80 and 2.21 and Most concentrations of the elements in milk are correlated with their concentration in soil and plants and the effect of environmental factors on the content of milk.
Mostafidi., *et al.* 2016 [52]	Camel milk	Iran	Pb, Cd, Ni	ICP	Mean average of lead, cadmium and nickel were 0.445 ± 0.4653, 0.03 ± 0.054, 0.052 ± 0.088. Heavy metal contamination was less than acceptable limit for cow
Nnadozie., *et al.* 2014 [53]	Milk and meat from four species of animals (camel, cow, goat and sheep)	Nigeria	Pb, Co, Cr, Mn, Zn, Cu, Ni, Hg, Ba, Cd	AAS AES	Toxic metals like Cu, Pb, Ni and Co were not detected in the samples.
Nguta, 2012 [54]	camel milk	Kenya	As, Pb	AAS	The samples had different levels of arsenic, varying from 0.007 ppm to 0.099 ppm. The samples had As levels and Pb were higher than the codex
Konuspayeva., *et al.* 2011 [49]	Camel Milk and Camel Fermented Milk	Kazakhstan	Pb, Cd, Zn, Cu	ICP	Only the amount of lead in milk samples containing high concentrations (> 500 ppb)
Konuspayeva., *et al.* 2009 [51]	Forage, Camel Milk, Fermented Camel Milk	Kazakhstan	Cu, Fe, Mn, Zn, As, Pb	AAS	Consentration of camel milk 0.07 ± 0.04, 1.48 ± 0.53, 0.08 ± 0.03, 5.16 ± 2.17, <0.1 and 0.025 ± 0.02 ppm. for Cu, Fe, Mn, Zn, As and Pb. In shubat (fermented milk) the mean content was 0.163 ± 0.164, 1.57 ± 0.46, 0.088± 0.02, 7.217 ± 2.55 and 0.007 ppm. Arsenic was identified in some milk samples and no clear correlation was observed with forage composition.
Al-Wabel, 2008 [55]	Camel Milk	Saudi Arabia	Cu, Fe, Mn, Zn	AAS	The mean of Zn, Mn, Cu, Fe, Ca, Na and K concentrations in milk of cow in mg kg-1 (dry matter) was 0.28 ± 2.0, 431.21 ± 2.43, 1.80 ± 1.10, 4.214 ± 1.78, 66.91 ± 41.95, 91.4 ± 3.45 and 7.84 ± 5.84 for camels: 0.76 ± 1.48, 1.299 ± 0.11, 1.61 ± 0.90, 2.9481 ± 2.24, 699.3 ± 96.65, 99.87 ± 4.99 and 73.77 ± 5.64. For goats: 12.12 ± 0.99, 0.77 ± 0.07, 78.7 ± 90.68, 72.77 ± 72.7, 1013.11 and 93.93 ± 94.9 respectively. For sheep: 0.91 ± 3.09, 1.144 ± 0.05, 0.22 ± 0.62, 3.24 ± 5.101, 113.36 ± 822.5, 47.54 ± 95.4 and 127.11 ± 11.11. Copper in cow and camel milk is more than goat and sheep milk.

Table 2: Overview of heavy metal pollution in camel milk.

Pollution of Heavy Metals in Yogurt

Yogurt is a fermented dairy product that grows like Lactobacillus bulgaricus and Streptococcus thermophilus. Other lactic acid species are also commonly found in yogurt, including: Lactobacillus acidophilus and Streptococcus lactis. Yogurt can be a good source of essential nutrients as a mineral in a human diet. This can significantly contribute to the recommended daily recommendations for calcium and magnesium to maintain physiological processes. Yogurt is also a good food source of phosphorus (in addition to calcium, which is the most important nutrient for bone health) and its contribution to total phosphorus in the western countries has been reported to be between 30 and 45%. Other nutrients supplied include zinc [56]. The measurement of metals in yogurt, which is a complex matrix, is usually performed by spectrometric methods after complex processing of sample preparation for organic matrix decomposition. However, slurry sampling methods are used with spectrometric methods to determine metals in complex samples. It is also used to simplify the sample preparation phase. Other benefits of this method are to reduce the discharge of the analyte and in the process of pollution, low consumption of materials, etc [57]. Measuring the components of a small and rare ingredient is very useful in evaluating the quality of milk and dairies in products that is shown in table 3. In some studies, it has been reported that yogurt mixed with fruits potentially causing copper (Cu) poisoning due to high Cu content in the fruit portion can inhibit microflora, oxidation of fats and its toxicity to living organisms at concentrations show above [58].

Researchers	Sample	Place	Elements	Test Method	Result
de Andrade., *et al.* 2018 [57]	Yogurt	Brazil	Pb, Cd, Cr, Cu	Electro-thermal atomic absorption	This study showed that sampling of AAS slurry is suitable for the determination of fast Cu, Cr, Cd and Pb in yogurt.
Capcarova., *et al.* 2017 [58]	white and fruit (strawberry, blueberry, and cherry) parts of commercially available yogurts	Slovak Republic	Cu, Cd, Pb, Mn, Cr, Co, Ni, Zn, Hg	AAS	High concentrations of toxic elements (Cd and Pb) were observed in the fruits parts of the yogurt samples, and in some cases, the tolerable limit was too high. The white part of yogurt was not contaminated with toxic elements
Khan., *et al.* 2014 [59]	Yogurt and milk	Korea	Cd, Pb, Cr, Se, Cu, Mn, Zn, As	ICP-MS	Cd and Mn were high in fruit mixed yogurts, while selenium was high in milk samples. According to RDA, concentration of all elements was good nutritional value. The level of toxic trace elements, including As, Cd and Pb, was very low and there was no threat to consumers.
Cigdem., *et al.* 2013 [60]	Milk and yogurt	Turkey	Pb, Ni	Solid phase extraction using a new polymer aminotyazole resin	Limits of detection were found to be 0.15 ng mL_1 for Pb and 0.75 ng mL_1 for Ni. The lead concentrations in the studied samples were found to be in the range of 15-61 ng Pb mL_1 for milk and 21-42 ng Pb g_1 for yoghurt samples. Synthesized resins can be used to modify contaminated environment matrices such as soil and water. Lead concentrations were found in the range of 15-61 ng / ml in milk samples and 21 - 42 ng / ml in yogurt samples.

Table 3: Overview of heavy metal pollution in yogurt samples.

Milk Powder

Baby formula, fluids or powder, prepared for newborns and young children. They are used as alternatives to human milk. Except for breast milk, infant formulas play a special role in infant nutrition because they are the main source of nutrients for babies and a unique source of food during the first months of life of children, and many mothers in industrialized countries, it has decided to use a commercial formula to feed their babies despite serious breastfeeding support by breastfeeding support organizations. Most of the newborns in the United States use the formula for newborns until they are two months old. Also, lactation in the world today, especially among low-income women, is very important in terms of health, the psychological and social benefits of breastfeeding. Some other reasons for mothers who do not breastfeed their baby may include work or school demands, living conditions, such as difficult home situations, and social problems with breastfeeding in general [61]. The special sensitivity of newborns to toxins, especially metals, are due to the formation of bodybuilding, high intestinal absorption of toxic substances in them, mental development and higher energy consumption in the first year of their life. Many studies have reported that infants are more vulnerable to contact with heavy metals, being the lack of evolution of their renal systems and low levels of tolerance to these, contaminants [47]. Formulas are divided into two basic types: (i) products for newborns; and (2) for children over the age of 4 or 6 months [62]. According to Codex Alimentarius, the term "baby formula formulation" for Products designed for babies in the first months of life, as long as they feed the perfect supplement (up to 12 months). However, the Codex does not have a specific term for formulations that are exclusively used for newborns less than 6 months of age, and the term start, and follow-up are for children aged 0 - 6 years and 6 to 12 to avoid the use of different terms [63]. Toxic elements are found throughout the environment, and they are found in almost all foods, and these pollutants affect children more. Many growth problems in newborns and children are directly related to exposure to toxic elements. Exposure to high levels of manganese in childhood can commence to a neurovascular syndrome that affects the balance and control of dopamine behavior. Lead in milk products and cereals are of particular importance because they are the first to be considered as solid foods for babies and children, and Lead levels in baby food, especially under the supervision of international organizations. This whole of children absorbs a higher percentage of lead and commences to even lower levels of exposure to lead. Cadmium is less commonly consumed by the air for breathing air for the general population, and its exposure is almost exclusively through the consumption of daily dietetic foods. It was also found that, even in recent years, cadmium in rice is the most important daily intake of cadmium in the diet of the general population in the world [64]. On the whole in table 4, the overview of heavy metals contents in Infant Formula are indicated.

Researchers	Sample	Place	Elements	Test Method	Result
Sager., *et al.* 2018 [65]	Formula and milk powder	Tanzania	Pb,	ICP-MS	Median Ca, K and P concentrations declined from 11.14 g/kg to 3.21 g/kg, 14.11 g/kg to 4.95 g/kg and 9.12 g/kg to 2.75 g/kg dry mass 43 pieces of dry milk were studied for 43 chemical substances. By using a sample (2.3%), 240 μg/kg dry weight was infested over the threshold of Europe (130 μg/kg dry weight) at a lead concentration
Akhtar., *et al.* 2017 [66]	Infant Formula Milk	Pakestan	Pb, Cd, Ni, Mn	AAS	Concentrations of (Fe), (Zn) and (Ni) ranged between 45.40-97.10, 29.72-113.50 and < 0.001-50.90 μg/kg. Lead and cadmium found to be less than the detection limit in each sample was higher than standard,
Mania., *et al.* 2015 [67]	Infant Food	Poland	As, Hg, Pb	AAS	The mean lead amounts to 0.013 mg/kg (90%, 028 mg/kg). Lead levels in infant formulation are not more than 0.010 mg/kg, while the mean contamination is 0.005 mg/kg. The highest average cadmium 0.010 mg/kg in vegetable feed (90%, 0.017 mg/kg) was reported. In milk formula, it was less than 0.003 mg/kg and for soybean it was 0.009 mg/kg. The content of arsenic and mercury - The highest intake of infants with fish is 0.18 mg/kg and 0.013 mg/kg, respectively. In rice products for infants, arsenic did not exceed 0.14 mg/kg. The consumption of arsenic and mercury was lower than the reference value. Lead levels were lower than milk infestation in all products.
Lutfullah., et al. 2014 [68]	infant Formula, powdered and fluid (fresh and processedcow milk	Pakistan	Ca, Mg, Cu, Zn, Fe, Mn, Pb, Cd, Cr, and Ni	AAS	The toxic metals were within the acceptable and did not show significant levels leading to toxicity.
Mehrnia and Basht, 2014 [64]	Infant Foods	Iran	Cd, Ni, Pd, Mn	AAS	The range of toxic elements in infant foods were 40.3-58.0 μg/kg, 4479.1-6415.0 μg/kg, 2300-4875 μg/kg and 31.83-31.85 μg/kg for Cd, Ni, Mn and Pb, respectively Elements for children through infant foods were also estimated to be much lower than the levels tolerated, except at the level of Nickel that was severe.
Sipahi., *et al.* 2014 [69]	Formulas	Turkey	Pb, Cd, Al, Cr, Co, Mn	AAS	The level of toxic metal substances measured in the formulas was acceptable. Cobalt levels in 10 formulas were higher than the RDA. According to these findings, the level of metal in the formulas of the baby is generally much higher From milk-like milk.
Solidum., *et al.* 2012 [70]	powdered children's milk	Philippines	Ca, Cr	FLLAAS	Result show the cdmium and cr of samples are within the safe limits as recommended intake of these metals by the WHO.
Dabeka., *et al.* 2011 [71]	Infant formula	Canada	Pb, Cd, Al	ICP-MS	There was no significant difference in Pb and Cd levels. Al concentration was very different between manufacturers. However, all manufacturers are able to produce simple formulas based on milk containing less than 50 ng of aluminum, for example, in the range of total concentration of human milk in addition to formulas based on soy and hypoallergenic, premature formulas Among the highest were.

de Castro., *et al.* 2010 [72]	Infant Formulas and Milk	Brasilia	Pb, Cd	voltammetric and spectroscopic analyses	The concentration of powdery samples was 109 mg/kg and 03.03/μg/kg, but in The potential liquid samples had a concentration of 084 mg/kg, but the concentration of Cd was less than the detection limit median Cd concentration was below the limit of detection and overall values were below reference safety levels. However, 62% of these samples presented higher Pb concentration values than those
Cruz., *et al.* 2009 [73]	Infant Formulas Milk	Philippines	As, Hg, Pb	AAS	Three types of samples were negative for lead and arsenic, but a mercury sample was positive and higher than the weekly tolerable amount
Kazi., *et al.* 2009 [74]	Infant formula	Pakistan	Al, Cd, Pb	Electrothermal atomic absorption spectrometer	Al, Cd and Pb were detected in different branded infant formulae, in the range of (1070-2170), (10.5-34.4), and (28.7-119) lg/kg, respectively. Soya-based formula-based foods contain a higher concentration of toxic analgesics compared to milk.
Sola-Larrañaga and Navarro-Blasco, 2006 [75]	Infant formulae	Spain	Cr	Graphite furnace atomic absorption	The infant formulas contain a higher chromium concentration than human milk (reference range: 0.18-0.88 mg/L), especially in the case of hyporalgia (18.16 to 7.89 mg/L), without lactose 11.37 and 3.0.07 mg/L), premenstrual (11.48 ± 3.15 mg/l), soy (10.43? 4.05 mg/l) formula. Baby formula formulations contain chromium concentrations higher than those found in human milk
Ikem., *et al.* 2002 [61]	Infant formula	USA	Cd, Pb, Ni, Cr and other minerals	ICP-OES	Soy-based powdered milk formulations generally have higher levels of milk-based powder formulations. Cadmium, lead, Nickel and chromium were less than those of drinking water, and the daily consumption of Pb and Cd from breast milk formula is lower than the FAO/WHO Expert Committee for food additives.
Angeles Torres., *et al.* 1999 [76]	Human milk and infant formula	Spain	Se	Atomic absorption of hydride	The values obtained are close to those of other authors reported in Europe and less than reported in the United States, Japan, and Korea.

Table 4: Overview on Heavy Metals Contamination in Infant Formula.

Pollution of Heavy Metals in Cheese and Whey

Metals are one of the factors that influence the process of cheese production and ultimately cause contamination that can enter the food chain in different ways. The source of the lead in cheese is based on studies of environmental contamination and, consequently, contamination of livestock and Followed by a lead-contaminated valve, process related matters including contaminated salt, water contamination in the process, contamination of the containers and equipment used in the cheese making process, pollution of the places where the cheese comes. On the other hand, the process of flocculation in cheese as the combination of the lead with caseins and fat increases the amount of this metal in the cheese than milk (Baseri., *et al.* 1396). The amount of heavy metals in cheese is as a result of factors such as the difference between species, the geographic of region, characteristics of production methods and contamination of the equipment depend on the process [77].

Conclusion

As mentioned, the importance of having heavy metals in milk and its products are very valuable today. Heavy metals can be transferred from industrial sites to canals and rivers through direct discharges and runoff of contaminated sites. Water storm runoff from city roads may also contain significant amounts of heavy metals. These heavy metals ultimately lead to agricultural land that grows as animal feed. Ultimately, these metals may come in by consuming food or water contaminated with metals by dairy animals or through dishes used for milk transportation and washing, and sometimes infants exposed by the pipe connection to dirty water such as canal water Involved are some source of heavy metals. The adsorption or bio-adsorption of heavy metals from industrial effluent has been successful. Some heavy metals have been potentially cheap, including chemical acids, which are waste products of some industrial processes. Reducing the pollution of heavy metals in milk may also be achieved through changes in the milk production process. To monitor the level of heavy metals, water used for drinking animals and forage should be regularly inspected. To prevent the contamination of metals during handling, processing, and storage of milk and dairies, regards should be taken and at these levels, only food materials could be used. Animal herds and land used for animal fodder should be away from industrial and heavy traffic areas to prevent contamination of the metal. Authors recommended more precautions in the milk and dairy production should be taken and the safe water from deep and clean wills or portable water for animals such as cows, camels must be provided, and the heavy metal content tests and their determination have to be monitoring by responsible organizations. We suggest that some projects should be done to improve the operational efficiency and financial sustainability of provincial milk and dairy products and also improve water distribution systems. Public Health and Environmental Department in every province in all countries should be established due to detecting contaminant contents in tap and well-water. The infected hand pumps and tube wells, which were being used for domestic usages in the Lead/Mercury contaminated areas, must be identified and Milk processing units should be under strict observation [83-88].

Researchers	Studied Sample(s)	Country	Elements	Test Method	Result
Bilandžić 2014 [8]	Cheese, cream and butter	Croatia	Al, Co, Cr, Li, Mn, Mo, Ni, Sr	ICP-OES	Trace elements were measured as follows (mg/kg): Al 0.01-3.93, Co<0.005, Cr 0.005-1.66, Li 0.008-0.056, Mn 0.068-5.37, Mo 0.003-0.225, Ni 0.01-0.163 and Sr 0.085-3.49. There were significant differences considering the concentrations of Mn, Cr and Al (p<0.01, all) among the analyzed dairy products. There were no significant differences in Sr, Mo, Ni and Li levels among products. However, the high contribution of Al concentrations (56 and 124 %) to PTWI (provisional maximum tolerable daily intake) calculated in fresh and melted cheese may pose a health risk to consumers
Bakirciogl., *et al.* 2011 [78]	Cheese samples packaged in plastic, tin containers	Turkey	Cd, Co, Cr, Cu, Mn, Ni, Pb, Se, Zn	ICP-OES	Among the studied elements, there is a significant difference between the samples of cheese packed in Chinese containers and plastic containers, which show that cheeses and packaging materials play an important role in the content of metals
Maas., *et al.* 2011 [79]	Raw cows' milk and assessment of transfer to Comté cheese	France	Pb, Cd, Cu, Zn	AAS	metal concentrations (dry weight) in raw milk were very low (Cd: 0.34–1.01 ng/g; Pb: 0.009–0.126 lg/g; Cu: 0.28–1.71 lg/g; Zn: 20.62–30.96 lg/g), concentrations in the corresponding cheese were significantly higher (Cd: 0.68–11.37 ng/g; Pb: 0.020–0.925 lg/g; Cu: 5.35– 21.34 lg/g; Zn: 33.66–63.41 lg/g) The interaction during the cheese production process, especially for Cu, is high due to the use of copper vats, and the concentration (cadmium and carbamide) is generally lower compared to what is considered to be dangerous to consumers.
Starska., *et al.* 2011 [80]	Milk and Milk Products	Poland	Pb, Cd, Hg, As	Atomic absorption with flame, furnace, cold vapor, hydride	Average contents for milk products, were: lead 0.008 and 0.017 mg/kg,, cadmium 0.001 and 0.002 mg/kg, arsenic 0.005 and 0.009 mg/kg, and mercury 0.001 and 0.002 mg/kg. The performance criteria specified in the EU regulations on official food control. Based on the results of milk and milk products, it does not pose a threat to human health.
Nuray Yuzbasi., *et al.* 2009 [77]	Kassr cheese	Turkey	Pb, Cd, Fe, Cu, Zn	AAS	During the milk transfer to fresh cheese, almost all the tested metals have dropped because whey juice exits these metals into whey.
Lante., *et al.* 2006 [81]	milk and in Crescenza. Squacquerone Italian fresh cheeses	Italy	Pb, Cd, Al, Cu, Fe	ICP-OES	The amount of cadmium in milk and cheese was not observed and the amounts of metals were below the limits
Yuzbasi., *et al.* 2003 [82]	Kassr cheese	Turkey	Pb, Cd, Fe, Cu, Zn	Graphite furnace atomic absorption	The mean (range) of the lead, cadmium, iron, copper and zinc content of the samples were 86 (10–421) -gkg-1, 1.8 (0.3–8.3) -gkg-1, 4.2 (1.0–14.1) mg kg-1, 0.7 (0.3–1.6) mg kg_1 and 37.7 (26.5–63.0) mg kg_1, respectively. The lowest daily intake of cheese and the highest daily intake of zinc metal.
Saldaml, 1997	white cheese	Turkey	Pb, Cd, As, Hg	Graphite furnace absorption	No detectable levels of mercury were found except in one case.

Table 5: A Survey on Heavy Metals Pollution in Cheese.

Conflicts of Interest

None of the authors have any conflict of interest associated with this study.

Bibliography

1. Ziarati P., *et al*. "Risk Assessment of Heavy Metal Contents (Lead and Cadmium) in Lipsticks in Iran". *International Journal of Chemical Engineering and Applications* 3.6 (2012): 450-452.
2. Tavakoli-Hosseinabady B., *et al*. "Detoxification of Heavy Metals from Leafy Edible Vegetables by Agricultural Waste: Apricot Pit Shell". *Journal of Environmental and Analytical Toxicology* 8.1 (2018): 548.
3. Alimardan M., *et al*. "Adsorption of Heavy Metal Ions from Contaminated Soil by B. integerrima Barberry". *Biomedical and Pharmacology Journal* 9.1 (2016): 169-175.
4. Aazami J., *et al*. "A Review of Biotic Indices for Heavy Metals in Polluted Environment". *Human and Environment* 15.1 (2017): 13-24.
5. Ziarati P., *et al*. "Novel Adsorption Method for Contaminated Water by Wild Endemic Almond: Amygdalus scoparia". *Biosciences Biotechnology Research Asia* 13.1 (2016): 147-153.
6. Bonyadian M., *et al*. "Study on the residual of lead and cadmium in raw and pasteurized milks in Shahrekord area". *Iranian Veterinary Journal* 2.2-13 (2006): 74-81.
7. HamidiRavari EM and Daneshpajooh M. "Measuring the lead, arsenic, copper, zinc, selenum, sodium, potassium, Nickel, and magnesium ions in black tea". *Journal of Kashan University of Medical Sciences* 13.3 (2009): 242-248.
8. Bilandžić N. "Trace elements content in cheese, cream and butter". *Mljekarstvo* 64.3 (2014): 150-158.
9. Lahiji FA., *et al*. "Potential of Rice Husk Biosorption in Reduction of Heavy Metals from *Oryza sativa* Rice". *Biosciences Biotechnology Research Asia* 13.4 (2016): 2231-2237.
10. Ziarati P and Alaedini S. "The Phytoremediation Technique for Cleaning up Contaminated Soil by Amaranthus sp". *Journal of Environmental and Analytical Toxicology* 4.2 (2014): 208.
11. Gholizadeh E and Ziarati P. "Remediation of Contaminated Rice Farmlands Soil and Oryza sativa Rice Product by Apple Pomace as Adsorbent". *Bioscience Biotechnology Research Asia* 13.4 (2016): 2245-2253.
12. Motaghi M and Ziarati P. "Adsorptive Removal of Cadmium and Lead from Oryza sativa Rice by Banana Peel as Bio-sorbent". *Biomedical and Pharmacology Journal* 9 (2016): 739-749.
13. RazafshaA and Ziarati P. "Removal of Heavy Metals from Oryza sativa Rice by Sour Lemon Peel as Bio-sorbent". *Biomedical and Pharmacology Journal* 9 (2016): 543-553.
14. Salah FAAE., *et al*. "Heavy metals residues and trace elements in milk powder marketed in Dakahlia Governorate". *International Food Research Journal* 20.4 (2013): 1807-1812.
15. Meshref AMS., *et al*. "Heavy metals and trace elements levels in milk and milk products". *Journal of Food Measurement and Characterization* 8.4 (2014): 381-388.
16. Fathy S and El AA. "Assessment of Toxic Heavy Metals in Some Dairy Products and the Effect of Storage on its Distribution". *Journal of American Science* 8.8 (2012): 665-670.
17. Mahmoudi R., *et al*. "A review of the importance, detection and controlling of heavy metal in milk and dairy products". *Malaysian Journal of Science* 36.1 (2017): 1-16.
18. Ismail A., *et al*. "Heavy metals in milk: global prevalence and health risk assessment". *Toxin Reviews* (2017): 1-12.
19. Castro-González., *et al*. "Heavy Metals in Cow's Milk and Cheese Produced in Areas Irrigated with Waste Water in Puebla, Mexico". *Food Additives and Contaminants: Part B Surveillance* 11.1 (2018): 33-36.
20. Oliveira., *et al*. "Direct Determination of Pb in Raw Milk by Graphite Furnace Atomic Absorption Spectrometry (GF AAS) with Electrothermal Atomization Sampling from Slurries". *Food Chemistry* 229 (2017): 721-25.
21. Miedico O., *et al*. "Trace Elements in Sheep and Goat Milk Samples from Apulia and Basilicata Regions (Italy): Valuation by Multivariate Data Analysis". *Small Ruminant Research* 135 (2016): 60-65.
22. Shahbazi Y., *et al*. "Voltammetric determination of Pb, Cd, Zn, Cu and Se in milk and dairy products collected from Iran: An emphasis on permissible limits and risk assessment of exposure to heavy metals". *Food Chemistry* 192 (2016): 1060-1067.
23. Pérez-Carrera., *et al*. "Concentration of Trace Elements in Raw Milk from Cows in the Southeast of Córdoba Province, Argentina". *Dairy Science and Technology* 96.5 (2016): 591-602.
24. Ismail A., *et al*. "Estimated daily intake and health risk of heavy metals by consumption of milk". *Food Additives and Contaminants: Part B Surveillance* 8.4 (2015): 260-265.
25. Najarnezhad V., *et al*. "Lead and Cadmium in Raw Buffalo, Cow and Ewe Milk from West Azerbaijan, Iran". *Food Additives and Contaminants: Part B Surveillance* 8.2 (2015): 123-127.
26. Nejatolahi M., *et al*. "Lead Concentrations in Raw Cows Milk from Fars Province of Iran". *American Journal of Food and Nutrition* 2.5 (2014): 92-94.
27. Rezaei M., *et al*. "Assessment of dairy products consumed on the Arakmarket as determined by heavy metal residues". *Health* 6.5 (2014): 323-327.
28. Suturović Z., *et al*. "Determination of heavy metals in milk and fermented milk products by potentiometric stripping analysis with constant inverse current in the analytical step". *Food Chemistry* 155 (2014): 120-125.
29. Rey-Crespo F., *et al*. "Essential Trace and Toxic Element Concentrations in Organic and Conventional Milk in NW Spain". *Food and Chemical Toxicology* 55 (2013): 513-518.
30. Tona GO., *et al*. "Evaluation of lead and cadmium heavy metal residues in milk and milk products sold in Ogbomoso, Southwestern Nigeria". *Pakistan Journal of Nutrition* 12.2 (2013): 168-171.

31. Abdulkhaliq A., *et al*. "Levels of metals (Cd, Pb, Cu and Fe) in cow's milk, dairy products and hen's eggs from the West Bank, Palestine, Metals in dairy products from Palestine". *International Food Research Journal* 19.3 (2012): 1089-1094.

32. Derakhshesh SM and Rahimi E. "Determination of Lead Residue in Raw Cow Milk from Different Regions of Iran by Flameless Atomic Absorption Spectrometry". *American-Eurasian Journal of Toxicological Sciences* 4.1 (2012): 16-19.

33. Dizaji AA., *et al*. "Evaluation and determination of toxic metals (Lead and Cadmium) in cow milk collected from East Azerbaijan, Iran". *European Journal of Experimental Biology* 2.1 (2012): 261-265.

34. Licata P., *et al*. "Determination of Trace Elements in Goat and Ovine Milk from Calabria (Italy) by ICP-AES". *Food Additives and Contaminants: Part B Surveillance* 5.4 (2012): 268-271.

35. Póti P., *et al*. "Accumulation of Some Heavy Metals (Pd, Cd and Cr) in Milk of Grazing Sheep in North-East Hungary". *Journal of Microbiology, Biotechnology and Food Sciences* 2.1 (2012): 389-394.

36. Isamov NN., *et al*. "Content of Biogenic and Toxic Elements in Goat Feed and Milk". *Russian Agricultural Sciences* 37.5 (2011): 413-415.

37. Ataro A., *et al*. "Quantification of trace elements in raw cow's milk by inductively coupled plasma mass spectrometry (ICP-MS)". *Food Chemistry* 111.1 (2008): 243-248.

38. Birghila S., *et al*. "Determination of Major and Minor Elements in Milk through ICP-AES". *Environmental Engineering and Management Journal* 7.6 (2008): 805-808.

39. Tajkarimi M., *et al*. "Lead residue levels in raw milk from different regions of Iran". *Food Control* 19.5 (2008): 495-498.

40. Caggiano R., *et al*. "Metal levels in fodder, milk, dairy products, and tissues sampled in ovine farms of Southern Italy". *Environmental Research* 99.1 (2005): 48-57.

41. Pavlovic I., *et al*. "Lead and cadmium levels in raw cow's milk from an industrialised Croatian region determined by electrothermal atomic absorption spectrometry". *Czech Journal of Animal Science* 49.4 (2004): 164-168.

42. Tokuşoğlu Ö., *et al*. "Simultaneous differential pulse polarographic determination of cadmium, lead, and copper in milk and dairy products". *Journal of agricultural and food chemistry* 52.7 (2004): 1795-1799.

43. Ikirić M S., *et al*. "Determination of Metals in Cow's Milk by Flame Atomic Absorption Spectrophotometry". *Czech Journal of Animal Science* 48.11 (2003): 481-486.

44. Soltan ME., *et al*. "Effect of the environmental factors on some element contents in camel and sheep milks: A comparative study between Qassim and Riyadh regions, KSA". *International Research Journal of Public and Environmental Health* 4.8 (2017): 184-192.

45. Mati A., *et al*. "Dromedary camel milk proteins, a source of peptides having biological activities - A review". *International Dairy Journal* 73 (2017): 25-37.

46. El-Agamy EI. "Camel milk". In: YW Park and GF Haenlein (Editors), Handbook of milk of non-bovine mammals, Oxford: Blackwell (2006): 297-344.

47. Ziarati P and Moslehishad M. "Determination of Heavy Metals (Cd, Pb, Ni) in Iranian and Imported Rice Consumed in Tehran". *Iranian Journal of Nutrition Sciences and Food Technology* 12.2 (2017): 97-104.

48. Ahmad I., *et al*. "Atomic Absorption Spectrophotometery Detection of Heavy Metals in Milk of Camel, Cattle, Buffalo and Goat from Various Areas of Khyber- Pakhtunkhwa (KPK), Pakistan". *Journal of Analytical and Bioanalytical Techniques* 8.3 (2017).

49. Konuspayeva G., *et al*. "Contamination of Camel Milk (Heavy Metals, Organic Pollutants and Radionuclides) in Kazakhstan". *Journal of Environmental Protection* 2.1 (2011): 90-96.

50. Konuspayeva G., *et al*. "Variation factors of some minerals in camel milk". Faye B, Sinyaskiy Y (editors), Impact of pollution on animal products, NATO sciences series, Dordrecht(Netherlands). Springer Sciences + Business Media B.V. *Impact of Pollution on Animal Products* (2008):125-132.

51. Konuspayeva G., *et al*. "Pollution of Camel Milk by Heavy Metals in Kazakhstan". *The Open Environmental Pollution and Toxicology Journal* 1 (2009): 112-118.

52. Mostafidi M., *et al*. "Evaluation of mineral content and heavy metals of dromedary camel milk in Iran". *Food Science and Technology* 36.4 (2016): 717-723.

53. Nnadozie CU., *et al*. "Assessment of some diary products sold in Sokoto Metropolis, Nigeria". *International Journal of Advanced Research in Chemical Science* 1.10 (2014): 31-37.

54. Nguta JM. "Heavy metal residues in camel milk from Kenya: Health Implications". *Journal of Clinical Toxicology* 2.9 (2012): 4172.

55. Al-Wabel NA. "Mineral contents of milk of cattle, camels, goats and sheep in the central region of Saudi Arabia". *Asian Journal of Biochemistry* 3.6 (2008): 373-375.

56. Tarakccedil Z and Dağ B. "Mineral and heavy metal by inductively coupled plasma optical emission spectrometer in traditional Turkish yogurts". *International Journal of Physical Sciences* 8.19 (2013): 963-966.

57. de Andrade CK., *et al*. "Determination of Cu, Cd, Pb and Cr in yogurt by slurry sampling electrothermal atomic absorption spectrometry: A case study for Brazilian yogurt". *Food Chemistry* 240 (2018): 268-274.

58. Capcarova., *et al*. "Detection of selected trace elements in yogurt components". *Journal of Environmental Science and Health Part B* 52.12 (2017): 858-863.

59. Khan N., *et al*. "Analysis of minor and trace elements in milk and yogurts by inductively coupled plasma-mass spectrometry (ICP-MS)". *Food Chemistry* 147 (2014): 220-224.

60. Cigdem E., *et al*. "Determination of lead in milk and yoghurt samples by solid phase extraction using a novel aminothioazole-polymeric resin". *Food Chemistry* 137.1-4 (2013): 55-61.

61. Ikem A., *et al*. "Levels of 26 elements in infant formula from USA, UK, and Nigeria by microwave digestion and ICP-OES". *Food Chemistry* 77.4 (2002): 439-447.

62. Molska A., *et al*. "The content of elements in infant formulas and drinks against mineral requirements of children". *Biological Trace Element Research* 158.3 (2014): 422-427.

63. da Silva SV., *et al*. "Evaluation of the mineral content of infant formulas consumed in Brazil". *Journal of Dairy Science*. 96.6 (2013): 3498-3505.

64. Mehrnia MA and Bashti A. "Evaluation of Toxic Element Contents in Infant Foods Commercially Available in Iran". *Bulletin of Environment, Pharmacology and Life Sciences* 3.6 (2014): 249-253.

65. Sager M., *et al*. "Heavy metal content and element analysis of infant formula and milk powder samples purchased on the Tanzanian market: International branded versus black market products". *Food Chemistry* 255 (2018): 365-371.

66. Akhtar S., *et al*. "Determination of Aflatoxin M1 and Heavy Metals in Infant Formula Milk Brands Available in Pakistani Markets". *Korean Journal for Food Science of Animal Resources* 37.1 (2017): 79-86.

67. Mania M., *et al*. "Toxic Elements in Commercial Infant Food, Estimated Dietary Intake, and Risk Assessment in Poland". *Polish Journal of Environmental Studies* 24.6 (2015): 2525-2536.

68. Lutfullah., *et al*. "Comparative Study of Heavy Metals in Dried and Fluid Milk in Peshawar by Atomic Absorption Spectrophotometry". *The Scientific World Journal* (2014): 1-5.

69. Sipahi H., *et al*. "Safety assessment of essential and toxic metals in infant formulas". *The Turkish journal of pediatrics* 56.4 (2014): 385-391.

70. Solidum JN., *et al*. "A Quantitative Analysis on Cadmium and Chromium Contamination in Powdered Children's Milk Available in Metro Manila, Philippines". *2nd International Conference on Environment and BioScience* 44.6 (2012): 26-28.

71. Dabeka R., *et al*. "Lead, cadmium and aluminum in Canadian infant formulae, oral electrolytes and glucose solutions". *Food Additives and Contaminants - Part A* 28.6 (2011): 744-753.

72. De Castro CSP., *et al*. "Toxic metals (Pb and Cd) and their respective antagonists (Ca and Zn) in infant formulas and milk marketed in Brasilia, Brazil". *International Journal of Environmental Research and Public Health* 7.11 (2010): 4062-4077.

73. Cruz GC., *et al*. "Analysis of Toxic Heavy Metals (Arsenic, Lead and Mercury) in Selected Infant Formula Milk Commercially Available in the Philippines By Aas". *E-International Scientific Research Journal* 1.1 (2009): 40-51.

74. Kazi TG., *et al*. "Determination of toxic elements in infant formulae by using electrothermal atomic absorption spectrometer". *Food and Chemical Toxicology*. 47.7 (2009): 1425-1429.

75. Sola-Larrañaga C and Navarro-Blasco I. "Chromium content in different kinds of Spanish infant formulae and estimation of dietary intake by infants fed on reconstituted powder formulae". *Food Additives and Contaminants* 23.11 (2006): 1157-1168.

76. Torres MA., *et al*. "Selenium contents of human milk and infant formulas in Spain". *Science of the Total Environment* 228.2-3 (1999): 185-192.

77. YÜZBAŞI N., *et al*. "Changes in Pb, Cd, Fe, Cu and Zn levels during the production of kaşar cheese". *Journal of Food Quality* 32.1 (2009): 73-83.

78. Bakircioglu D., *et al*. "Determination of some traces metal levels in cheese samples packaged in plastic and tin containers by ICP-OES after dry, wet and microwave digestion". *Food and Chemical Toxicology* 49.1 (2011): 202-207.

79. Maas S., *et al*. "Trace metals in raw cows' milk and assessment of transfer to Comté cheese". *Food Chemistry* 129.1 (2011): 7-12.

80. Starska K., *et al*. "Noxious elements in milk and milk products in Poland". *Polish Journal of Environmental Studies* 20.4 (2011): 1043-1051.

81. Lante A., *et al*. "Content and characterisation of minerals in milk and in Crescenza and Squacquerone Italian fresh cheeses by ICP-OES". *Food Control* 17.3 (2006): 229-233.

82. Yüzbaşı N., *et al*. "Survey of lead, cadmium, iron, copper and zinc in Kasar cheese". *Food Additives and Contaminants* 20.5 (2003): 464-469.

83. Elamin FM and Wilcox CJ. "Milk Composition of Majaheim Camels". *Journal of Dairy Science* 75.11 (1992): 3155-3157.

84. Güler Z. "Levels of 24 minerals in local goat milk, its strained yoghurt and salted yoghurt (tuzlu yoğurt)". *Small Ruminant Research* 71.1-3 (2007): 130-137.

85. Llorent-Martínez EJ., *et al*. "Analysis of 20 trace and minor elements in soy and dairy yogurts by ICP-MS". *Microchemical Journal* 102 (2012): 23-27.

86. Muhib Md Iftakharul., *et al*. "Investigation of Heavy Metal Contents in Cow Milk Samples from Area of Dhaka Bangladesh". *International Journal of Food Contamination* 3.1 (2016): 16.

87. Pajohi-Alamoti MR., *et al*. "Lead and Cadmium Contamination in Raw Milk and Some of the Dairy Products of Hamadan Province in 2013-2014". *Journal of Health* 8.1 (2017): 27-34.

88. Saeed Faraji M., *et al*. "Elimination of lead using adsorption by pear peel". *Journal of Environmental Science and Technology* 19.4 (2017): 51-59.

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