

## Determination of Heavy Metal Contents in Milk Samples: A Review

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### Abstract

*In the dairy industry, mining is the main industry that affects the production of this food and its dairy products, with the contamination of heavy metals such as lead (pb), cadmium (cd) and mercury (Hg), a investigation of the different scientific articles, the purpose of this article is to present the different methods used to determine the concentrations of contaminants, such as the use of atomic absorption spectrometry in cow's milk, the method in this investigation begins with the collection of information from the bibliographic database of abstracts and citations of scientific articles Scopus, the selection of scientific production, working with fifty (50) scientific articles, with a maximum age of five (5) years having a subject in common, about the contamination of milk and dairy products, mass spectrometry to determine the level of contamination produced in milk , result that the concentrations of heavy metals such as lead, cadmium and mercury exceed in all the samples analyzed, the FDA recommended permissible limits mainly that are greater than 0.020 mg / kg.*

**Keywords:** heavy metals; cadmium; lead; mining

### Introduction

Contamination of dairy products by heavy metals in China, there is an appropriate procedure to determine raw milk with contaminants and improve control (Zhou, Qu, et al., 2019), itself the contamination of milk by heavy metals in Serbia analyzing the different samples, the concentrations exceeded the permissible limits (Davidov et al., 2019). In sugarcane factories, lead (pb) and cadmium could be detected in cow's milk (Hegazy et al., 2019). The level of lead in areas with overexposed population is drinking water and also contaminated milk in children under 2 years of age. (Tebby et al., 2022), the risks of cancer in the Chinese population due to heavy metals, arsenic in the regions exceed the

limits it is urgent to reduce the levels of arsenic in the Chinese markets (Sun et al., 2022). Chemical composition and heavy metal contaminants in goat milk in Bogor Indonesia, minimal heavy metal contamination was found in the milk (Wanniatie et al., 2019).

The analysis of heavy metals and radionuclides in food resulted in a decrease in zinc, cadmium, lead and copper. (Kakimov et al., 2019). In the USA, heavy metals were examined for concentrations of cadmium and lead in children's foods and according to the United States Food and Drug Administration (FDA) they exceed the limits with the metal of lead and cadmium (Gardener et al., 2019), arsenic is

present in water, heavy metals are estimated in dietary intake in schoolchildren in northeast argentina (Rossi et al., 2019), in nigeria heavy metals present a health risk in sweets (sweets) and GIS technology will be used for soil remediation on dairy farm (Pillay et al., 2019), Heavy metals in milk and dairy products in Tabriz are unfit for human consumption (Beikzadeh et al., 2019). the

## **Methods**

### *Materials*

The materials used in this investigation are the analysis, compilation of information and research of fifty (50) scientific articles, with a maximum age of five (5) years, having a common theme, about the contamination of milk and dairy products from both animal origin such as cow and breast milk that are contaminated by heavy metals, some of them lead (Pb), chromium (Cr), cadmium (Cd) and arsenic (As).

### *Investigation procedure*

Milk of both animal origin and human breast milk was analyzed from different scientific articles, analyzing the amount of concentration of heavy metals lead (Pb), chromium (Cr), cadmium (Cd), arsenic (As) and others. In different parts of the world. It began with the collection of information from the Scopus page where fifty (50)

## **Result and Discussion**

### *Risk assessment of heavy metals in milk*

The evaluation of heavy metal contamination in raw milk for human consumption, the presence of contaminants in various agricultural inputs, including feed, fertilizer, water and the environment leads to the excretion of residues in animals, because milk consumption contaminated food poses serious threats to the health of consumers, a study was conducted in 2012 - 2013 in Pakistan to assess the crude unprocessed concentrations, there was a significant difference in concentration in the

determination of the heavy metals copper, lead and cadmium simultaneously with voltammetry is an advantage for the determination of contaminants in mineralized samples (Silva et al., 2021), *L. acidophilus* is an absorbent that removes cadmium and lead in milk (Massoud et al., 2020).

scientific articles were chosen, the selected ones had to be the most current and cited with a maximum of five (5) years old, they had to be related to the topic of contamination of milk by heavy metals and the keywords, these selected articles were downloaded and loaded into the Mendeley Desktop program, previously they had to read and analyze in detail each scientific article of which the authors, year of publication, title were selected, number of citations, purpose, sample, measurement, results, findings, journal, and source.

Of all the information obtained, it had to be selected in ascending order from the oldest article to the current one, respecting the sub-themes, the concept maps of each sub-theme were made, the information obtained from the articles was reflected in the development. Each subtopic is cited with Mendeley Desktop, previously attached from the Scopus page and some details had to be corrected, such as the year of publication, journal and author of some articles.

summer and winter seasons (Younus et al., 2016).

That said, the evaluation of pathogenic bacterial and heavy metal toxicity in the quality assessment of raw unpasteurized milk through biochemical tests collected from dairy cows, aimed to assess hygienic quality by determining the presence of predominant pathogenic microbial contaminants (contagious or environmental) and indiscriminate heavy metal content in unpasteurized samples collected in Kohat district, Khyber Pakhtunkhwa, Pakistan. Samples analyzed on MacConkey media and nutrient agar were found to be contaminated mainly with coliforms, *Staphylococcus*

aureus, *Enterobacter aerogenes*, and *Proteus vulgaris* (Iqbal et al., 2016). Thus, the risk assessment for children's health due to consumption of cow's milk in contaminated areas in Puebla and Tlaxcala, Mexico. This study aimed to determine the content of heavy metals in cow's milk produced in areas irrigated with wastewater and to evaluate the health risk with the daily consumption of Milk for children. The sample consisted of four areas in which small farmers were selected, the metals in decreasing order were 0.36; 0.046; 0.035; 0.029; 0.015; 0.012 and 0.002 mg kg<sup>-1</sup> for Zn, Pb, As, Cu, Cr, Ni and Cd, respectively (Castro Gonzalez et al., 2017).

Beside that, the evaluation of the environmental impact on physical-chemical parameters and metal content of bovine milk in Malir district, this work designed to investigate the physical-chemical properties (pH, conductivity, salinity and specific gravity) the level of essential heavy (Fe, Cu and Zn) and harmful (Cd) metals were analyzed in bovine milk samples, for consumers in Malir district, Karachi, the average concentration ranges of Fe, Cu, Zn and Cd were 0.262 -1.104 mg/l, 0.001-2.740 mg/l, 2.800-5.600 mg/l and 0.001-0.034 mg/l in the same order. Approximately 54% of the samples were noted to be highly contaminated with Cd. (Parween et al., 2018).

The analysis and risk assessment of residues of seven toxic elements in raw milk bovines located in China, the residue levels of the toxic elements in raw milk were analyzed and the potential health risk of those residues was evaluated, samples were collected from the eight main milk-producing provinces and three types of weather stations were tested for arsenic (As), lead (Pb), cadmium (Cd), chromium (Cr), mercury (Hg), aluminum (Al), and nickel (Ni) using mass spectrometry, the result is Al, Pb, Hg, Ni, Cr and As were detected in 47.8, 29.2, 28.1, 23.6, 12.4 and 9.0% of the total samples. (Qu et al., 2018).

The evaluation of the risk to human health of Cd, Cu, Pb and Zn through the consumption of raw and pasteurized milk, the analysis of the residual contents of toxic

metals in food, especially in milk could be an important indicator of the safety, mean concentrations ( $\mu\text{g}/\text{kg}$ ) of Cd, Cu, Pb and Zn in milk and samples were  $0.36\pm 0.28$ ,  $9.77\pm 3.91$ ,  $32.83\pm 20.80$   $\mu\text{g}/\text{kg}$  and  $253.70\pm 87.96$ ,  $\mu\text{g}/\text{kg}$  respectively and in the pasteurized were  $5.57\pm 9.33$   $\mu\text{g}/\text{kg}$ ,  $8.41\pm 5.99$   $\mu\text{g}/\text{kg}$ ,  $25.54\pm 26.50$   $\mu\text{g}/\text{kg}$  and  $90.12\pm 91.52$   $\mu\text{g}/\text{kg}$ , respectively (Sobhanardakani, 2018).

Lead and cadmium levels in raw bovine milk and dietary risk assessment in areas close to oil extraction industries, oil fields are a source of heavy metal contamination, but few studies have evaluated their impact on intake of these contaminants through milk, the levels of lead (Pb) and cadmium (Cd) were evaluated by atomic absorption spectrometry in a graphite furnace, the results are  $47.0 \pm 3.9$  and  $54.0 \pm 6$ ,  $9$   $\mu\text{g}/\text{kg}$  for Pb, and  $4.7 \pm 1.0$  and  $3.5 \pm 1.3$   $\mu\text{g}/\text{kg}$  for Cd (Norouzirad et al., 2018).

Risk assessment of heavy metals in milk from cows raised in industrial areas of India, when exposed to mining plants, poses a serious health risk to people close to Indian industries, the results are suggesting that polluting activities such as lead industries should be kept away from cows that are raised in the midst of heavy metal contaminants that consequently the end affected is the consumer of cow's milk, the following metals with their arsenic values (As) 46.64%, chromium (Cr) 25.54%, lead (Pb) 24.30% and cadmium (Cd) 3.52%, are percentages to the general risk index of each metal already pronounced (Yasothea et al., 2021).

The evaluation of aflatoxin contamination in dairy concentrated animal feed from Punjab in India, aflatoxins are concentrated in dairy starts from the consumption of their feed by cows, said aflatoxins are (B1, B2, G1 and G2) contaminant tolerances in milk exceeded the allowable lead standards at 50–100% milk contamination (Patyal et al., 2021).

Human health risk assessment of heavy metals in fresh raw milk from cows grazing near the Brik Kilns mining project, Iraq. In food, laboratory tests of heavy metals contained in milk must be carried out, these

tests are the guarantees of quality and safety in prevention, these studies gave the result, revealed the permissible limits in the consumption of milk, the significant increases were Cd (43.71), Hg (95.04) and Pb (57.54) and a low SOD (11.27), KAT (3.52) and GPx (0.65) compared to those exposed to contamination and also to those who are not exposed (Hussein et al., 2021).

Assessing the risks of dietary lead exposure in China Dietary Lead (Pb) risk across China. When making an adjustment in the dietary structures, lead (Pb) with its risk has possibilities of being reduced, less than 1, they are of a high risk, it will have to be reduced in percentages 56% to 37%, 41% or 24%, in the foods such as vegetables or cereals close to the industries were chosen with the minimum concentrations of lead (Zhang et al., 2021).

In the same way, the evaluation of occurrence, pathways and risks of heavy metals in raw milk from industrial areas in China. Milk is contaminated near large industries and consequently it is also necessary to analyze the concentrations of heavy metals such as lead (Pb), chromium (Cr), cadmium (Cd) and arsenic (As), the risk index for heavy metals have contributions with said risk (HI) of arsenic (As), chromium (Cr), lead (Pb) and cadmium (Cd) with values 46.64%, 25.54%, 24.30% and 3, 52%, respectively to the already mentioned heavy metals (Su, Gao, et al., 2021).

In the same way, the evaluation of the health risks of heavy metals through the consumption of cow's milk in the Transhimalaya region, human health is affected by the consumption of milk and dairy products with concentrations of heavy metals, consequently, a study of milk and dairy products contaminated with heavy metals was carried out and the impact occurred mainly in the winter and summer seasons. (Giri et al., 2021).

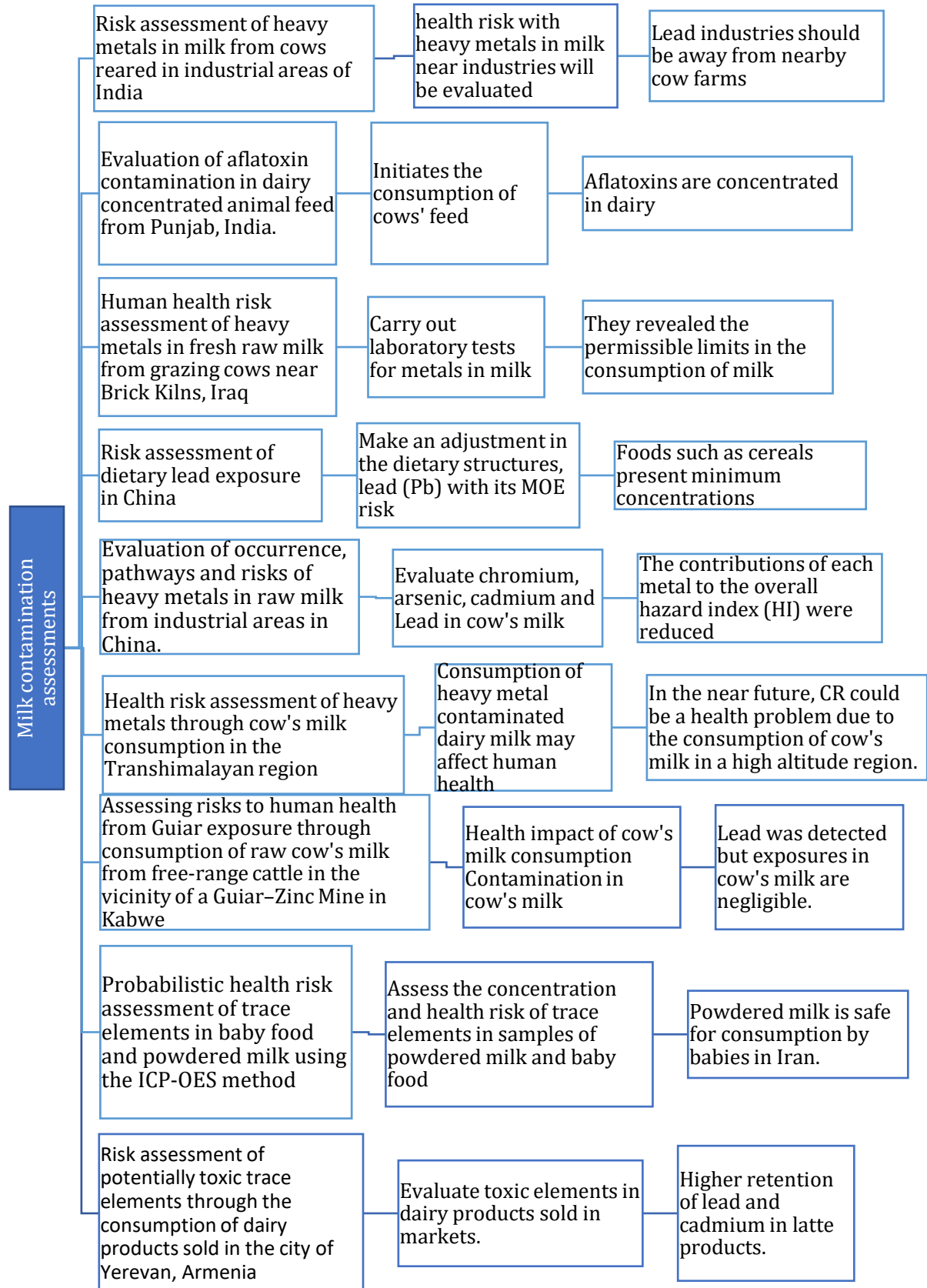
In turn, the evaluation of risks to human health of exposure through the consumption of raw cow's milk, raised in freedom in the vicinity of a Guiar-Zinc mine in Kabwe, the cows show contamination and the

consequences on health. that is an imminent risk, lead (Pb) was detected in the milk from said lead exposure, the result does not present risks for people because they do not exceed the permissible limits, the concentrations of lead (Pb) ranged from 0.60 to 2, 22  $\mu\text{g}/\text{kg}$  in the wet season and 0.50 and 4. 24  $\mu\text{g}/\text{kg}$  in the dry season (Zyambo et al., 2022).

As we will see below, the probabilistic health risk assessment of trace elements in baby food and powdered milk using the ICP-OES method, powdered milk for babies was analyzed for concentrations of toxic elements, the result was that the concentrations in powdered milk are within the permissible limits and are considered acceptable for consumption by children, the ranking order and risk quotient is mercury (Hg) > nickel (Ni) > arsenic (As) > cadmium (Cd) > aluminum (Al) and risk of non-cancer HQ > 1 and risk of cancer (CR) >  $1 \times 10^{-4}$  (Kiani et al., 2022).

In fact, the risk assessment of potentially toxic trace elements through the consumption of dairy products sold in the city of Yerevan, Armenia, in the markets we find milk and dairy products, some of these products have toxic elements in their content that necessarily have to be investigated, such as lead (Pb), cadmium (Cd), mercury (Hg), molybdenum (Mo) and copper (Cu) the results of milk and dairy products indicate a high concentration of lead (Pb) and cadmium (Cd), the exposure margin for lead (Pb) is 8.71 and for cadmium (Cd) 8.80 (Pipoyan et al., 2022).

In any case, the evaluation of the concentration of lead in raw milk collected from some of the main dairy farms in Iran and the evaluation of the associated health risk, lead (Pb) was found in their milk concentrations, which is why it is very dangerous for human consumption, a study was carried out with results that lead levels in milk are within acceptable levels because their samples were less than 1 for all samples the risk coefficient (HQ) < 1 (Sharifi, Sharifi, S. et al. 2022. "The AssSharifi, Sharifi et al., 2022).



*Determination and relationship of heavy metals*

Preliminary data on the presence of heavy metals in milk located in Shkodra products are important components of the daily diet and are recommended for all ages, the Shkoder region is well known for milk production in Albania, the goal of this investigation was to evaluate the possible contamination by heavy metals in several farms, the concentrations of Fe, Cr, Cu, Zn and Mg varied between 0.33-4.12, 0.02-0.73, 0.004-0.59, 0.07-14.00 and 45.14-95.03 mg/l, respectively (Preka & Bekteshi, 2016). Determination of some heavy metal residues in raw milk from cows, sheep and goats in Al-Qadisiya Governorate, was carried out in Al-Qadisiya Governorate during the period from December 2012 to March 2013. It involved five regions with different geographical locations (Diwania city center, Saniya district, Shafeia district, Daghara district and Al-Hamza district) to determine the residues of nickel, arsenic and mercury in raw materials, the results showed that there are significant differences ( $p < 0.05$ ) in the concentrations of nickel, arsenic and mercury between the milk of cows, sheep and goats (Taher & Ali, 2016).

In turn, the analysis and concentrations of heavy metals in raw cow's milk in three dairy farms in the north of Gondar, Ethiopia, the chemometric approach of concentrations of essential metals (Cu, Mn and Zn) and toxic (Cr, Cd and Pb) samples were quantified using flame atomic absorption spectrometry, they were collected from the Nara-Awudarda, Tana-Abo and Kosoye Amba-Rass areas in North Gondar, Ethiopia, the mean concentrations of Cr, Mn, Cu, Zn, Cd and Pb in the milk with the samples ranged between 0.468 and 0.828, 1.614 and 2.806, 0.840 and 1.532, 1.208 and 5.267, ND and 0.330 and ND and 0.186 mg/kg, respectively (Akele et al., 2017).

Contamination of water, soil and milk from the industrial area adjacent to the Swan River, Islamabad, Pakistan Metals such as Cr, Ni, Cd, Zn, Pb and Cu are dangerous pollutants and are located in areas with high anthropogenic activity. Their concentrations

were analyzed using atomic absorption spectroscopy, their concentrations were found to be several times higher in samples from downstream of the Swan River of the Kahuta Industrial Triangle compared to upstream. The order of metals in milk  $Zn > Cr > Cu > Cd > Pb = Ni$  (Perveen et al., 2017).

Heavy metals in milk and cheese produced in areas irrigated with wastewater in Puebla Mexico, the objective of this work was to determine the levels of Ni, Cr, Cu, Zn, Pb and As in raw milk and oxaca and rancho type cheeses, produced in areas irrigated with wastewater from Puebla Mexico, the results showed an average level of Pb of 0.03 mg kg<sup>-1</sup>, which is above the maximum limit established by the Codex Alimentarius and the standards of the European Commission. (Castro-González, Calderón-Sánchez, et al., 2018).

Heavy metals in the milk of cows fed with alfalfa produced in soils irrigated with wastewater in Puebla and Tlaxcala Mexico, to determine the presence of Cd, Pb, Ni, Cu, Cr, Zn and As in the food chain of cattle and the Milk produced in areas where alfalfa is grown in soils irrigated with industrial, domestic and agricultural wastewater had a lead (Pb) content in a range of  $0.039 \pm 0.02$  to  $0.059 \pm 0.05$  mg kg<sup>-1</sup>, values per above the international limit allowed (Castro-González, Moreno-Rojas, et al., 2018).

Some toxic metals aluminum (Al), arsenic (As), molybdenum (Mo) and mercury (Hg) found in cow's milk, raised in an area possibly contaminated by different sources, the relationship of milk with heavy metals is evaluated, it is an indicator that milk deteriorates in the environment, giving as a result that the values found in comparison to other studies already carried out agree, indicating that the population is in significant danger, due to the different activities close to mining and industries that are considered contaminated areas, arsenic (As) was found in  $18.45 \pm 6.89$  liquid milk and  $166.45 \pm 42.30$  µg/kg freeze-dried milk, no mercury was found in these samples (González-Montaña et al., 2019).

The determination of trace elements, heavy metals and antimony in polyethylene terephthalate, from raw cow's milk bottled in

the Iğdir region in Turkey, the containers of different products such as milk are present heavy metals and antimony in polyethylene terephthalate, when they are The study conducted found high contamination with lead and arsenic in milk in containers such as PET bottles, 70% of these samples exceeded the lead limit by 2.5 times and the lowest lead sample is 1.25 times the maximum level. 35% were 5 times higher, of the total samples 40% of the antimony is higher than the permissible limit (Koyuncu & Alwazeer, 2019). In the same way, the determination of lead in milk samples using a vortex-assisted deep eutectic solvent-based liquid phase slotted quartz tube flame atomic absorption spectrometry system, to reduce the detection limit the parameters were optimized. and efficiency, limits of detection (LOD)  $8.7 \mu\text{g L}^{-1}$  and quantification (LOQ)  $29.0 \mu\text{g L}^{-1}$  (Borahan et al., 2019).

The relationships between lead(Pb), arsenic(As), chromium(Cr) and cadmium(Cd) in individual cows and milk composition and heavy metal contents in water, silage and soil, heavy metals in milk contents of cow, industrial activities of lead and cadmium contaminate milk, close to industries such as drinking water, said relationship between milk and metal content in milk there is no acceptable relationship so far, levels of Pb and Cd in contaminated area is ( $P < 0.01$ ) not contaminated, As in milk ( $r = 0.09$ ) with As in silage, in water and silage is positive correlation ( $r = 0.78$ ) (Zhou, Zheng, et al., 2019). Contamination in food consumed and produced in Brazil, systematic review and meta-analysis, to determine the levels of lead in food, a random model had to be used, the analysis of food contamination has important results in lead through meta-analysis even when they presented high heterogeneity, analyzing lead (Pb) it was estimated at  $0.0541 \text{ mg/kg}$  and ranged between  $0.0004 \text{ mg/kg}$  and  $0.4842 \text{ mg/kg}$  (Vasconcelos Neto et al., 2019).

Cadmium in infant milk and cereal-based formulas marketed in Nigeria: a non-carcinogenic probabilistic assessment of the risk to human health, lead and cadmium have to be compared and evaluated in infant formulas and established internationally

established limits, for the children's health the consumption of cadmium and lead affect health, periodic evaluation and supervision of the concentrations of heavy metals concentrated in said formulas is recommended, in the measurement of lead (Pb) in milk formulas ( $1.49 \text{ mg/kg}$ ) is a little high compared to others, not significant ( $p < 0.05$ ), the average level of cadmium ( $0.17 \text{ mg/kg}$ ) (Igweze et al., 2020).

Concentrations of toxic metals and essential elements in raw cow milk from areas with a potentially undisturbed and highly disturbed environment in Slovakia, contamination of cow's milk and comparison between from Slovakia and the Slovak Republic will have to be determined, the use of milk from cow have a low content of toxic metals in these areas does not represent any risk for humans, content of cadmium (Cd) zinc (Zn) and magnesium (Mg) is higher in milk ( $P < 0.001$ ) (Pšenková et al., 2020). Spatial distribution of heavy metals contamination in molisol dairy farm, it is used to determine the contamination of heavy metals GIS technology provides data on the soil of dairy farms and how to remedy them, the order of heavy metals in the full score was  $\text{As} > \text{Zn} > \text{Cr} > \text{Ni} > \text{Cu} > \text{Pb} > \text{Cd} > \text{Hg}$  (Qi et al., 2020).

Levels of pesticides and heavy metals in dairy products: evaluation of the risk to human health, the specific risk index of adversity had to be calculated and also the source risk quotient, these results exceeded the MRLs of cheese samples with zinc and copper,  $\text{HQ} > 10$  for lead is a higher risk,  $\text{HQ} > 1$  for copper, in milk and cheese the risks were allowable (Năstăsescu et al., 2020). Environmental Lead contamination in dairy farms in Narayanganj, Bangladesh. The objective is to analyze the spatial distribution in food and its concentration of lead (Pb), this study identified the potential distribution of lead starting in the environment up to dairy products, the concentration of lead (Pb) in soil ( $26\text{-}39 \mu\text{g/kg}$ ), and in water ( $0.023\text{-}0.059 \mu\text{g/kg}$ ), fodder ( $0.017\text{-}0.035 \mu\text{g/kg}$ ) and milk ( $0.041\text{-}0.068 \mu\text{g/kg}$ ) (Aktar et al., 2020).

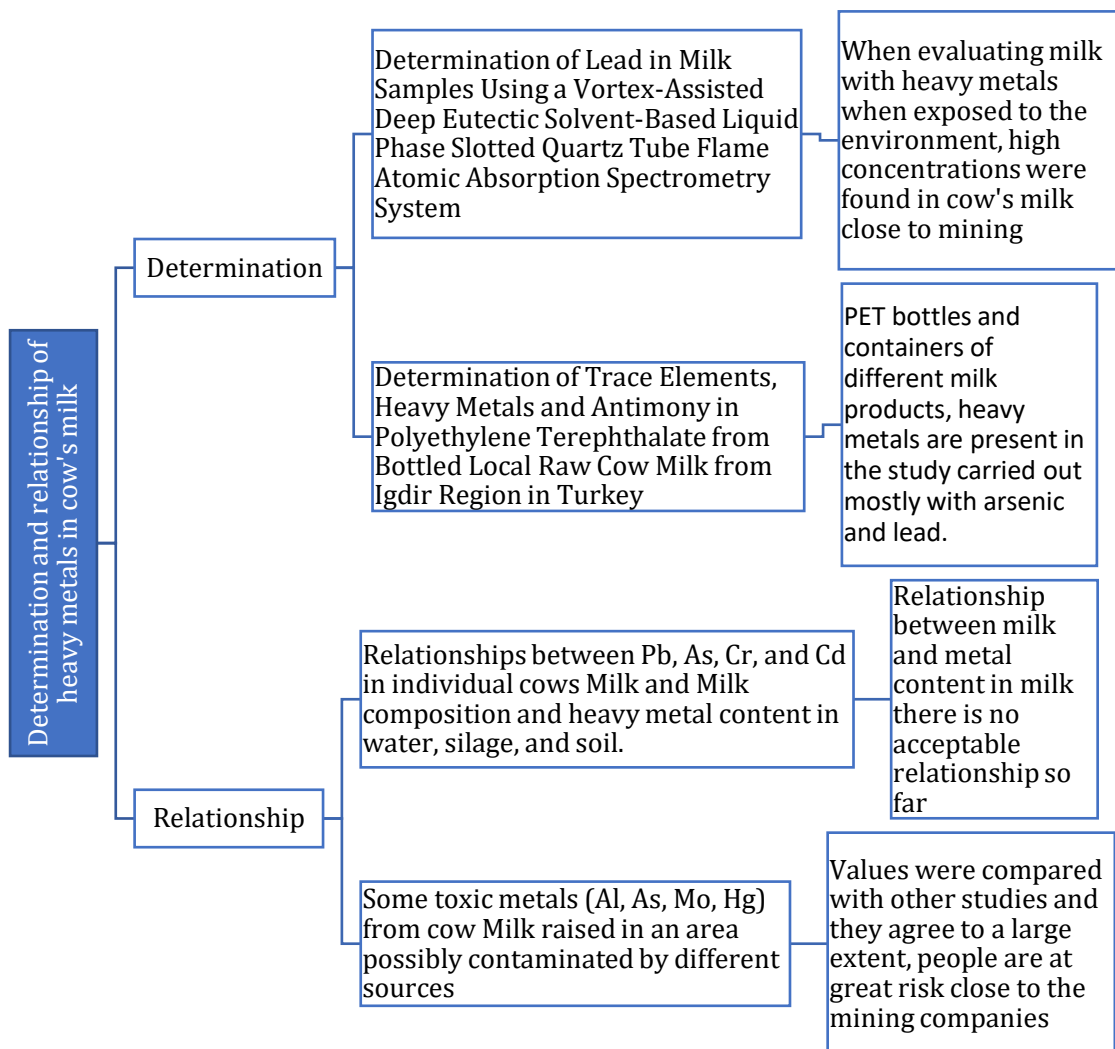
Heavy metal residues in Milk and milk products produced in Northern Cyprus, milk

and milk products will have to be determined the concentrations of heavy metals (75 As, 111 Cd, 208 Pb, 65 Cu, 200 Hg) these products will be analyzed and there were no health concerns in the HRI and THRI results, the following average residues of As, Cd, Pb, Cu and Hg in the packaged products were  $4.55 \pm 6.19$  (range: 0.00-25 0.00  $\mu\text{g}/\text{kg}$ ),  $14.44 \pm 20.65$  (range: 0.00-58.00  $\mu\text{g}/\text{kg}$ ),  $6.83 \pm 19.03$  (range: 0.00-81.00  $\mu\text{g}/\text{kg}$ ) ,  $237.38 \pm 215.22$  (range: 0.00-738.00  $\mu\text{g}/\text{kg}$ ) and  $4.61 \pm 6.37$  (range: 0.00-24.00  $\mu\text{g}/\text{kg}$ ), respectively (Dağcilar & Gezer, 2021). To evaluate the levels of heavy metals and their antagonists in dairy products available in the markets of São Luís, Northeast Brazil. Heavy metals such as lead, copper, mercury and nickel and their antagonists selenium, cobalt, calcium, iron and zinc in dairy products the heavy metals mainly observed were nickel, mercury, lead and selenium, non-significant positive correlation between Pb and Ca ( $\rho = 0.387$ ,  $p = 0.056$ ), and Hg and Se ( $\rho = 0.055$ ,  $p = 0.795$ ) (Ribeiro Sant'Ana et al., 2021). Heavy metals in raw milk and dietary exposure assessment in the vicinity of leather processing plants, in raw milk arsenic, chromium, lead and cadmium have to be tested for contamination levels, in nearby leather industries consumers are at risk to their health, in these areas contaminated with arsenic and lead and arsenic their concentrations are  $0.43 \pm 0.21$  and  $2.86 \pm 0.96$   $\mu\text{g}/\text{L}$  respectively, the results are much higher than on the farm uncontaminated with values  $0.20 \pm 0.05$  and  $2.32 \pm 0.78$   $\mu\text{g}/\text{L}$ , respectively (Su, Liu, et al., 2021).

Dietary risk of milk contaminated with lead and cadmium in areas close to mining-metallurgical industries in the Central Andes of Peru. In Peru there are no studies on the impact of ingestion in the mining-metallurgical industries located in the Andes, in children the consumption of milk with high concentrations of lead and cadmium was close to the mining industries and there was also evidence of the serious affectation by heavy metals to nearby communities due to environmental contamination. The mean concentrations of Pb and Cd were  $577 \pm 18.2$  and  $18.35 \pm 5.4$   $\mu\text{g}/\text{kg}$ , the different samples exceeded the limits (Castro-Bedriñana et al., 2021). Heavy metal levels in milk and cheese produced in the Kvemo Kartli region, Georgia. In milk and cheese, the concentrations of cadmium, lead, iron, zinc, copper, chromium, manganese, cobalt, nickel, selenium and molybdenum must be determined. The results do not directly and indirectly affect the health of milk consumers, lead concentration and copper in milk exceeded the limits between 0.027 to 1003  $\text{mg L}^{-1}$  and 0.42 to 1.28  $\text{mg L}^{-1}$  respectively (Sidawi et al., 2021).

High concentrations of lead (Pb) in blood and milk of brown bears (*Ursus arctos*) in the wild in Scandinavia. World health needs to prevent lead exposure includes animals, lead contamination with high concentrations of lead detected in the blood of brown bears in recent decades currently for identification and lead exposure in brown bears requires for more research (Fuchs et al., 2021).





## Conclusion

Cow's milk must be cared for in different countries of the world with laws so that it is not contaminated with heavy metals, the food safety of milk must be guaranteed so that children and adults do not suffer the consequences of milk contaminated with heavy metals especially lead. The different evaluations of concentrations of heavy metals revealed the permissible limits that exceed said limits of the different regulations and contributions of cow's milk from different countries. The determinations and relationship of heavy metals in cow's milk, concentrations were found and in the PET bottles containers of the different products

heavy metals are present mostly with arsenic and lead.

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