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EVALUATION ON THE LEVEL OF LEAD (PB) HEAVY METAL IN THE MILK OF COWS IN FARMS OF ARDEBIL PROVINCE, IRAN

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ABSTRACT

Milk and its products are considered as a nearlycomplete food, since they are good sources of protein,fat and major minerals. The minor or trace elements maybe present in the animal and plant tissues only atconcentrations of a few ppm, examples are Co, Se and Mo. The otherminerals like Pb, Cd and F may be verytoxic and result from contamination of theenvironmentby man and may cause reduced productivity or death. This study was undertaken to evaluate the level of lead in milk of cows in farms around Ardebil province of Iran. A total of 150 samples of cow milk were obtained from farms in Ardebil provnce in Iran.Analysis of Pb in milk samples was done using the Atomic Absorption Spectrophotometer (AAS).Data obtained from present study showed that there is significant difference in term of lead level in milk in different areas of Ardebil province ($p<0.01$).That this must draw the attention of food regulatory bodies to adopt measures that could bring the heavy metal residues in food chain up to permissible values not injurious to human health.

Keywords: Milk, Lead, Dairy Cow, Ardebil

INTRODUCTION

Milk as an excretion of the mammary gland can carry numerous xenobiotic substances, which constitute a technological risk factor for dairy products and, above all, for the health of the consumer. Determination of the residual concentrations of metals in milk could be an important "direct indicator" of the hygienic status of the milk, as well as an "indirect indicator" of the degree of pollution of the environment in which the milk was produced **(Licata *et al*. 2004; González-Montaña *et al*. 2012)**.

In the last few years, the contamination of milk is considered as one of the main dangerous aspects. Trace metals are a general collective term applying to the group of metals and metalloids with an atomic density greater than 6 g/cm. This term is widely recognized and usually applied to the elements such as cadmium (Cd), Cu, Fe, lead (Pb), and Zn which are commonly associated with pollution and toxicity problems **(Malhat *et al*. 2012)**. One of the main problems with metals is their ability to bio-accumulate. Metal residues in milk are of particular concern because milk is largely consumed by infants and children **(Tripathi *et al*. 1999)**.

The food chain is an important source of Pb accumulation, especially for plants grown on polluted soils. Significant amounts of Pb can be transferred from contaminated soil to plants and grass, causing accumulation of these potentially toxic metals in grazing ruminants, particularly in cattle **(López Alonso *et al*. 2003; Miranda *et al*. 2005).** Accumulation of Pb in ruminants causes toxic effects in cattle, but also in humans consuming meat and milk contaminated with toxic metals **(González-Weller et al.2006; Vromman et al. 2008; Cai et al. 2009**).

Pbare amongst the elements that have caused the most concern in terms of adverse effects on human health. This is because they are readily transferred through food chains and are not known to serve any essential biological function. Lead is a pervasive and widely distributed environmental pollutant with no beneficial biological roles. The poisoning is more common in farm ruminants, which are considered most susceptible to the toxic effects of lead (**Swarup *et al*. 2005)**. For that reason, the concentration of Pb in cow's milk should be monitored to ensure the consumers' health **(Jen *et al*. 1994**).

In most studies, the concentrations of toxic heavy metals and trace elements were determined in the milk obtained most frequently from Holstein-Friesian cows. It seems justified to compare the concentration and the relationships between the levels of individual elements in the milk of Simmental and Holstein-Friesian cows, kept in the same environment and fed identically, which allows finding breed differences in the concentration of elements and assimilability of heavy metals. Therefore, This study was undertaken to evaluate the level of lead in milk of cows in farms around Ardebil province of Iran.

MATERIALS AND METHODS

A totalof 150 samples of cow milk were obtained from farms in Ardebil province in Iran. Analysis of Pb in milk samples was done using the Atomic AbsorptionSpectrophotometer (AAS). The milk samples first needed to be brought into clear solution foranalysis by theAAS. Thus the samples were firstdigested with strong acids where the organic portions ofthe samples were destroyed and the minerals left in aclear solution.Amounts of 0.5g ofeach sample wereweighed into a set of digestion tubes and 10mls each of perchloric and nitric concentrated inorganic acids weredispensed into the sample tubes. The samples werethen digested on the digestion block at 120°C for 2hours, until the organic substances werecompletelydecomposed. At the end of the digestion, the sampleswere allowed to cool toroom temperature. Digested samples were made up to the 50mls volume with deionizedwater and thentransferred into centrifuge tubes and shaken for 10minutes. The shaken solutions were transferred to thecentrifuge machine and centrifuged at the rate of 4500rpm for 5 minutes. Finally, the supernatants were placedin duplicates in a set of pyrex glassvials to be analyzedin the AAS, for the determination of Pb and Cd levelsthrough comparisons with known standardconcentrations **(AOAC, 2005)**.

The softwaregenerates the standard curve or equations from thesignals of the working standard versus the standardconcentrations of the unknown analytes. The resultswere then expressed in ppm.Samples were analyzed induplicates. The standard deviations of treatment meanswere calculated. All statements of differences werebased on significance at $P<0.05$.

RESULTS

Data obtained from present study showed that there is significant difference in term of lead level in milk in different areas of Ardebil province ($p<0.01$). **Table 1** shows the milk's value of lead in details by area.

Table 1: Milk's value of lead in different areas of Ardebil province

Area	Mean±SE (ppm)	SD	p-value
South	0.02±0.001	0.009	0.01
East	0.01±0.00	0.007	
North	0.009±0.00	0.003	
West	0.01±0.00	0.012	
Total	0.012±0.002	0.004	

DISCUSSION AND CONCLUSION

The detection of residual concentrations of Pb in all the 150 milk samples might be dueto the contamination of the soil, fodder and water on which the lactating ruminants were nourished **(Wardand Savage, 1994; Aslam *etal*., 2011)**. The range 0.012 ppm of Pb concentrations obtained in the milk samplesin this study. Also, these values were lowerthan the values of 0.0167-0.0232 ppm Pb concentrations in cow milk reported by **Aslam *et al*. (2011)**. Similarly, **Anastasio *et al*. (2006)** observed highest residual Pbconcentration in cheese (0.390 ppm) processed fromhe raw milk of sheep (0.180 ppm of Pb). **Anastasio *et al*. (2006)** attributed higher concentrations of Pb incheese than in the raw milk and other milk productsto contamination during the cheese making process.Processing of the cow milk into butterfat and yoghurtalso did not eliminate Pb residues. In this study, mean concentration of Pb incattle milk was similar to the concentration in goat milk.This result was however contrary to the observation ofhigher levels of Pb in goat milk (0.0434 ppm) than that incattle milk (0.0199 ppm of Pb) reported by **Aslam *et al*.(2011)**.

Somer (1974) stated that it has been noticed that most of the heavy metals are members of the micro elements which are required in small doses for proper functioning of animals.

Aslam *et al*. (2011) defined heavy metals as the elements with density more than 5gcm-3, atomic eight between 63.55 and 200.59 and specific gravity greater than 4. The authors then mentioned that although heavy metals normally remain in ground water and soil, however in certain areas their levels might increase and they could tend to accumulate to toxic levels in human and animal tissues, deriving food from water and soils.

Chitmanat and Traichaiyaporn (2010) explained that living organisms normally require some of these heavy metals up to certain limits but if excess accumulation occurs it could lead to severe detrimental effects. The mineral content of milk depends on numerous factors such as genetic characteristics, the stage of lactation, environmental conditions, the type of pasture and soil contamination.

Ward and Savage (1994) also mentioned that foodstuffs grown on contaminated soil or irrigated with impure water accumulate metal contents and could be sources of heavy metals exposure to animals and humans. Again, livestock reared on contaminated fodder become continuous sources of heavy metal residues in edible tissues and milk **(Aslam *et al*., 2011)**.

Lead is toxic to the lood, the nervous, gastric and genital systems and the accumulation of lead produces damaging effects in the hematopoetical, hematic, renal and gastro-intestinal systems **(Correia*et al*., 2000)**.

Santhi *et al*. (2008) reported that at relatively low concentrations, heavy metals could cause adverse effects and this calls for the immediate attention of health regulatory authorities and researchers. **Tripathi *et al*. (1999)** stated the recommended safe value of Pb concentration as 0.0125 to 0.0175 ppm and that for Cd as 0.0028 to 0.0035 ppm in milk and milk products .**Anastasio *et al*. (2006)** reported that the Maximum Residue Limit (MRL) of Pb concentrations for bovine milk was 0.0200 ppm but that there was no specific MRL for Cd in milk and dairy products. **Aslam *et al*. (2011)** stated that high levels of heavy metal residues in milk of cattle and goat above the Maximum

Residue Limits (MRLs) must be regarded as a potential health hazard in animals and human beings. That this must draw the attention of food regulatory bodies to adopt measures that could bring the heavy metal residues in food chain up to permissible values not injurious to human health.

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