Research Paper

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Evaluation of Selenium level in Blood, Milk & Urine in Lactating Cattle around Koradi Thermal Power Plant in Nagpur, Maharashtra.

Veterniary

KEYWORDS : Flyash,Thermal power plant,cattle,lactation

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ABSTRACT

The experiment was conducted to assess the level of selenium from fly ash emitted by coal fired thermal power plant in blood, urine and milk of Lactating Cattle within a radius of 5km around Koradi Thermal power plantin Nagpur Mahrashtra,India. Twenty cattle which were born and attained lactational status were randomly selected and investigated for levels of selenium in blood, toxicokinetics of selenium and urine analysis. Blood selenium concentration of exposed cattle was non significantly higher than control group of animals while urine and milk of exposed cattle were having significantly higher selenium concentration than control group of animals.

Introduction

Fly ash is one of the numerous substances that cause air, water and soil pollution, disrupt ecological cycles and set off environmental hazards. Fly ash contains trace concentrations of heavy metals and other substances that are known to be detrimental to health in sufficient quantities.Selenium is an essential trace element present in fly ash. It is believed that selenium enters the animal diets through feedstuffs of plant origin, including grains and grasses. Plants do not require selenium for growth and development, the amount of selenium in a plant is in direct relationship to the amount of selenium in the soil. Selenium is retained in the plant when selenium replaces sulphur in an amino acid for selenium or in plant tissue that normally contains sulphur. Selenium has been shown to be a natural component in the enzyme glutathione peroxidase and other proteins. Selenium occurs naturally in a number of inorganic forms, including selenide, selenate and selenite containing minerals. Most selenium compounds are water-soluble and can efficiently be taken up in the intestine. Soluble as well as non-soluble compounds can be taken up by the lungs. When given in excess,

selenium compounds are rapidly distributed to major organs of the body. Identified metabolites are trimethylselenide in urine and dimethylselenide in breath.

Materials & Methods

In the present study 20 cows were randomly selected within a radius of 5km of Koradi Thermal Power Plant in villages namely Surradevi and Khapri. Only those cows born and attained lactation status in this particular area were selected.

Figure 1:Sampling of Exposed Cattle

Figure 2: Sampling of Exposed cattle.

Figure 3:Koradi Thermal Power Plant

All these cows were first examined for the presence of any morbid and overt disease conditions and only those which were not showing any apparent infection or metabolic disorder were included in the present study. To assess the level of selenium in blood about 5ml of blood samples were collected from each lactating cow kept in Sodium citrate vials for Selenium estimation. For urine collection the external genitalia of the cow was cleaned properly and 50ml urine from midstream was collected and stored in clean and dry sterile vial and stored at -20°C for selenium estimation. While as for Milk collection the udder and teats were cleaned properly and 2-3 streaks of milk were discarded and 50ml of milk was collected in sterile vial and stored at -20°Cfor selenium estimation For comparative analysis of selenium in blood,milk, urine, 20 lactating cattle from Agriculture Dairy farm,Deolapar Cattle Farm and Cattle Breeding Farm of Nagpur Veterinary college were taken as a healthy control group.Selenium estimation was done at National Environmental Engineering Research Institute (NEERI), Nagpur.Analysis of Se was done by using an instrument(ICP-OES) Model : THERMO ICAP 6300 DUO. Made by : THERMO FISCHER SCIENTIFIC, UK.

The data which was obtained after compilation of the results were statistically analysed by standard method and technique as outlined by Snedecor and Cochran (1994).

Results

In the present study the level of selenium in the blood of exposed cattle was1.37±0.33 ppm which was non significantly higher than the the value of standard control group of animals(0.39±0.04)ppm where as the selenium level in milk of exposed cattle were 0.60± 0.20ppm which was non significantly higher than the control group of cattle having 0.05± 0.003ppm.Higher levels of selenium in milk samples of cows from exposed area could be due to persisting nature of this metal there by gradually becoming accumulated in the body and probably excreted through milk.The level of selenium in exposed group of cattle was 1.113±0.278ppm where as the level of selenium in control group of cattle was 0.067±0.008ppm.The level of selenium in exposed group of cattle was significantly higher than control group of cattle(p<0.01).As the level of selenium in blood was elevated so there must be concentration of selenium in the glomerulus thereby creating hyperosmolar state inducing excretion of selenium in the urine which is nothing but a renal clearance.

Table 1.Selenium concentration in Blood,Milk and Urine of exposed and unexposed group of animals

Sr. No	Selenium				
	Particulars		Average±S.E	f value	Significance
1	Blood	Exposed	1.37±0.32	3.43	NS
		Control	0.39±0.04		
2	Milk	Exposed	0.60±0.20	7.72	*
		Control	0.05±0.003		
3	Urine	Exposed	1.31±0.27	20.18	**
		Control	0.07±0.008		

NS=Non Significant, * = Significant at 5% level, = Significant at 1% level.**

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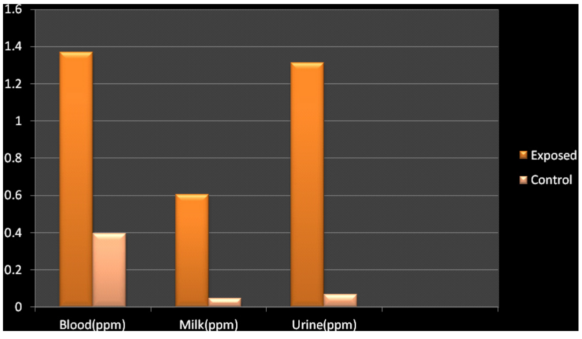
Figure:3 Graphical Representation of Selenium Concentration in Blood,Milk,and Urine of exposed and unexposed cattle



Discussion

It has been estimated that lactating dairy goats absorb about 65% of ingested selenomethionine. Selenium in its elemental state as selenate or selenite is in an inorganic state. Ruminants absorb inorganic selenium less efficiently than monogastric animals because the rumen microbes reduce it to a less soluble form before it reaches the intestinal tract. High levels of sulfur in the diet interfere with selenium absorption whereas adequate levels of calcium assists in selenium uptake. Once absorbed, selenium interacts with the sulfur-containing amino acids (e.g., cysteine and methionine) to form the enzyme glutathione peroxidase, and for incorporation into various proteins, such as hemoglobin and myoglobin. Selenocysteine is then combined with other amino acids to create proteins called selenoproteins..

Selenium is an important constituent of the enzyme glutathione peroxidase. This enzyme acts to destroy peroxides, thereby protecting cells and membranes against oxidative damage. Vitamin E and selenium tend to enhance the effect of one another in that vitamin E works to prevent the formation of peroxides, and glutathione peroxide acts to destroy.Glutathione peroxidase is also a constituent of blood platelets and white blood cells, making it an important part of the body's immune system and blood clotting mechanism. Deore et al (2002) reported that in experimentally induced selenosis in male buffalo calves,signs appeared when selenium level in blood were about 2ppm and were prominenet above 2.5 to 2.6 ppm.Though the level of selenium is non significantly higher than control group of animals; but, it did not reach the level to simulate chronic toxicosis of selenium.The optimum blood levels of selenium are still a point of discussion among scientists, but > 100 ug/L is generally agreed to be adequate.

Absorption of selenium is much lower in ruminants than in non-ruminants. The low absorption of selenium in ruminants is due to modifications that occur in the rumen environment. Low absorption of selenium in ruminants is believed to result from reduction of dietary selenium to insoluble forms such as elemental selenium or selenides in the rumen environment.Selenium crosses placental barrier. Selenomethionine is the predominant form of selenium that occurs naturally in feedstuffs and in selenized yeast. Incorporation of selenomethionine into nonspecific body proteins in place of methionine likely explains the higher selenium concentrations in tissue and milk of ruminants that were fed organic compared with selenite selenium.

The observations of the present study are in accordance with Lean et al. (1990) who reported that herd milk selenium levels are directly proportional to the cows blood selenium level;however, herd selenium levels were not significantly related to soil selenium level.Mean bulk tank milk selenium levels were 0.0224ppm.This finding also goes with the findings of the present study .Based on the observations of the present study it can be inferred that determination of selenium in bulk milk samples has the potential of evaluating herd selenium levels in order to determine selenium status. Naveiro et al. (2009) found that selenium in cows milk in 8.5–21 µg/Lrange.(0.0085 to 0.021ppm).The level of selenium in exposed group of cattle was significantly higher than control group of animals(p<0.01). In the present investigation the level of selenium in blood of exposed cattle was higher than control group of animals,selenium probably easily entered into milk from circulation.

Selenium homeostasis is regulated primarily through excretion. Selenium is excreted via two main paths: urinary (50-67%) and fecal (40-50s%). Extremely high intakes of selenium can lead to ventilatory elimination of the mineral in the form of dimethylselenide. Excretion via the lungs is characterized by a garlic smell odour to the volatile selenium compound . Faecal excretion does not appear to be a major pathway in regulation. Instead, urinary excretion is the primary route of regulation under normal physiological conditions. Selenium is rapidly excreted in urine in the form of trimethylselenonium ion.

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inducing excretion of selenium in the urine which is nothing but a renal clearance.The observations of the present study are in general agreement with that of Burk et al.(1972) who also reported that excretion of selenium is predominantly through mechanisms of renal clearance in the form of trimethylselenium,especially with chronic exposure.However, the amount of selenium excreted in the urine vs.deposition in the faeces depends on the mode of exposure(injection or ingestion) and the animal species of interest.The majority of selenium is excreted in the manure; but, this was out of the scope of the present study.

Conclusion

The level of Selenium has not crossed the safety limit in the body fluids like milk,blood and urine in Lactating Cattle around Koradi thermal Power plant in Nagpur,mahrashtra India.The cattle appeared to be tolerant for higher intake of selenium. Selenium is filtered out of the body by excreting it through urine and milk.Determination of bulk tank milk selenium levels has the potential to be a low cost, non-invasive means of evaluating herd selenium levels in order to determine selenium status.

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