

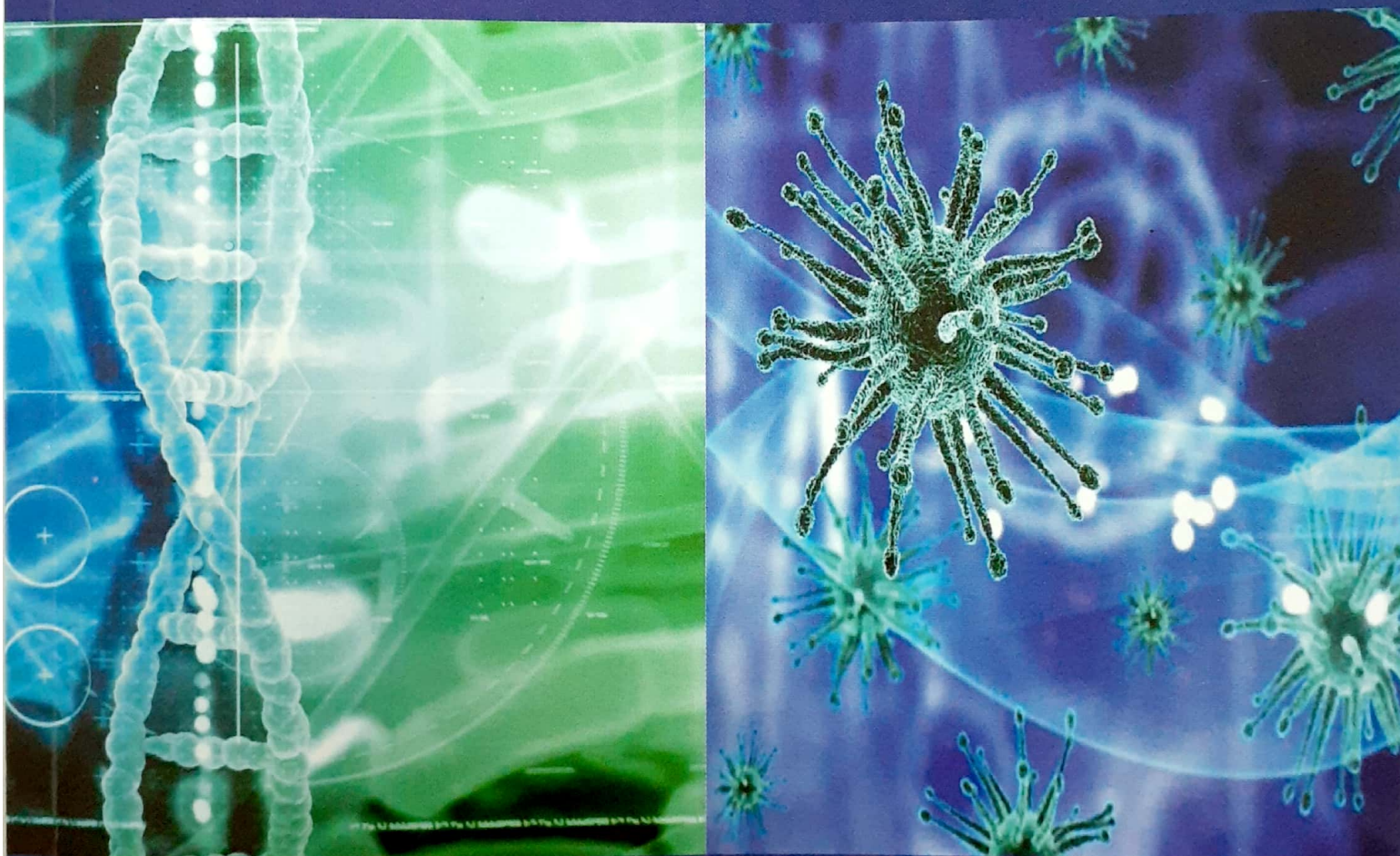


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Determination of Concentrations of Heavy Metals in Bovine Blood and Milk in identified Human CKDu-prevalent areas of Sri Lanka

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Heavy metal toxicity has been a major public health concern, especially in developing countries. Human chronic kidney disease of unknown (CKDu) etiology is an unsolved controversy in Sri Lanka. A probable cause of human CKDu is heavy metals entering through the food chain and water. Several studies in other developing countries have shown that livestock products play a major role in human heavy metal toxicity. The objective of this study was to determine concentrations of the heavy metals As, Cd and Pb, and trace elements Zn, Mn, Cu, Co, and Fe in lactating cows reared in human CKDu prevalent areas of the country. Samples were collected from cows belonging to farmer families where at least one person was diagnosed with human CKDu. Blood and milk samples were collected from Jugular vein to a vacutainer and from teat to a sterile sample bottle respectively from lactating cows in Padaviya (blood: n=20, milk: n=20) and Thambuththegama (blood: n=20, milk: n=20) veterinary ranges and as a negative control, a total of 20 samples (blood: n=20, milk: n=20) were collected from a location in Kandy where CKDu is not prevalent. Samples digested under microwave digestion procedure for blood and milk, were analyzed through Inductively Coupled Plasma Optical Emission Spectrophotometry (ICP-OES). The mean heavy metal and trace element concentrations ($\mu\text{g/ml}$) were obtained for Padaviya (serum: As: 0.03 ± 0.01 , Cd: 0.001 ± 0.00 , Pb: 0.02 ± 0.02 and Zn: 1.15 ± 0.70 , Mn: 0.006 ± 0.00 , Cu: 0.38 ± 0.13 , Co: 0.003 ± 0.00 , Fe: 6.65 ± 9.70 ; milk: As: 0.03 ± 0.01 , Cd: 0.001 ± 0.00 , Pb: 0.01 ± 0.01 , Zn: 3.07 ± 0.97 , Mn: 0.02 ± 0.01 , Cu: 0.10 ± 0.03 , Co: 0.003 ± 0.00 , Fe: 1.09 ± 0.68 in milk), Thambuththegama (serum: As: 0.04 ± 0.02 , Cd: 0.01 ± 0.00 , Pb: 0.04 ± 0.01 and Zn: 2.84 ± 0.69 , Mn: 0.04 ± 0.01 , Cu: 0.65 ± 0.30 , Co: 0.003 ± 0.00 , Fe: 0.004 ± 0.00 ; milk: As: 0.03 ± 0.03 , Cd: 0.04 ± 0.06 , Pb: 0.18 ± 0.11 and Zn: 12.03 ± 2.85 , Mn: 0.15 ± 0.0 , Cu: 0.20 ± 0.071 , Co: 0.002 ± 0.00 , Fe: 0.004 ± 0.00) and Kandy (serum: As: 0.03 ± 0.00 , Cd: 0.0003 ± 0.00 , Pb: 0.02 ± 0.005 and Zn: 0.71 ± 0.21 , Mn: 0.002 ± 0.00 , Cu: 0.37 ± 0.10 , Co: 0.002 ± 0.00 , Fe: 1.38 ± 0.60 ; milk: As: 0.02 ± 0.00 , Cd: 0.0003 ± 0.00 , Pb: 0.004 ± 0.00 , Zn: 3.07 ± 0.40 , Mn: 0.02 ± 0.00 , Cu: 0.07 ± 0.00 , Co: 0.001 ± 0.00 , Fe: 0.50 ± 0.13). Of the heavy metals, Cd and Pb concentrations were different ($P < 0.05$) in the three locations with the highest concentration in Thambuththegama and lowest in Kandy. The As concentrations were not different ($P > 0.05$) but were higher than the CODEX permissible level ($0.015 \mu\text{g/ml}$) for milk in all three locations. In Padaviya, As concentration was 0.78% and 24.16% higher in milk than that of Thambuththegama and Kandy respectively. Arsenic concentrations in blood from Padaviya and Thambuththegama were not different ($P > 0.05$) from that of Kandy. The As concentration in blood from Thambuththegama was 18.9% and 24.9% higher than that of Padaviya and Kandy respectively. The Cd and Pb concentrations in blood were different ($P < 0.05$) in three locations being highest in Thambuththegama and lowest in Kandy. Out of the total population, 76%, 52%, 28% showed higher As, Pb, and Cd in milk than in blood, respectively. This investigation revealed that there is a higher tendency for heavy metals to accumulate in bovine milk than in blood, which might contribute to human CKDu through the food chain. Further studies are going on in other CKDu identified areas of Sri Lanka.