Risk of environmental chemical contaminants associated with animal feeding in peri-urban areas of Kisumu Town

Charles Muleke Inyagwa [1*], Wekesa Sabesia[2], Kenneth Orengo[2], Price Amanya[3], Raymond Mdachi[4]

[1]Faculty of Veterinary Medicine and Surgery, Egerton University, P. O. Box 536-20115 Egerton, Kenya

[2] Central Veterinary Investigation Laboratories (CVIL), Kabete, Kenya

[3] Department of Agricultural Economics and Agri-Business Management, Egerton University

[4] Kenya Agricultural and Livestock Research Organization (KARLO), Kenya

[1*]Corresponding author: Charles Muleke Inyagwa, Egerton University, Kenya

Email: charles.muleke @egerton.ac.ke or cimuleke@yahoo.com. Phone No. +254722912661
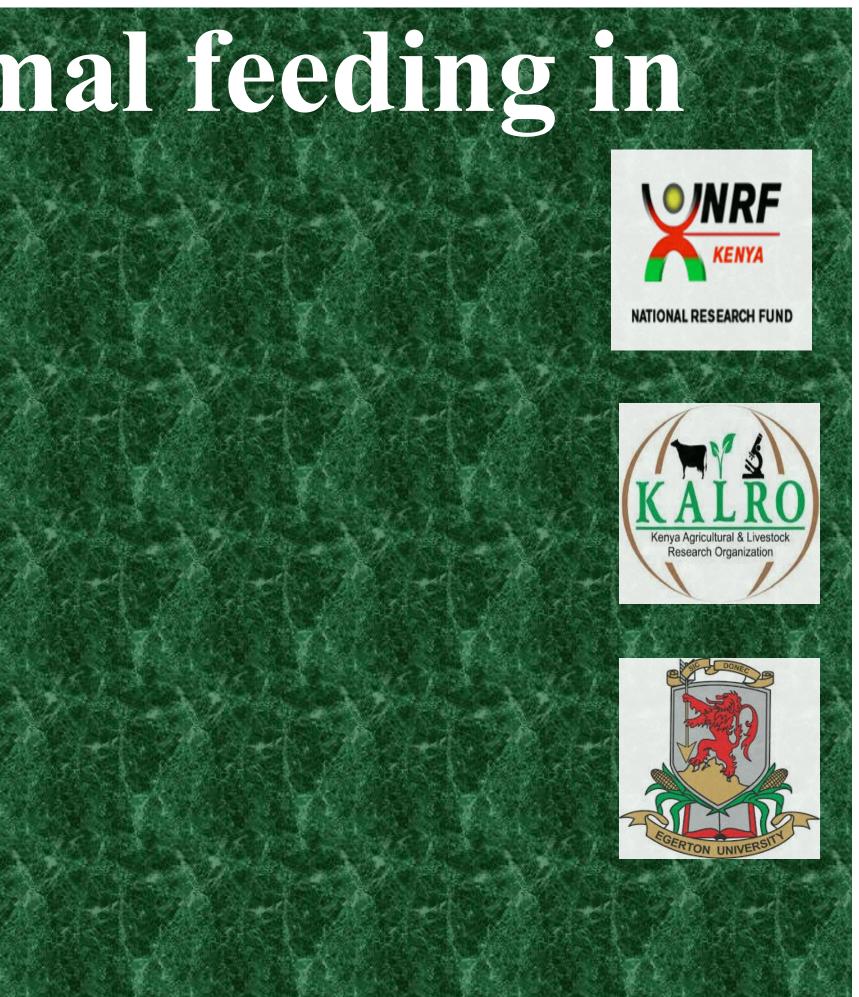
INTRODUCTION

This study sought to determine, quantify and disseminate the level of environmental chemical contaminants in the topsoil, water, pasture, milk, blood, feaces, kidney, and adipose tissues from cattle reared in peri-urban slum of Kisumu County. Various samples were collected from Mamboleo, Nyalenda and Otonglo in Kisumu County in the months of April and August 2019 respectively to determine possible seasonal or environmental variability of contaminants.

METHODOLOGY

Inductively Coupled Plasma Mass Spectrometry (ICP-MS) was used to identify and quantify the level of toxic heavy metals and the results were compared to WHO food safety limits. Flotation method was used to determine Helminths infections. Viable bacterial cell counts were determined using the Spread-Plate method. The heavy metals analyzed were: Lead (Pb), Mercury (Hg), Cadmium (Cd), Arsenic (As) and Copper (Cu). One-way ANOVA (Analysis of Variance) test was used to determine significant difference in the mean level of heavy metals.

RESULTS

- Three Lead (Pb) (Pb 206, Pb 207, Pb 208) and two Mercury (Hg) isotopes (Hg 199, Hg 202) were identified.

- Cadmium (Cd) and Arsenic (As) were either not detected or detected at levels below 1 part per billion (ppb).

- Significant difference in the mean levels of Hg199 and Cu among the sites.

- Lead (Pb), Mercury (Hg) and Copper (Cu) mean concentration levels detected exceeded the World Health Organization (WHO) tolerable food safety limits.

- Seasonal variation in the distribution of toxic metals with higher Lead, Mercury and Copper mean concentration levels in the second visit (August 2019 - month with most precipitation).

- There was an increase in helminths and mean FEC infections between 1st – 2nd visit.

Risk of environmental chemical contaminants associated with animal feeding in peri-urban areas of Kisumu town

CONCLUSIONS

The following conclusions can be made from finding of this study.

i) There were season variations of heavy metal concentrations with higher concentrations during the wet season (April 2019 – first visit).

ii) Average Lead (Pb), Mercury (Hg), and Copper (Cu) levels surpassed the WHO/FAO food safety limits while Cadmium (Cd) and Arsenic (As) were below WHO/FAO food safety levels.

iii) Environmental pollution from anthropogenic activities such as dumpsites, heavy metal contaminants and animal feeding practices such as free-range farming system positively influence the prevalence of helminth infections and food safety

iv) Prevalence of helminth infection increased between April and August 2019 while the total Fecal Egg Count (FEC) varied across sites and samples.

RECOMMENDATIONS

i) Policies that recognizes, enables and regulates urban agriculture as the legal situation on urban agriculture is unclear with most urban dwellers assuming it is illegal.

ii) A risk analysis and assessment policy approach should be implemented on identifying and characterizing environmental hazards, exposure assessment and risk characterization with emphasis on zoonoses, heavy metals, pesticides, microbial infections and helminths.

iii) In light of contamination from waste and anthropogenic activities policies highlighting an economic Cost Benefit Analysis on recycling and potential utilization of urban waste should be implemented.

iv) Public sensitization particularly among peri-urban farmers on the code of practice to ensure compliance to standards of food production systems, handling, processing and marketing.