

# Enhancing public health awareness on food safety risks associated with livestock feeding practices in the peri-urban slums of Kisumu city, Kenya.

**Presenter Name:** PROF. CHARLES MULEKE INYAGWA, PHD  
**Institution:** EGERTON UNIVERSITY  
**Country:** KENYA  
**Event:** 2<sup>ND</sup> MULTI-SECTORAL CONFERENCE ON STI

# Motivation, Problem Area

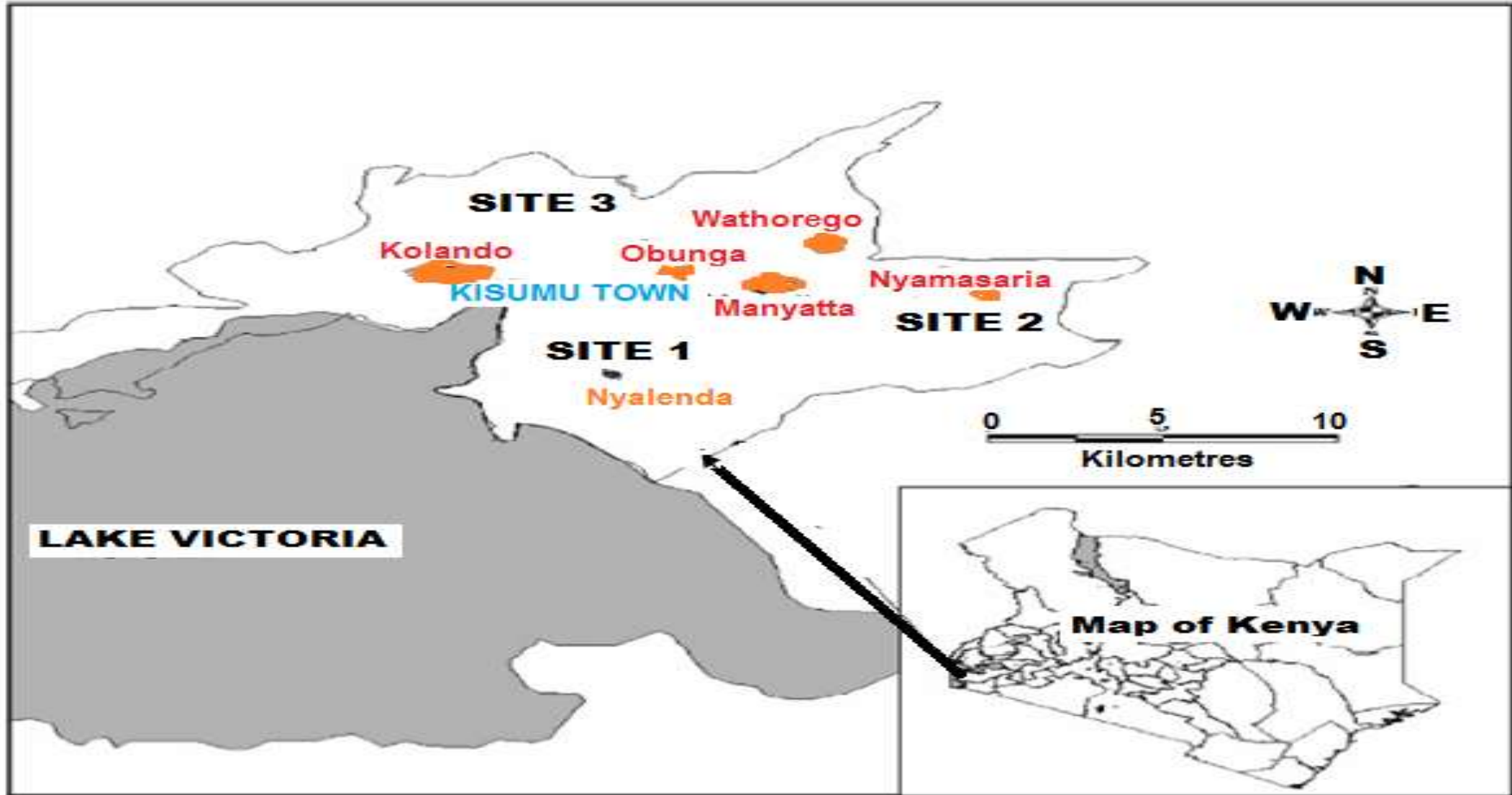
- ❖ Livestock kept in **urban slums** feed on waste dumpsite material and drink water **contaminated with** seepage from **industrial waste**.
- ❖ Peri-urban livestock farmers in Kisumu city **graze animals, harvest grass** around dumpsites or use **water ponds** in open spaces for **animal drinking**
- ❖ There is high risk of **food contamination** along the **animal-human food chain** from **heavy metals and microbial pathogens**.
- ❖ Kisumu city Urban slums was chosen since they have **high urban livestock population** but lacked adequate **waste management** and **water supply** posing risks of environmental contamination.
- ❖ Project contributed to **enhanced food safety** from **farm to fork** to **consumers in urban slums**



# Research Objectives

- 1) To **identify, characterise and disseminate** risk factors associated with livestock feeding and disease control practices in peri-urban slums of Kisumu city.
- 2) To **determine, quantify and disseminate** the level of toxic heavy metals in the topsoil, drinking water, forage, milk, blood, kidney, and adipose tissues from cattle reared in peri-urban slum sites of Kisumu city.
- 3) To **create stakeholder awareness** for minimizing risks of food safety in the peri-urban areas of Kisumu city.

# Research Approach, Methodology



## Study Sites -1, 2 & 3

**Study sites within peri-urban areas of Kisumu city:**

**Sites 1: Nyalenda, Obunga, Manyatta – Kachok --- animals feed and graze at the dumping site in urban slums**

**Sites 2: Nyamasaria, Mamboleo lie in a peri-urban area --- outskirts of the city with good animal husbandry practices .**

**Site 3: Chiga: 8 km - outskirts of the city slums with subsistence with poor animal husbandry.**

- The choice of the sampling **sites 2 and 3** is based on the fact that cows **graze freely** in their areas but **cannot reach the dumping site.**
- All 3-sites practice urban livestock keeping, have evidence of waste discharges from industrial firms with poor disposal practices

# Research Approach, Methodology

- **Objective 1:**
- A **semi-structured** pre-tested **questionnaire** was administered - **primary data analyzed** using **StataCorp 2011-** computer program.
- Questionnaire addressed **farmer characteristics, disease constraints, administration practices, milk production,** and regular **illnesses at farm level.**
- Descriptive statistics were calculated in form of cross tabulations, **means and frequencies.**

# Research Approach, Methodology

- **Objective 2:**
- 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/EC** food safety limits.
- The heavy metals analyzed were: **Lead (Pb), Mercury (Hg), Copper (Cu)**, Cadmium (Cd), and Arsenic (As).
- **Fecal Floatation method** used to determine **FEC & Helminth infections**.
- One-way ANOVA (Analysis of Variance) test was used to determine significant difference in the **mean level of heavy metals**.

# Research Approach, Methodology

**Table.1** Total number of samples collected in April 2019

<b>1<sup>st</sup> Visit</b>	<b>Soil</b>	<b>Water</b>	<b>Pasture</b>	<b>Milk</b>	<b>Blood</b>	<b>Tissue</b>
<b>Mamboleo</b>	13	20	22	20	20	20
<b>Nyalenda</b>	20	26	26	20	18	0
<b>Otonglo</b>	15	31	14	20	21	20

**Table.2** Total number of samples collected in August 2019

<b>2<sup>nd</sup> Visit</b>	<b>Soil</b>	<b>Water</b>	<b>Pasture</b>	<b>Milk</b>	<b>Blood</b>	<b>Tissue</b>
<b>Mamboleo</b>	24	13	21	11	18	12
<b>Nyalenda</b>	14	12	16	10	15	0
<b>Otonglo</b>	11	12	10	8	19	10

## Livestock feeding in a dumpsite in Nyalenda, Kisumu City



## Typical dumpsite in Kachok, Kisumu City

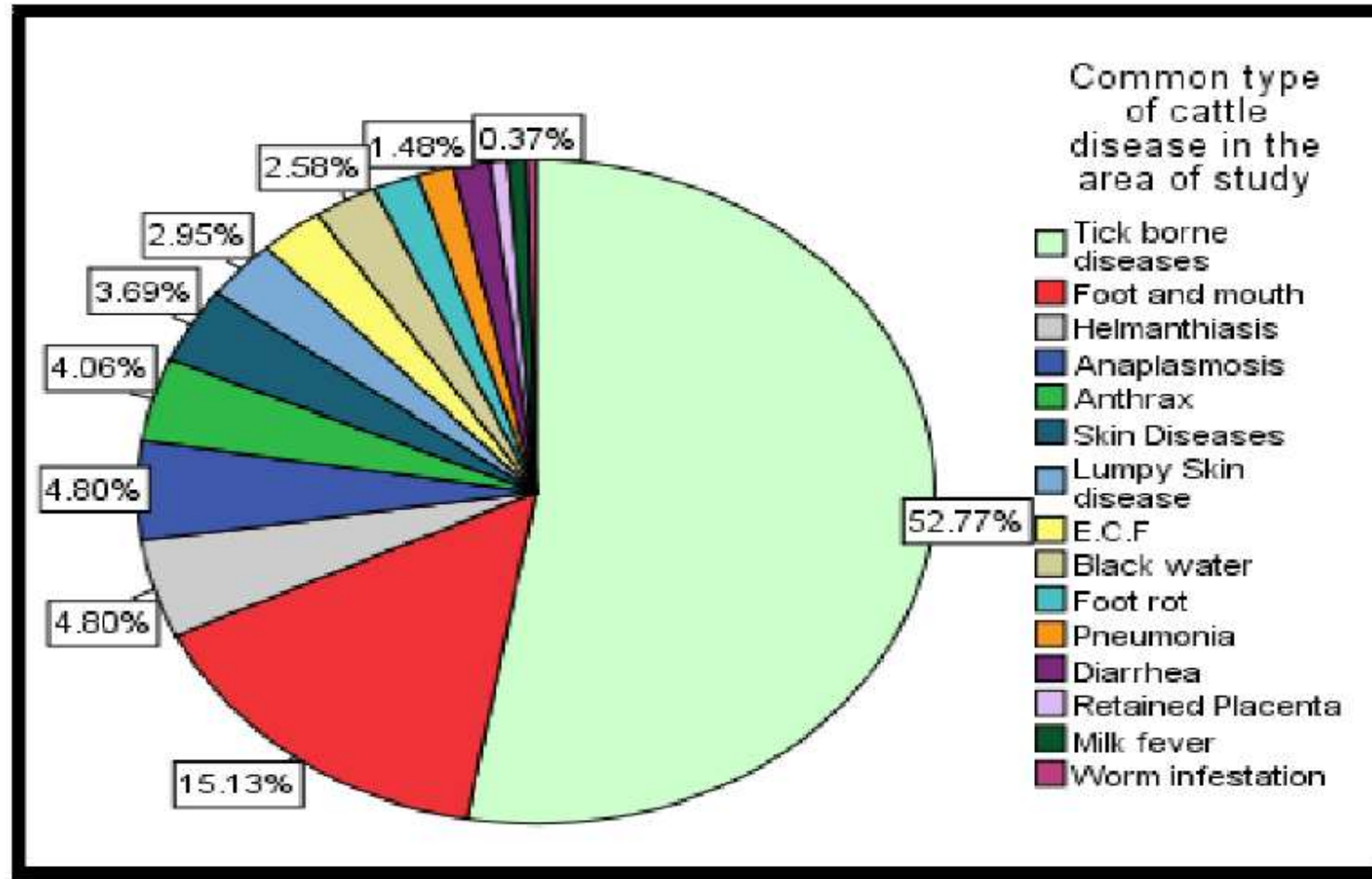


# Major Outcomes/Results

- a) **Two scientific papers** published
- b) **Two policy briefs** published and disseminated
- c) **Two extension posters** developed and disseminated
- d) Evidence on **heavy metals contamination** in Kisumu **generated and disseminated**
- e) Risk factors associated with livestock feeding in peri-urban slums **identified, and disseminated** to key stakeholders.
- f) **Disseminated** project findings at NACOSTI /NRF **Poster exhibition held at KICC**  
**7<sup>th</sup>/August/2019.**

# Major Outcomes/Results

- Identifiable production constraints - Tick-borne/Foot and Mouth Disease



# Major Outcomes/Results

Mineral Mg/Kg)	<u>Mamboleo</u>	<u>Nyalenda</u>	<u>Otonglo</u>	Permissible FAO/WHO	EC/CODEX
Lead (Pb)	9565.1mg/kg,	4252.47mg/kg	15891.95mg/kg	2mg/kg	0.2mg/kg
Mercury (Hg)	291.39mg/kg	6639.39mg/kg	325.18gm/kg	0.1gm/kg	0.3mg/kg
Copper (Cu)	9604.33mg/kg	5494.99mg/kg	4597.61mg/kg	30mg/kg	0.3g/kg

- ❖ Lead (Pb), Mercury (Hg) and Copper (Cu) mean concentration levels detected exceeded the World Health Organization (WHO) & EC/CODEX tolerable food safety limits
- ❖ Seasonal variation in the distribution of toxic metals - high Lead, Mercury and Copper levels during rainy seasons.
- ❖ Toxic metals concentrations due to automobile exhaust fumes, dry cell batteries and sewage effluents causing bio-accumulation in plants via uptake from the soil and eventual entry into the food chain.

# Major Outcomes/Results

**SCIENTIFIC PUBLICATION-1:-** JULY 2020: *International Journal of Innovative Research & Development -*  
DOI No. : 10.24940/Ijird/2020/V9/I7/JUL20038



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## Risk Factors Associated with Livestock Feeding and Disease Control Practices in the Peri-Urban Slums of Kisumu City, Kenya

**Charles Muleke Inyagwa**

Associate Professor, Department of Veterinary Medicine and Surgery,  
Egerton University, Kenya

**Wekesa Sabesia**

Senior Research Officer, Central Veterinary Investigation Laboratories, Kabete, Kenya

**Kenneth Orengo**

Senior Research Officer, Central Veterinary Investigation Laboratories, Kabete, Kenya

**Price Amanyia**

Research Assistant, Department of Agricultural Economics and Agri-Business Management,  
Egerton University, Kenya

**Raymond Mdachi**

Senior Research Officer, Kenya Agricultural and Livestock Research Organization, Kenya

### **Abstract:**

*Livestock feeding practices present food safety concerns to consumers who are aware of food safety and their linkage to feeding practices. Domesticated animals kept in the peri-urban territories often feed on waste dump feeds and polluted waters. Consequently, animal feeds could be contaminated with potentially toxic metals and diseases which may lead to death and economic losses in lost trade opportunities. Objective of this study was to determine the risk factors associated with livestock feeding and disease control practices in the peri-urban slums of Kisumu City, Kenya. This was achieved through identifying, characterizing and disseminating peri-urban livestock feeding practices and constraints, and their effects on food safety as well as general well-being of livestock. Primary data was collected from 291 randomly selected smallholder livestock farmers in the peri-urban slums of the City by use of semi-structured questionnaires. Descriptive statistics inform of cross tabulations, means and frequencies were used to characterize peri-urban livestock feeding and disease control practices. The results revealed that 58% of the county residents were male while 42 % were female. Their ages ranged between 18 and 90years with a mean age of 55. Majority (74%) practiced both livestock and crop production while 26% kept livestock only. The farmers mainly kept indigenous cattle (97%) as opposed to exotic (3%). The prevalent livestock farming system was free range (93%) where most farmers grazed their livestock on open unutilized spaces and dump sites. Animals were kept for consumption (62%) and for income generation (32%). The main production constraints identified by farmers were diseases (65%) and lack of feed (20%). The diseases varied with region and animal species which included tick-borne diseases (53%) and foot and mouth (15%). Farmers obtained information on management and treatment of livestock largely from private veterinarians (64%). There is need to create policies on peri-urban slum livestock keeping practices, and waste management to reduce the risks associated with livestock feeding and diseases in Kisumu city.*

**Keywords:** Food safety risks, peri-urban, livestock feeding, Kisumu County

# Major Outcomes/Results

**SCIENTIFIC PUBLICATION-2** :- May 2022: *International Journal of Current Microbiology and Applied Sciences*. ISSN: 2319-7706 Vol. 11 No. 05, 170-181. <https://DOI.org/10.20546/ijcmas.2022.1105.021>



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Journal homepage: <http://www.ijcmas.com>



Original Research Article

<https://doi.org/10.20546/ijcmas.2022.1105.021>

## Risk of Environmental Chemical Contaminants Associated with Animal Feeding in Peri Urban Areas of Kisumu Town

Charles Muleke Inyagwa<sup>1\*</sup>, Kenneth Orengo<sup>2</sup>, Price Amanya<sup>3</sup> and Raymond Mdachi<sup>4</sup>

<sup>1</sup>Faculty of Veterinary Medicine and Surgery, Egerton University, P.O. Box 536-20115 Egerton, Kenya

<sup>2</sup>Central Veterinary Investigation Laboratories (CVIL), Kabete, Kenya

<sup>3</sup>Department of Agricultural Economics and Agri-Business Management, Egerton University

<sup>4</sup>Kenya Agricultural and Livestock Research Organization (KARLO), Kenya

\*Corresponding author

### ABSTRACT

The objective of this study was to determine, quantify and disseminate the level of environmental chemical contaminants in the topsoil, water, pasture, milk, blood, faeces, 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. 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 Helminth's 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. There were variations in mean heavy concentration levels between the two visits ( $p < 0.05$ ). Helminthosis was prevalent (59.5%) and total Fecal Egg Count (FEC) varied across samples. Study findings show varying heavy metal concentration levels which exceed WHO/FAO food safety limits implying livestock kept in peri-urban setting of Kisumu town are at a risk of ingest contaminated pasture, threatening food safety among consumers. This study recommends policies aimed at mitigating pollution from chemical contaminants and other anthropogenic activities and farmer sensitization on better farming system with limited risks on food safety and animal-human food chain.

#### Keywords


Toxic heavy metals, peri-urban, food safety, Kisumu town

#### Article Info

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10 May 2022


# Major Outcomes/Results

Poster for Dissemination at NACOSTI /NRF Poster Exhibition Held at KICC  
7<sup>th</sup>/8/2019 & 2<sup>nd</sup> Multisectoral Conference, 23-5-2023.



**Risk factors associated with livestock feeding and disease control practices in peri-urban slums: case of small holder farmers in Kisumu Municipality, Kenya.**

Muleke Charles, Orengo Kenneth and Mdachi Raymond  
Egerton University




**ABSTRACT**

Livestock feeding practices present food safety concerns to consumers who are aware of food safety issues and their linkage to feeding practices. Livestock kept in the urban slums where human population densities are high feed on waste dump feeds and contaminated water. There is the risk of contamination of animal foods with toxic heavy metals and associated illnesses, deaths and economic losses in lost trade opportunities. Knowledge of concentrations of heavy metals in livestock plasma, feeds, water and soils is important for assessing the effects of pollutants on foods and contaminant intakes by human. The objective for this project is to promote good livestock feeding practices within peri-urban slum producers to guarantee food safety to consumers. A study was undertaken to identify, characterize and disseminate risk factors associated with livestock feeding and disease control practices in peri-urban slums of Kisumu municipality. Primary data was collected from 291 randomly selected smallholder livestock farmers in Kisumu municipality, by use of semi-structured questionnaires. Descriptive statistics in form of cross tabulations, means and frequencies were used to characterize peri-urban livestock feeding and disease control practices. Results of this study indicate that most livestock farmers are not aware of health risks associated with peri-urban livestock farming, and livestock feeding and disease control practices in Kisumu municipality contribute to contamination of animal based products. The Government should regulate urban livestock farming systems by monitoring disease management practices, quarantine, quality control and food safety regulations. This study recommends creating awareness on better livestock management practices among farmers, better waste management and associations to aid farmers in negotiating their bargaining power and profits at large.


**RESULTS**

- Majority of the livestock farmers are not aware of health risks associated with peri-urban livestock farming.
- Livestock feeding and disease control practices in Kisumu municipality contribute to contamination of animal based products.



**DISCUSSION**

- i) The main risk factors and production constraints identified by livestock farmers were diseases, lack of animal feed and inadequate veterinary services sometimes leading farmers to treat livestock by themselves.
- ii) Majority (93%) of urban livestock farmers practice free range livestock production system which increases the risks of animals ingesting contaminated fodder and water.
- iii) Indigenous cattle (97%) were preferred in contrast to exotic cattle ((3%) with farmers citing resilience to diseases, availability and inability to sustain exotic cattle due to lack of funds (poverty).
- iv) Livestock farmers mostly utilized kitchen leftovers to supplement their livestock which may play a significant role in spread of diseases as these feeds are not inspected by veterinary officers.
- v) The main diseases among different species of livestock were diarrhoea, respiratory infections and tick borne diseases.
- vi) Marketing constraints were exemplified as: low market prices for livestock and agricultural products, exploitation by middlemen, lack of credit and poor infrastructure hindering accessibility to markets and extension services.




**CONCLUSIONS**

- Based on this study, most livestock farmers are not aware of health risks associated with peri-urban livestock farming.
- Livestock feeding and disease control practices in Kisumu municipality contribute to contamination of animal based products.


**RECOMMENDATIONS**

- Government should monitor disease management practices and food safety regulations.
- Public Education to create awareness on food safety risks.



**MATERIALS AND METHODS**

Primary data was collected from 291 randomly selected smallholder livestock farmers in Kisumu municipality, by use of semi-structured questionnaires. Descriptive statistics in form of cross tabulations, means and frequencies were used to characterize peri-urban livestock feeding and disease control practices.



*For further inquiries please contact:*  
**Prof. Charles Muleke Inyagwa,**  
 Faculty of Veterinary Medicine and Surgery  
 P.O. Box 536 – 20115, Egerton, Kenya  
 Tel: +254 51 221 7737 Mobile: +254 (0)722 912 661  
 Email: cimuleke@yahoo.com charles.muleke@egerton.ac.ke

# Major Outcomes/Results

## Project Poster for Dissemination

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

Charles Muleke Inyagwa<sup>1\*</sup>, Wekesa Sabesia<sup>2</sup>, Kenneth Orengo<sup>2</sup>, Price Amanywa<sup>3</sup>, Raymond Mdachi<sup>4</sup>

<sup>1</sup>Faculty of Veterinary Medicine and Surgery, Egerton University, P. O. Box 536-20115 Egerton, Kenya

<sup>2</sup>Central Veterinary Investigation Laboratories (CVIL), Kabete, Kenya

<sup>3</sup>Department of Agricultural Economics and Agri-Business Management, Egerton University

<sup>4</sup>Kenya Agricultural and Livestock Research Organization (KARLO), Kenya

<sup>1\*</sup>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, faeces, 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 1<sup>st</sup> - 2<sup>nd</sup> visit.

# Major Outcomes/Results

## Project Policy Brief to Kisumu County Government

### **POLICY BRIEF**

#### **RISKS ASSOCIATED WITH PERI-URBAN LIVESTOCK FARMING: STUDY FROM KISUMU MUNICIPALITY, KENYA**

##### **Urban livestock farming versus public health**

The poverty rate as well as undernourishment is increasing in the majority of sub-Saharan African nations and cities. With the declining purchasing power and steady rising penury rate in the urban areas, many urban family units have countered by broadening of financial sources, the most outstanding being peri-urban and urban livestock farming. Livestock feeding practices present food safety concerns to consumers who are sentient of nourishment safety and their linkage to feeding practices. Domesticated animals kept in the peri-urban territories often feed on waste dump feeds and polluted waters. Consequently, animal sustenance could be tainted with potentially noxious metals and diseases which may lead to death and economic losses in lost trade opportunities.

Peri-urban livestock farmers in Kisumu municipality tend to graze, harvest grass around dumpsites or utilize water ponds in open spaces as animal drinking water due to scarcity of adequate feeds and water. This presents high risk of food contamination along the animal-human food chain from heavy metals and microbial pathogens. Furthermore, the fundamental focal point of previous studies in Kisumu municipality have been on advancing farming activities in rustic regions with the view that improved sustenance generation in rural zones can supply the extending urban populace. This has largely neglected peri-urban livestock farming, risk factors associated it as well implications on food safety and food security. This study sought to fill this knowledge gap by identifying, characterizing and disseminating peri-urban livestock feeding practices and constraints, and their ramifications on food safety as well as general well being of livestock.

##### **Urban livestock farming in Kisumu municipality**

The findings indicate that majority of urban farmers practice free range livestock production system which increases the risks of animals ingesting contaminated fodder and water. A significant proportion of farmers had attained upper primary edification which could be advantageous in sensitization and creating awareness on better livestock keeping practices. Mixed farming dominated over pure livestock production. Indigenous cattle were preferred in contrast to exotic cattle with farmers citing resilience to diseases, availability and inability to

# Major Outcomes/Results

## Project dissemination- Kisumu County



# Major Outcomes/Results

## Project dissemination- Kisumu County



# Objective 1

## Conclusion and Outlook

- ❖ Lack of **awareness of health risks associated** with peri-urban livestock farming.
- ❖ Contaminated **animal based products pose food safety risks.**
- ❖ County Government of Kisumu to **adopt project policy brief** to reduce the risks associated with livestock feeding practices in the city.
- ❖ **More peri-urban farmer sensitization workshops** to **reduce** on food safety **risks along animal-human food chain.**



# Objective 2

## Conclusion and Outlook

- ❖ Average **Lead (Pb), Mercury (Hg), and Copper (Cu)** levels **exceeded** the **WHO/FAO & EC/CODEX** food safety limits.
- ❖ Environmental **pollution** from **dumpsites** increased the food safety **risks** due to **metal and helminth infections**
- ❖ County Government of Kisumu to **adopt project policy briefs**
- ❖ Need for more **peri-urban farmer sensitization workshops**



# CONTACT US



Prof. Charles Muleke Inyagwa, PhD  
Egerton University  
P.O. Box 536 – 20115, Egerton, Kenya  
Mobile: +254 (0)722 912 661  
[charles.muleke@egerton.ac.ke](mailto:charles.muleke@egerton.ac.ke)



Thank  
you

