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

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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*

1. Introduction

Livestock keeping in peri-urban areas nourishment security and gives effectively convertible resources that empower the poor to have money to cover school fees, medicinal costs and day to day financial requirements (Schiere, 2000). Embracing peri-urban livestock rearing empowers the poor to broaden livelihood opportunities with available choices to the susceptible groups. Food safety is a growing concern in the peri-urban areas dependent on food chains (Shimshoni, 2017). Safe, good quality sustenance is vital to food security, general wellbeing and monetary improvement since it promotes trade. The production of safe food of animal origin is the task of livestock farmers, animal feed suppliers, public health officials and extension agents who are deemed stakeholders. Majority of livestock keepers in the peri-urban focuses are susceptible groups of female headed family units, youths, retired individuals, widows and the less educated who regularly utilize tainted water for domesticated animals because of poverty and scarcity of resources. The wastewater and fertilizer residue released locally are of ecological concerns (FAO, 2007).

Livestock feeding practices impacts candidly on the production of safe nourishment, trading of food and sustenance security (Barnes, 2018). To guarantee food sanitation, security and non-interruption of trade, code of practice on good animal feeding (CAC/RCP, 2004) was launched in 2004 for joint implementation efforts including national experts and the private sector (FAO, 2007). The target of the code is to guarantee safe human nourishment utilization through adherence to great animal feeding practices at the ranch level and Good Manufacturing Practices(GMPs) during procurement, handling, processing, preparing and dissemination of animal feed and feed ingredients for sustenance producing animals. The Code applies to the production and utilization of all materials bound for animal feed and feed ingredients at all dimensions, regardless of whether delivered modernly or at homestead level. This encompasses grazing or free-range feeding, forage crop and aquaculture.

Majority of primary, secondary and key stakeholders involved in peri-urban livestock keeping sector are unaware of the use of the Codex Code of Practice on Good Animal Feeding for limiting potential risks. With livestock population steadily increasing with the development of human masses in the urban slums, there is need to train food safety regulators, inspectors, feed and livestock industry personnel, and farmers for the production of safe feed (Waters, 2016).Kisumu town, a lakeside city in western Kenya, is predominated with small enterprises dealing with metal works, car garages (Jua Kali Sheds) and construction works that pose a risk of contamination to the environment with hazardous substances including heavy metals. Kisumu County government collects and dump solid wastes at a Nyalenda - Kachok dumpsite. The waste is mainly from the city's supermarkets, industries, petrol stations, residences and markets.

Peri-urban livestock farmers tend to graze or harvest grass around this dumpsite due to scarcity of adequate feeds and water. Nonetheless, peri-urban livestock farmers in Kisumu municipality also graze livestock near the dumpsite and utilize water ponds as animal drinking water which may be contaminated. 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 on farming advancement activities has been on rustic regions with the view that improved sustenance generation in rustic zones can supply the extending urban populace. This has largely neglected peri-urban agriculture, risk factors associated with urban livestock feeding practices as well implications on food safety and security. It is therefore on this basis that this study is geared toward filling the knowledge gap on risk factors associated with livestock feeding and disease control practices in Kisumu County, Kenya. Objective of this study was to identify, characterize and disseminate peri-urban livestock feeding practices and constraints, and their ramifications on food safety as well as general well-being of livestock. This study also contributes to the body of knowledge on developing and maintaining a food safety system from farm to table involving all the stakeholders along the food chain for enhanced food safety from livestock reared in the urban slums of Kisumu city, Kenya.

2. Methodology

2.1. Study Area

The study was undertaken at the shore of Lake Victoria, Kisumu city and its environs within the area limits of 00° 51' South and Longitude 00°41' North and longitudes 33° 20'- 35°20' East and an altitude of 528 meters above the sea level. Location of the study sites within peri-urban areas of Kisumu city were as follows: Sites 1: Nyalenda Obunga, Manyatta - Kachok: whose animals feed and graze at the dumping site in urban slums - suspected to be polluted with the metals. Sites 2: Nyamasaria, Mamboleo lie in a peri-urban area: 8 km – north eastern outskirts of the city with relative high animal husbandry. Site 3: Otonglo located in Chiga: 8 km- eastern outskirts of the city slums with subsistence with light animal husbandry. The choice of the sites 2 and 3 was based on the fact that animals graze freely in these areas but cannot reach the dumping site where only those from site 1 (Nyalenda, Obunga, Manyatta, Kochak) access for forage. Nearly 65 % of Kisumu's population subsists in the informal settlements and an additional 50 % of the inhabitants are engaged in some type of urban agriculture and livestock keeping, (Ishagi*et al*., 2002).

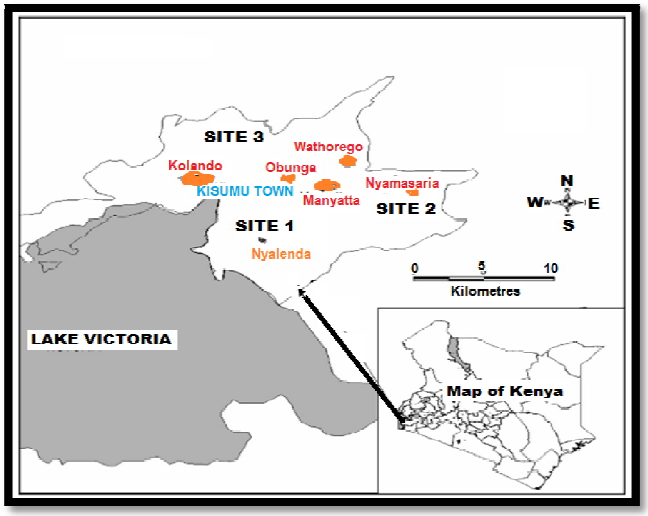

Figure 1: Map of Kenya (Inset), Bolded the Study Sites 1, 2 And 3 in the Peri-Urban Precincts of Kisumu City (Courtesy: Maoulidi, M., 2012)

2.2. Research Design and Data Management

Field visits were undertaken to purposely select study sites 1, 2 and 3(see Fig. 1) in collaboration with the County/ Sub-County Veterinary Officers, Sub-County and Ward administration personnel. Study sites headed by village/ward chairperson were demarcated on the basis of having a higher concentration of livestock keeping in the urban and peri-urban areas within Kisumu city. At each study site, the farmers were randomly selected based on a list from previous animal disease vaccination campaigns availed by the county and sub-county veterinary officers in Kisumu County. A semi-structured pre-tested questionnaire was administered to household heads or responsible persons (if the household head was not available) using *swahili* language, which is common in the area. Primary data was collected from 291 randomly selected smallholder livestock farmers in the urban and peri-urban slums within city. The questionnaires addressed: farmer characteristics, spatial attributes, size of land, system of tenure, livestock kept on the farm, production systems and disease constraints, administration practices, milk production, and regular illnesses at farm level. Descriptive statistics in form of cross tabulations, means and frequencies were used to identify and characterize the risk factors associated with livestock feeding and disease control practices in the city slums. Data management involved cleaning the filled questionnaires for errors and coding of the statistical variables. Data was then analyzed using the Statistics Computer Program (Stata Corp 2011) to characterize and identify distinct groups by the production objectives, level of regulatory supervision on food safety, level of market orientation, level of consumer pressure for compliance with food safety and quality controls, education level and farmer experience of the farmers.

3. Results

3.1. Farmer Socio-Economic Characteristics in the Peri-Urban Slums of Kisumu City

The results indicate that 58% of the respondents were male while 42% were female (see Table 1). Majority (25%) of the respondents were aged between 61 to 70 years with an overall sample mean age of 55 years (see Table 2). Thirty six percent (36%) of the farmers had reached upper primary level of education, 27% had secondary education, 14% had no formal education, 13% had lower primary education and 10% had attained tertiary level of education such as colleges and universities (see Table 1). Inhabitants were educated with over 9 years of schooling with a mean of 7 members per household (see Table 2). Fifty one percent (51%) of respondents did not engage in other off-farm activities besides farming practices while 49% participated in other non-farming practices such as fishing, masonry (see Table 1). Twenty nine percent (29 %) of respondents were occupied with shops and kiosks, masonry and carpentry (5%), livestock trading (1%), fishing (2%) and other occupations (12%) (see Table 1).

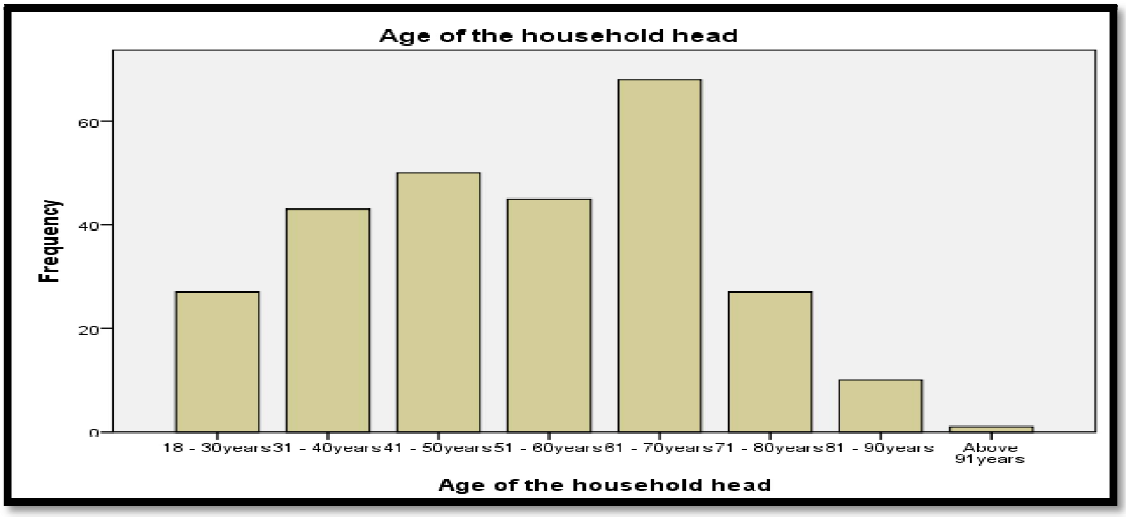

Figure 2: Age Distribution of the Household Heads in the Peri-Urban Slums of Kisumu City

Ninety seven percent (97%) of inhabitants had access to water *(drinking, cooking)* while 3% had no access. Farmer water sources included: tap water from the Kisumu City (68%), boreholes and nearby wells (17%), rivers (11%), flood water and water ponds (2%), Lake Victoria (2%) and water vendors (1%). Majority (65%) of farmers had access to agricultural and veterinary extension services while 35 % had no access (see Table 1). Eighty percent (80%) of respondents had title deeds while 20% did not. In addition, 80% of land was privately owned and 19% was owned by the community. Less than 1% of the inhabitants were tenants residing in residential houses and did not own land (see Table 1). The average land size was 0.8 acres. Farmers had an average of 2 contacts per year with agricultural and veterinary extension agents. The average distance to the nearest extension offices was 5 kilometers (see Table 2).

Variables	Frequency	Percentage
Socio-economic characteristics		
Gender		
Male	156	57.56
Female	115	42.44
Level of education		
No formal schooling	38	14.02
Lower Primary	36	13.28
Upper Primary	97	35.79
Secondary	73	26.94
College/University	27	9.96
Non-farm activities		
Yes	133	49.08
No	138	50.92
Type of non-farm activities		
Shops/Kiosk	79	29.15
Livestock trading	3	1.10
Masonry and carpentry	13	4.80
Fishing	5	1.84
Access to water		
Yes	264	97.42
No	7	2.58
Sources of water (*drinking, cooking)*		
Tap water	185	68.27
Well/borehole water	46	16.97
River water	30	11.07
Flood/water pans	6	2.21
Lakes water	4	1.48
Other (Water vendors)	1	0.36
Access to veterinary extension services		
Yes	176	64.94
No	95	35.06
System of tenure		
With title deed	216	79.70
Without title deed	55	20.30
Type of land ownership		
Private	218	80.44
Community	52	19.19
Other (tenant)	1	0.38

Table 1: Farmer Socio-Economic Characteristics (Categorical Variables)

Variables	Mean	Standard deviation
Years of schooling	8.58	4.89
Household size	7.05	3.92
Members involved in income generating activities	1.70	1.56
Years of practicing agriculture	17.72	13.03
Average size of land owned *(acres)*	0.80	0.94
Contacts with veterinary extension *(per year)*	2.02	2.82
Distance to nearest veterinary services *(Kms)*	5.22	3.86
Average number of livestock owned	21.98	21.21
Average household milk consumption *litres/day)*	1.33	1.30
Average amount of milk sold *(litres/day)*	0.44	1.62
Average cost of treating livestock *(ksh)*	4230.67	6473.40

Table 2: Farmers Socio-economic Characteristics (Continuous Variables)

3.2. Farm and Livestock Production System in the Peri-Urban Slums of Kisumu City

Inhabitant farmers surveyed had kept livestock for an average of 18 years (see Table 2). Twenty-six (26%) practiced pure livestock production while 74 % were mixed farmers. Ninety seven percent (97%) of cattle kept were indigenous while 3% were exotic. Reasons for keeping indigenous cattle were: affordability and ease of management (72%), disease resistance (16%) and local availability (4%). Exotic cattle were kept due to their high milk and meat

production (see Table 3). Reasons for keeping livestock were: income generation (33%), cultural purposes (3%) and domestic consumption (62%). The main livestock production systems were free range (93%) and zero grazing (7%) (see Table 3). Average number of animals per households was 22 (see Table 2). Sixty-six percent (66%) of farmers used family members as source of labor while (34%), hired labor. Materials used for constructing ruminant housing were: wooden (35%), metallic (24%), concrete (5%) and mud (11%). Twenty-five (25%) of ruminants were tethered outside the household compound (see Table 3).

Variables	Frequency	Percentage
Farming activities		
Livestock production only	70	25.83
Both crop and livestock production	201	74.16
Type of livestock		
Indigenous	263	97.05
Exotic	8	2.95
Reasons for choice of type livestock		
Affordability	196	72.32
Resilience (hardy)	43	15.87
Availability	12	4.42
Others *(Norm, lack of feed, income etc)*	20	7.38
Reason for keeping type of livestock		
Income	90	33.21
Domestic consumption	169	62.21
Cultural purposes	8	2.95
Others *(Collateral, ploughing)*	4	1.48
Livestock farming system		
Free range	252	92.99
Zero grazing	19	7.01
Ruminant housing material		
Wooden	94	34.69
Metallic	65	23.99
Concrete	14	5.17
Mud	31	11.44
Other (tethering)	67	24.72
Source of labor		
Family members	180	66.42
Hired	91	33.58
Concrete	14	5.17
Mud	31	11.44
Other (tethering)	67	24.72
Type of supplement		
Market and kitchen left over	101	37.27
Brewer's waste *(machicha)*	2	0.73
Hay/Napier grass	19	7.01
Commercial supplement	7	2.58

Table 3: Farm and Livestock Production System in the Peri-Urban Slums of Kisumu City

Fifty four percent (54%) of farmers did not provide supplementary feeds other than natural grazing (see Fig. 3). Forty four percent (44%) of farmers supplemented their animal feeds using local supplements from the garden and nearby open spaces while 2% used commercial feeds. Local supplements consisted of kitchen left over's and market waste (37%), hay and Nappier grass 7% while less than 1 % consisted of brewer's waste (Machicha) (Table 3).

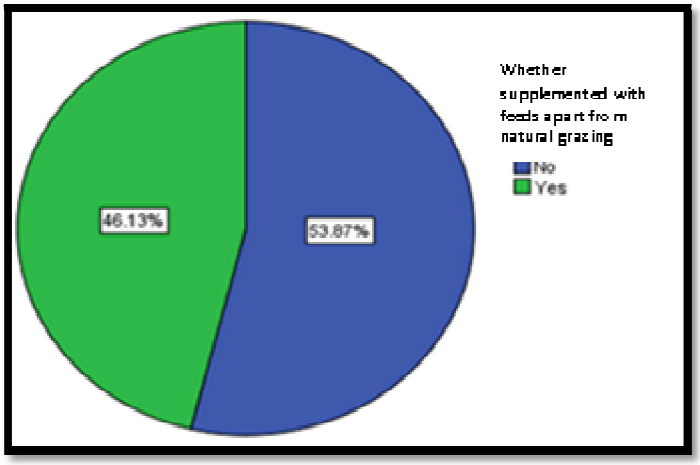

Figure 3: Farmers Using Supplementary Livestock Feeds Apart from Natural Grazing

3.3. Livestock Production Constraints in the Peri-Urban Slums of Kisumu City

The results show that 63% of the farmers milked their cattle while 37% did not. Milk was produced for domestic consumption (69%) while (7%) was sold. The average volume of milk consumed was 1.3 litres and 0.4 litres sold (Table 4). Production constraints included: diseases (65%), lack of animal feed (19%), inadequate veterinary services (6%), stock theft (4%), lack of labor (3%), and poor genetic fertility (1%). and other constraints (2%) such as: poverty, drought and premature death. Marketing constraints were: low prices for livestock products (42%), exploitation by middle men (30%), lack of credit (3%) and poor infrastructure (2%) (see Table 4). Sixty-four farmers (24%) could not identify marketing constraints associated with livestock feeding and production. The most prevalent disease in cattle were: tick-borne diseases (53%), foot and mouth (15%), anaplasmosis (4%), helminthosis (4%) and anthrax (4%). Other diseases included: milk fever (0.37%), foot rot (1.5%) and black water (3%) (see Fig. 4).

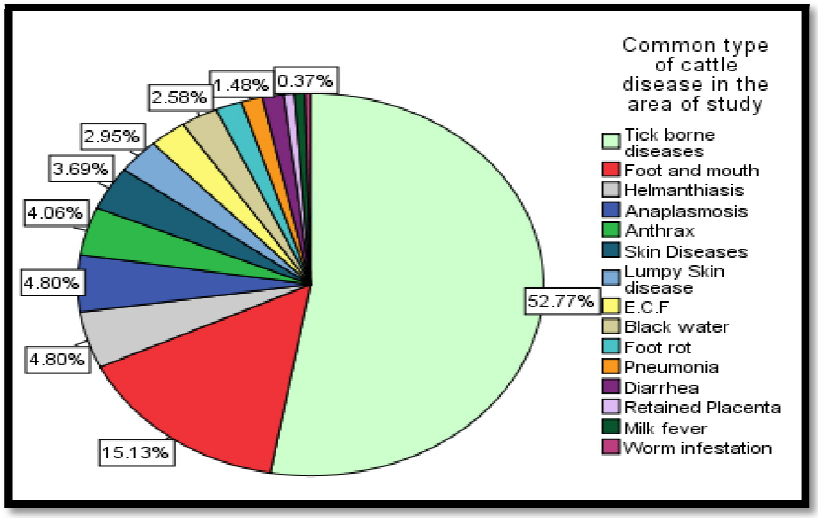

Figure 4: Common Cattle Disease Constraints in the Peri-Urban Slums of Kisumu City

The common pig diseases were: diarrhea (5%), respiratory infections (0.4%), mange (0.4%) and African swine fever (3%). Common poultry diseases were: Newcastle disease (13%), chicken pox (21 %), diarrhea (33 %) and respiratory infections (24%) (see Table 4). Ticks were the most common disease transmitters among ruminants. Farmers obtained information on management and treatment of livestock largely from private veterinarians (64%) (see Table 4). The average cost of livestock production and management at the household level was depicted as 4300 Kenyan shillings (see Table 2).

Variable	Frequency	Percentage
Milking Livestock		
Yes	171	63.10
No	100	36.90
Milk Utilization		
Consumption	188	69.37
Selling	19	7.01
Production Constraints		
Diseases	175	64.58
Lack of Feed	51	18.82
Poor genetic fertility	5	1.85
Lack of labor	7	2.83
Inadequate veterinary services	16	5.90
Stock theft	12	4.43
Other (*poverty drought, premature death etc*)	5	1.85
Not aware	0	0.00
Marketing Constraints		
Low agricultural prices	113	41.64
Exploitation by middlemen	82	30.26
Lack of credit	7	2.58
Poor infrastructure	5	1.85
Not aware	64	23.62
Common chicken diseases		
Newcastle disease	39	13.39
Respiratory Infections	65	23.99
Chicken pox	58	21.40
Diarrhea	89	32.84
Others *(lameness, theft etc)*	3	1.11
Not aware of any diseases	17	6.27
Source of agricultural information		
Private veterinarians	172	63.47
Government veterinarians	27	9.96
Agro-Vet Shops	47	17.34
Farmer to Farmer	27	9.96
Radio	12	4.43
Television	4	1.48
Farm magazines	1	0.37
Others*(Agricultural exhibitions, relatives)*	8	2.95

Table 4: Constraints to Livestock Production in the Peri-Urban Slums of Kisumu City

4. Discussion

The 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. The results showed that (93%) of inhabitant farmers grazed their animals in open land spaces, particularly government and metropolitan lands. These findings concur with those of Mougeot, 2000; Mekuriaw, 2014, who reported that urban livestock farmers grazed livestock along roadsides and in waste dumps. The presence of unfenced open land often acts as alternative grazing fields for urban livestock keepers. Grazing by the road sides and in rubbish dumpsites is not only a nuisance, but also poses a food safety risk for the transmission of zoonotic diseases.

As in many other African societies, most of the families in the current study were male-headed (58%). In this study, most farmers, (55%) were more than 45 years old and had been keeping livestock for a period of more than 15 years. Animals were kept mainly for domestic food and financial purposes, and ownership rights were vested primarily in men. These finding concur with those by (Jacobi *et al*., 2000; Slater, 2001; Danso *et al*., 2004), who reported that men mostly owned livestock while women claimed a few to no assets. Majority of the farmers kept ruminants, pigs, chicken and ducks and had an educational level ranging from lower primary to tertiary suggesting that exposure to basic or higher education might make it easier to educate farmers on improved livestock production and help them diversify the types of animals kept for increased income. The average land size owned by peri-urban slum farmers within Kisumu City was 0.8 acres. This observation is similar with findings in Kumasi city, Ghana, Drechsel *et al*. (2003), who reported, that 85% of the livestock kept were on small plot-sized packages of land of less than a half of an acre as opposed to rural areas where land sizes are relatively bigger. Most of the urban farmers have small land parcels which could hinder livestock production and other farming strategies.

Majority (97%) of the Kisumu city peri-urban slum farmers kept indigenous cattle while 3% kept exotic breeds of cattle. This is in contrast with findings by Smith (2010) who reported that small-scale dairy farming characterized with

exotic breeds was widespread in many sub-Saharan cities such as Nairobi and Dar es salaam. Lack of intensive farming within Kisumu city peri-urban slum livestock keepers could be attributed to less farmer education and minimum exposure to modern agricultural technology. Exotic livestock are frequently affected by diseases which could discourage Kisumu Cityperi-urban slum farmers from keeping them. As reported elsewhere, Kisumu is tropical in nature, livestock could be prone to vector-bone diseases caused by various ect- and endo-parasites. This could be the main reason why indigenous animals where kept since they are resilient and require minimal animal health care and farm inputs. These findings concur with those by Mlozi *et al*. (1992) who reported that urban farming in developing nations, especially tropical areas faces numerous limitations viz: animal diseases, low prices of agricultural products, conflicts, poor genetic fertility and exploitation by middlemen.

The main cattle diseases constraints to livestock production in Kisumu County were: tick-borne diseases, foot and mouth, anaplasmosis, helminthosis, anthrax, diarrhea, milk fever, foot rot and black water. These constraints have been cited by other studies conducted in cities in developing countries, Graefe *et al., (*2008) and Barnes *et al*., (2018), who reported that cattle diseases such as anthrax, tick-borne diseases and black water were widespread in tropical sub-Saharan Africa and could be attributed to unlawful animal movements to neighborhood markets and abattoirs. The rampant disease incidence within the peri-urban slum livestock keepers in the citycould be attributed to the free-range livestock production system that is widespread in the areas of study.

Farmers interviewed mainly relied on private veterinarians (63.47%), government veterinarians (10%), and Agro-Vet Shops (17.34%) for advice on management and treatment of livestock ailments. In Kumasi, Ghana, 39% of livestock keepers reported that they used the government veterinary service for animal health care problems but they also carried out many treatments themselves, (Poynter, 2001). In this study, most of the extension service providers were located at an average distance of 5 km from each farm and thus farmers would not be able to walk to their premises and seek their services. It is probably, the long distance to veterinary offices that contributed to farmers utilizing the alternate readily available private veterinarians and Agro-Vet Shops in this study. This type of scenario was also observed in the City of Kumasi, Ghana, by Afrane *et al*. (2004) who reported that over half of livestock farmers utilized private veterinarians for advice on livestock management as opposed to the government once. Studies elsewhere, in the rural Busia city, Kenya, Machila *et al*. (2003) reported that lack or absence of veterinary services caused farmers to traverse long distances to access them leading to many livestock deaths in the rural and urban farming communities. The extension services in Kenya were privatized in late 1980s as part of the World Bank Structural Adjustment Programme, (Oruko *et al*. 2000), the scenario was complicated by the creation of 47 county governments under which veterinary services were fully devolved and underfunded. This has created a negative impact on veterinary service extension service delivery as most resource poor farmers are unable to pay for the services of either government or private veterinarians (Oruko *et al*. 2000). With the high level of poverty amongst the peri-urban slum livestock farmers, subsidized veterinary extension services could easily improve the control of major livestock disease constraints and thus ensure food security in the cities.

5. Conclusions

- The livestock feeding practice in the peri-urban slums within Kisumu City can be described as open free-range grazing production system characterized by animals grazing along the roadsides, open government metropolitan land spaces and in waste dumpsites which is not only a nuisance, but poses a food safety risk for the transmission of zoonotic diseases.
- Majority of the peri-urban slum farmers practiced mixed farming engaging in both livestock and crop production and nearly all farmers kept indigenous cattle as opposed to exotic.
- The main production identifiable production constraints were diseases (tick-borne diseases and foot and mouth) and lack of animal feeds.
- Major of the risks associated with livestock feeding in peri-urban slums of Kisumu City were: zoonosis, diseases (tick-borne, helminthosis), dumpsites feeds contaminated with toxic materials and natural grazing on poor quality pastures.
- Urban slum farmers relied mainly on private veterinarians and Agro-Vet Shops for advice on management and treatment of livestock ailments.
- Based on these conclusions the project developed policy statement for adoption by the County Government of Kisumu to reduce the risks associated with livestock feeding practices the city.

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