

An Assessment of Good Hygienic Practices in the Small holder Broiler Meat Chain in Nairobi and Thika that impact on Food safety



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DEDICATION

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ABSTRACT

This study assesses good hygienic practices in the Broiler meat Chain in the peri urban areas of Nairobi and Thika.

Data for the study came was derived from desk studies, farmer survey and case studies. Two government acts and a proposed bill were perused to determine what aspects they cover for each level. Information about organization of smallholder chain was obtained from the researcher's own knowledge about the chain and was supplemented by information gathered from interviews with various chain actors. 40 farmers, 23 from Nairobi and 17 from Thika peri urban areas, were interviewed during the survey using a pre structured questionnaire. One trader/ middlemen and two retailers were interviewed to assess their hygienic practices. An official from the Ministry of Livestock Development was also interviewed

The study revealed that smallholders rear broilers in small batches of between 100 -500 batches in cycles ranging from 3- 6 times per year. It also emerged that majority of the broiler farmers did not consider broiler farming as a main income source.

Using the a combination of chain and HACCP models the study focuses on each level and determines current practices and how they pose a safety risk, and level of compliance with existing good hygienic practice

This study concludes that awareness of hygienic practices by chain actors exists but compliance of the same is low. Finally in order to enhance good hygienic practices by chain actors, several, recommendations to farmers and central government have been proposed.

1.0 INTRODUCTION

1.1 Background

Animal protein plays an important role in the provision of a balanced diet and thus must be safe for human consumption. The safety of foods of animal origin implies that they must be free from animal pathogens that can infect man as well as from any chemical residues. Of late the issue of food safety in the world has emerged as one of growing importance due to a series of highly publicized food scares such as *Salmonella*, *Bovine spongiform encephalopathy* (BSE) and more recently Highly Pathogenic Avian Influenza (HPAI). These together with genetically modified foods have increased public awareness of possible safety threats through food consumption.

In Kenya, increasing urban populations and rising incomes have contributed to an increased demand for livestock products. Coupled with this has been the increase in health consciousness amongst consumers leading to replacement of red meat with white in many urban households. This increase in demand has led to the rise of commercial broiler production systems in the peri urban areas of Kenya. Hence, practically all broiler populations, (93 %), are located close to the capital city, Nairobi, and other cities such as Mombasa and Kisumu, and other large towns. Within these commercial systems, the smallholder broiler meat chain forms a vital core in meeting this growing demand in the urban areas. Moreover, the chain provides benefits to a myriad of actors. Thus apart from the farmers themselves, the chain directly and indirectly supports the livelihoods of traders and employees of other jobs created by the chain such as the feed industry, equipment suppliers, veterinary drug suppliers, butchers as well as eating places. However due to the fragmented nature of the smallholder broiler meat chain, ensuring food safety control has been a challenging task. Thus, whilst current animal production methods cannot be expected to achieve a zero risk, there is need to reduce the risk and where possible, eliminate it at the 'on the farm stage'. Thus the current use of terms 'farm to table' or 'farm to fork' clearly identify the farm as one part of the production chain which must be considered in terms of food safety.

Hence assessments of food safety risks have to begin at the farm, as on farm activities greatly influence everything else that must be done during the processing and distribution of food.

1.2 Problem Statement

The smallholder broiler meat supply chain comprises a multitude of food handlers and middlemen extending the production, processing and distribution chain that exposes the broiler meat to a greater risk of contamination

1.2.1 Research Objective

The objective of the research is to assess the hygienic practices by actors in the smallholder broiler chain that impact on food safety in Kenya.

1.2.2 Main Research Question 1

What is the current legal framework for food safety regulation?

Sub Questions

1. What are the current food safety standards for chicken meat?
2. What are the voluntary standards with regard to broilers?

3. What is needed by actors in the smallholder broiler chain to comply with set food safety standards?

1.2.3 Main Research Question 2

What are the good hygienic practices amongst actors within the smallholder broiler value chain?

Sub questions

1. How is the small holder broiler chain organised?
2. What are the levels of awareness of and hygienic practices amongst at the smallholder broiler producer level?
3. What is the level of awareness and of hygienic broiler meat handling practices by broiler meat traders?
4. What is the level of awareness of and hygienic practices amongst broiler meat retailers?
5. What are gaps in awareness and practice of good hygienic practices within the smallholder broiler chain?

1.3 Study area

The research was conducted in Nairobi and Central Provinces, specifically Kasarani and Thika Districts. Both sites are largely peri urban with similar agro ecological zones and small scale livestock rearing activities are highly regarded as an important source of additional household income. With regard to broiler production, both districts boast of high populations within their respective provinces and thus provided a good base for conducting the study.

1.4 Research Strategy

The research was done by means of desk study, survey and case studies

Prior to and during the field work, a desk study was conducted in which various sources of information such as scientific journals, textbooks and internet sites were referred to, with an aim of gaining further insight into safety issues pertaining to chicken meat within the broiler meat chain. In addition various Kenyan regulations and policies such as the Meat Hygiene Act, The Public Health Act and the Agriculture Sector Bill were perused in order to understand the legal requirements pertaining to handling of chicken.

The field research was conducted in the Kasarani and Thika districts between July and August 2008.

A courtesy call to the offices of the Provincial Director of Veterinary (PDVS) and the Provincial Livestock Production Officer (PDLPO) was done to inform them about the research and to link the researcher with the respective field officers. This was done in order to facilitate smooth collection of data within the prescribed period.

A total of forty broiler farmers were interviewed based on snowball sampling, 23 from Nairobi district and 17 from Thika district. Questionnaire administration was combined with farm observation methods in which broiler house, litter condition and broiler house floor types were assessed with an aim of assessing level of adoption of basic farm hygiene practices..

During the case study phase, four individuals were interviewed in order to gain a profound insight of the organization of the smallholder chain as well as food handling practices at the middlemen and retailer levels. (Doorewaard and Verschuren, 2005)

In one case study a key informant (Chair person of KEPOFA – Kenya Poultry Farmers Association) was interviewed to gain an understanding of how the smallholder broiler chain is organised and to triangulate this with the researcher's own knowledge and with views from both farmers and traders.

In another case study, middlemen/ trader from Nairobi and retailers, one from Nairobi and the other from Thika, were interviewed at different times to determine their levels of awareness of and good hygienic practice at their respective chain levels.

The third case study was conducted on the Provincial Veterinary Office to determine level of compliance with current regulations, causes of non compliance with the said regulations and probable ways of ensuring compliance.

1.5 Sample Selection and size

The researcher consulted the Provincial Director of Livestock Production officer in Nairobi Province and subject matter specialists in the province on the best locations to conduct the survey. Based on the discussions, Kasarani District of Nairobi Province and Thika District of Central Province, were selected due to their high broiler populations and ease of accessibility.

Within the time frame (six weeks) the researcher conducted the survey amongst forty farmers with case studies being conducted amongst two broiler meat retailers, one broiler middlemen/trader broiler and one senior veterinary public health officer from the Ministry of Livestock Development.

1.5.1 Data collection

A pre structured questionnaire was used to collect data from the farmers. Prior to the field survey the questionnaire was pretested amongst ten (10) smallholder farmers in Ngong Division, in order to ensure that all questions are clear and that the respondents understand the questions in the same way.

Ngong is a peri urban town located on the edge of Nairobi province with similar agro ecological zones with the study sites

The actual data collection was carried out by the researcher with the assistance of the three field officers from the Ministry of Livestock Development (MOLD)

1.5.2 Method of Data Analysis

The data collected was analyzed both quantitatively and qualitatively

Value chain analysis (GTZ, 2007) was used to analyse the smallholder broiler chain.

Descriptive statistics was used to characterize smallholder broiler production practices such as average numbers, cycles per year, socio-demographic status of hygienic practice of the respondents.

Clustering was based on two regions, Nairobi and Thika peri urban.

The statistical package for social sciences (SPSS v 16) was used to process the data collected from the farmer survey. The specific statistical functions were used are cross tabulations and chi squares tests. The Chi square test was used where possible to test the statistical significance of cross tabulations between the two peri urban areas

Information gathered from the case studies was analysed qualitatively

1.6 Definition of terms

Good Hygienic Practices (GHP): All practices regarding the conditions and measures necessary to ensure the safety and suitability of food at all stages of the food chain (FAO, 2006)

Value Chain: A sequence of productive processes from the provision of specific inputs for a particular product to primary production, trans-formation, marketing and distribution and final consumption (GTZ/SMEDP,2008)

Value Chain Analysis (VCA): A process that identifies the production flow, how value is added along the chain, who are the major stakeholders/ players and supporting agencies of the chain and relationship among them. The analysis also assesses shortcomings as well as opportunities of the sectors. (GTZ/ SMEDP,2008)

Traceability: *“the ability to follow the movement of a food through specified stage(s) of production, processing and distribution* (Codex Alimentaris Commission- CAC, FAO)

Hazard Analysis Critical Control Points (HACCP): A quality management system for effectively and efficiently ensuring farm-to-table food safety by controlling microbial, chemical, and physical hazards associated with food production. It is a prevention-based system, and takes a proactive approach by identifying the principal hazards and the control points where contamination can be prevented, limited, or eliminated across the whole food production process – rather than trying to identify and control contamination after it has occurred.(American Society for Quality, 2009)

Critical Control Points: A step (point, procedure, operation, or stage in the food production system) at which control can be applied, and where control is essential to prevent or eliminate food safety hazard or to reduce it to an acceptable level (Luning, Marcelis and Jongen,2006)

1.7 Conceptual Framework

The value chain concept will be used to map out the various chain actors as well as other chain supporting and or influencing agencies (see figure 2). Hygienic practices at each chain level will then be assessed.

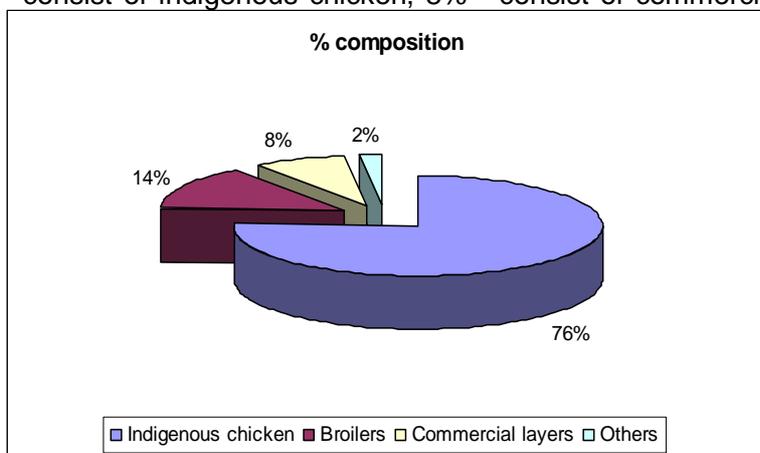
The HACCP model will then be applied at each chain level in order point out where possible risks may occur within the chain

2.0 POULTRY SECTOR IN KENYA

The livestock sector in Kenya accounts for about 12% percent of the country's GDP and over 30 percent of agricultural commodities production. (IGAD, 2007) Within the sector, poultry sub sector is one of the most important livestock enterprises, it is second to dairy in terms of popularity, and is a major contributor of readily available proteins in form of eggs and meat, and a source of cash money for 90% of the rural households.

It is one of most rapidly growing enterprises in the livestock sector and its growth is estimated to be about on average about 2.8 percent annually and is as a result of of its advantages in terns of land use and improvements in the feed conversion rates of genetically superior breeds.

Currently the poultry population is estimated to be approximately 29 million birds. Of these 76% consist of indigenous chicken, 8% - consist of commercial layers and 14% broilers. Other poultry species like ducks, turkeys, pigeons, ostriches, guinea fowls and quails make up 2 % of the population.



Chicken therefore constitute the most important class of poultry.

Figure 1Percentage composition of poultry per province

2.1 Broilers Populations by Province

Table 1 shows the estimated annual broiler population estimates per province for the years 2003 to 2007. Although there seems to be a decline in the number of broilers in the year 2005, the overall trend suggests an increase in the broiler population over the four year period. The decline observed in year 2005 is attributed to the threat of highly pathogenic avian influenza (HPAI) outbreak in country during which producers and consumers alike shunned poultry and poultry products.

Table 1 Broiler population per province

PROVINCE	BROILER POPULATION				
	2003	2004	2005	2006	2007
RIFT VALLEY	327,079	225,979	397,800	257,794	216,853
COAST	616,450	205,700	79,400	637,320	384,190
WESTERN	19,520	18,450	23,565	17,770	33,834
NYANZA	123,437.00	127,400	133,000	96,572	113,550
CENTRAL	1,373,770	2,149,870	957,892	1,437,270	1,434,670
EASTERN	138,025	111,300	131,402	112,640	125,694
N.EASTERN	300	-	800	200	300
NAIROBI	3,097,800	1,892,700	1,064,200	1,607,800	1,116,500
TOTAL	5,997,381	4,731,399	2,788,059	4,167,366	3,425,591

Source: Ministry of Livestock Development, 2003 – 2007

As can be observed from the table, the bulk of the broiler population is concentrated in Nairobi and Central provinces (highlighted sections). Within these provinces, farms are located on the fringes of provincial urban centres which enable producers to benefit from the proximity of day old chick (DOC) and feed suppliers and a guarantee of market access.

2.1.2 Broiler meat production

The chicken meat sector processes approximately 18,600 metric tonnes annually with a retail value of KShs. 3.52billion (GoK, 2008) of which broiler meat accounts for one third of the total production, the rest consisting of local chicken and spent layers.

The broiler sector has grown rapidly since independence mostly as a result of private

2.1.3 Broiler Feeds

Currently, the poultry industry is the largest consumer of livestock feeds and accounts for 50 percent of the national feed production (chick and duck mash, growers mash, layers mash, broiler starter and broiler finisher)

The feeds are primarily a mixture of cereal grain (mostly maize), protein meal (e.g. fishmeal and or soya bean cake), vitamins and minerals.

2.1.4 Import and Export of Broiler Meat

The Kenyan Poultry sector is not an exporter or importer of poultry or poultry meat products. National projection figures indicate that the country produces chicken meat for local consumption with very little surplus for export (see table 1).

It has been projected that there will be strong and growing demand for livestock products in the domestic market in the short and medium term and that the domestic market will continue to be the most important market for these products (FAO, 2009)

Table 2 Projected demand and supply trends of poultry meat

YEAR		2001	2002	2004	2006	2008
Poultry meat(Tonnes)	Production	21,540	22,078	23,196	24,371	25,694
	Demand	21,315	21,869	23,253	24,253	25,570

Source: Ministry of Planning and National Development, 2003

2.1.5 Poultry meat consumption trends

Poultry meat has for long been considered a luxury good to be consumed on special occasions, but with urbanization and increasing incomes this has changed. Consumption in year 2003 was estimated at 0.5 kg/ person/ year compared to 1.3Kg/ person/year in 2005.(FAO, 2009)This trend is likely to continue but has been threatened by recent scares of Highly Pathogenic Avian Influenza (HPAI) outbreaks.

2.2 Existing Food Safety Management Strategies for Chicken Meat

Food safety issues in Kenya relating to livestock products are managed through the following acts and by laws. The enforcing authorities are the Veterinary Department (MOLD) and the public health departments of the local authorities.

2.2.1 The Meat Control Act (Cap 356 of the Laws of Kenya)

The act begins by listing the animals to which the act applies. Hence all poultry types are covered by the act and to this end the act has a whole section. The section specifies poultry processing equipment, operating practices, packaging of finished products and ante mortem and post mortem inspection.

Under the ante mortem inspection section, the act explicitly states that ante mortem inspection shall be carried out immediately before all slaughter

The post mortem goes on to explain how the post mortem shall be conducted and which organs to pay attention to. It further specifies the conditions under which the carcass or organs shall be condemned if affected with certain diseases or conditions

Under the section on the meat control (transport of meat) regulations, the act states inter alia, that "any meat consignment intended for transportation should be carried in a "carrier" or a "container" as specified and accompanied by a "certificate of transport" which shall be duly signed by the officer in charge of the abattoir, slaughter house or processing plant from which the meat is consigned and shall be embossed with a meat inspection stamp"

In addition the act further specifies the "carrier" and "container" requirements as per distance travelled or time duration from the place of slaughter to the next chain level.

The act is silent on hygienic requirements at the production level.

2.2.2 The Public Health Act (Cap 242 of the Laws of Kenya)

Unlike the meat control act, Cap 242 does not include poultry in its list of animals to which the act applies.

Under part X1 on public water supplies, meat, milk and other articles of food, paragraph 135 states that,

“ the medical examination of any person in any premise who is involved in the preparation, collection, conveyance or distribution or sale of a food article”

2.2.3 The Agriculture Sector Bill 2008

This bill is posed for introduction into the national assembly and once passed will become law.

Part VII of the bill focuses on Food safety and Bio safety Provisions as guided by the Cartagena Protocol;

The section outlines measures that shall be taken to ensure that all food produced in Kenya whether for domestic consumption or export meets the highest standards of food safety. These include adherence of all agricultural producers to Good Agricultural Practices for each respective commodity chain.

In addition the bill proposes the establishment of a Scientific Food Safety Committee which shall be mandated to evaluate, in response to official requests or on its own initiative, physical, chemical or biological risks to human health arising throughout the production chain.

Further the bill proposes that all food businesses shall be required to establish a traceability system enabling them to identify any person who supplied or to whom they supplied a food or substance intended to be incorporated into a food. The bill also proposes the mandatory labelling for food displayed for sale in such a way as to permit traceability. More importantly the bill defines food safety offences and penalties for the offences

As can be seen, both the Meat Control and Public Health Acts have strong focus on hygienic practices at the processing and retailing and exclude processes at primary production. The agricultural sector review bill is therefore an improvement of the two as it focuses on hygienic practices at the production, processing and wholesaling /retailing of the food chain and even goes a step further to propose penalties for offenders.

2.3 Food borne risks associated with Poultry meat

Three types of food borne risks for human health can be recognised (FAO, 1998). These are biological, chemical and physical agents. For the purposes of this study physical risks will not be considered.

2.3.1 Biological risks

Biological contamination of poultry with biological agents such as *Salmonella species*, *Camphylobacter species*, *Listeria monocytogenes*, *Clostridium perfringens* and *Stappyllococcus aureus* and *Escherichia coli* has been known to occur during shed depopulation, transportation and slaughter. As such broilers must be off- feed prior to slaughter to reduce the risk of faecal contamination during processing and evisceration. Different research results confirm that the best gastrointestinal clean out is achieved when broilers are kept off feed for 8-12 hours before slaughter (World Poultry Science, 2009).

In many countries, food safety regulations consider faecal contaminated chicken carcasses inappropriate for human consumption.

2.3.1.1 Salmonella

The EC – zoonosis directive (EC/92/117) mentions that *Salmonella enteritidis* and *Salmomella typhimurium* as the predominant sources for human Samonellosis. Salmonella is commonly isolated across the whole poultry production chain, from the farm to the retail level. Infection of broiler flocks is transmitted via rodents and other vermin, faeces, contaminated feed or through the hatchery (Ostenbach, 2002).

The principle source of Salmonella on dressed poultry carcass is faeces. Hence proper evisceration is required to prevent carcass contamination. Since contamination may have occurred, rapid chilling of carcasses is recommended to prevent further growth of *Salmonellae*.

Animal feeds contaminated with Salmonella may also transmit the bacteria even though the feed maybe heat treated. This is turn can result in live birds being infected, pathogens becoming endemic in the bird flock and the potential for the pathogen to be transmitted through the food chain to humans. This has been previously been demonstrated in the United States where poultry feed contaminated with *Salmonella* was the source of infection in live birds (Crump, Griffin and Angulo, 2002).

2.3.1.2 Camphylobacter

The principal reservoir of pathogenic *Campylobacter species* is the gastro intestinal tract of wild and domesticated mammals and birds. Campylobacter species most commonly associated with human illness are *C. Jejuni* and *C. Coli and aree* distinguished from other campylobacter species primarily by their high optimum growth temperature (>42°C) and are therefore termed thermophilic Campylobacters. Once gain prompt chilling after slaughter is necessary if their numbers are to remain at safe levels after processing.

2.3.1.2 Chemical risks

Chemical hazards may be introduced into the food chain during broiler production. Chemicals may be added deliberately during the primary production and or processing (e.g. antimicrobial agents) or unintentionally via environmental exposure e.g. heavy metals, (polychlorinated biphenyls).

Anticoccidial drugs are antimicrobial agents that are widely used for therapeutic and prophylactic purposes in intensive poultry rearing (Chapman, 2000) and (Cabada, 2002). Furazolidone, is an example of an anticoccidial drug that has been used for years for treatment of bacterial and protozoal infections (Nazifi and Asasii, 2001). While the administration of furazolidone is prohibited in food producing animals in the United States and European countries (Vahl, 2005), the drug is commonly used by farmers in the Middle East, Far East and Africa as a coccidiostat.

Other coccidiostats such as Nicarbazin(Food Standards Agency,2008) are widely used in feeds to prevent coccidiosis(a protozoal disease of poultry with serious economic consequences).It is provided in feeds fed to broiler chickens and is typically fed upto 28 days of age when it is stopped to permit thinning of birds prior to slaughter. Five days is the minimum withdrawal period for this medicated feed.

The use of chemicals during processing of poultry is largely limited to the use of chlorine treated water during washing and chilling of the carcass.

During and after the slaughter processes the most probable risk of contamination is of biological nature. At primary production the risk posed is both biological and chemical in nature.

2.4 Voluntary Industry Food Safety Management Strategies

Voluntary food safety management strategies are strategies by industry players minimize contamination in a manner consistent with existing applicable regulations, standards and guidelines.

2.4.1 Food safety management strategies in Kenya

In Kenya, livestock products are marked with a variety of labels and logos denoting compliance with both public statutory and public and private voluntary product and process standards. Some of these include

Kenya Bureau of Standards (KEBS) Diamond Mark of Quality

Kenya Bureau of Standardization(S) Mark

ISO 22000

Halal Certification

National Environment Management Certification (NEMA) Certification

Stamping/ Approval by the Department of Veterinary Services

2.4.2 The Kenchic example

Within the poultry sector, Kenchic Ltd - a private company, and the largest fully integrated poultry company in East and Central Africa is compliant with both public statutory and public and private voluntary product and process standards. The company was HACCP (Hazard Analysis Critical Control Point) certified in 2006 and is also certified by the Kenya Bureau of Halal Certification.

The company operates five breeder farms for grandparent stock which operate under the total quality management. Under this system proper vaccination of all breeder flocks is strictly observed with blood testing of flocks done both locally and internationally and a very thorough breed management program is followed.

The company's hatcheries (one parent stock and two commercial) follow International Standard Operating Procedures. These procedures place great emphasis on hygienic practices to be followed at all facilities such as disinfection protocols for vehicles, houses, fixed and reusable equipment as well as personnel entry controls and rodent control. The procedures also include extra precautions to be taken in the event of outbreaks of HPAI and New Castle Disease (NCD) within 50km radius of the hatchery.

For products leaving the company the standards specify one use packaging materials which must be sealed to eliminate any possibility of contamination.

70 % of the chicks produced by these facilities are raised either under the company's own farms or under the contract farmer growing scheme, where a farmer enters a contract with the company to grow commercial broilers for it at an agreed price. The scale of production ranges from 3000 to 20,000 birds per farmer. The farmer is given chicks, feed and technical input including veterinary services. The company does not have its own feed mill and has therefore contracted one of the largest feed miller to manufacturer feed for its growers based on the company's (Kenchic) formulations

To be branded Farm to Fork operator, farmers is required to document all processes that occur during the rearing process e.g. feeds fed, kind of veterinary medicines administered and dates of administration etc. Moreover administration of veterinary drugs is done with close consultation with the company's veterinary doctor In addition hygienic practice such proper housing, footbaths, vaccination protocols are strictly adhered to.

At the end of the production cycle, the birds that are cropped from the contract farmer are taken to the company's processing plant and the farmer is paid for the mature birds delivered to the

processing plant. This is a modern poultry processing plant, which meets all the necessary health and safety requirements and is NEMA certified.

Birds scheduled for slaughter undergo ante and post mortem inspection birds by the company's veterinary. In order to qualify for the Halal label, the slaughter process is undertaken in accordance with Islamic dietary standards as prescribed by the Quran. This entails electrical stunning in water, followed by slaughter and proper bleeding. Slaughterers are not allowed to converse during the slaughter process and are required to recite a prescribed prayer (*Tasmiyah*).

Bird should be dead before and being scalded at 53 degrees Celsius (higher temperatures cause some ingesta to permeate the flesh thereby rendering the bird unlawful.) In addition any bird that drowns before slaughter is considered not fit for consumption.

The birds are then processed and products are coded which permits traceability to the eggs the bird was hatched from, the rearing farm and the feed the bird ate from day old to slaughter.

Contract farmers are paid after two weeks based on a live weight of chicken delivered to the processing company.

Traceability is very crucial for the high end markets, hence as a result of the company's quality and safety policy, it is the major supplier of processed chicken to tourist class hotels, restaurants, supermarkets and Kenchic branded fast food chain outlets.

Thus as can be observed, through the Kenchic case, compliance with public statutory and public and private voluntary product and process standards (HACCP and Halal) is an illustration of responsible market chains in which food safety issues are controlled at the production processing and wholesaling/ retailing functions. The use of the Halal has also enabled Kenchic to have a wider customer base through inclusion of muslim customers.

3.0 ORGANIZATION OF THE SMALLHOLDER BROILER MEAT CHAIN

In this chapter findings from the survey are also presented using text, figures, pie charts, graphs, and tables

3.1 The Smallholder Broiler Meat Chain

Information regarding organization of the smallholder broiler chain is obtained from the researcher own knowledge and information gathered from interviews with informants and actors along the chain

3.1.1 Primary Production

Small scale farmers keep flock sizes of less than 3000 birds per year and account for only 30 % of the total production.

The farmers are required to book for their supply of Day Old Chick (DOC) two weeks in advance of supply through the hatchery distributor or agent. Once the birds are obtained, they are reared under an all in all out system for an average of 6 to 8 weeks depending on market availability. During this period they attain an average weight of between 1.2 -1.5 Kg.

3.1.2 Processing

Smallholder broiler processing is done at the farm. Family or hired skilled labour is involved in the slaughter after which the birds are washed and packed in plastic bags and further packed into gunny bags for transport to the market.

Other meat processors such as Meatons and Alpha Fine foods who source broiler meat from non contracted small scale farmers will usually bring their own personnel to carry out the slaughter at the farm level after which they can further process it into cut ups or sell it as whole.

3.1.3 Wholesaling and Retailing

Once the chickens have been slaughtered, a majority of farmers will sell their chicken through middlemen/traders while others sell directly to low end market hotels. In both cases the sales tend to take place informally(without a written contract) and farmers are paid on the basis of an average cold dressed weight and receive payment approximately 2 to four weeks after the broiler have left the farm. The current price is KShs. 220/Kg. In addition small numbers are sold at the farm gate.

The retailing of broiler meat is segmented into high end markets such as airports (airline catering), franchise fast food outlets, supermarkets, tourist class hotels which are less price sensitive, while the low end markets such as local hotels and wet markets are more price sensitive.

As smallholders are unable to comply with traceability issues they are the major supplier for the low end markets.

3.2 Chain supporters and Influencers

3.2.1 Chain supporters

The various chain supporters in the smallholder broiler value chain

- **Ministry of Livestock Development**, which provides agricultural advisory services to farmers

- **Microfinance institutions**, which provide loan facilities to farmers to start up the business
- **Veterinary Drug Companies:** which provide the necessary vaccines and drug supplies needed for disease control measures

3.2.2 Chain Influencers

Department of Veterinary Services, which plays a critical role in ensuring that disease control and food safety mechanisms are put place in the especially for the hatcheries, meat inspection and licensing of slaughter facilities

Department of Public Health, which plays a role in licensing of wholesale and retail butchers

Kenya Bureau of Standards, which is mandated to ensure that both locally and imported goods comply with Kenyan standards and other standards it may approve of. The standards applicable to poultry feeds (KS 01-61) deals mainly with details of nutrient composition of the different type of poultry feed i.e. finished products whereas no standards exist for feed ingredients.

Broiler sub sector chain map

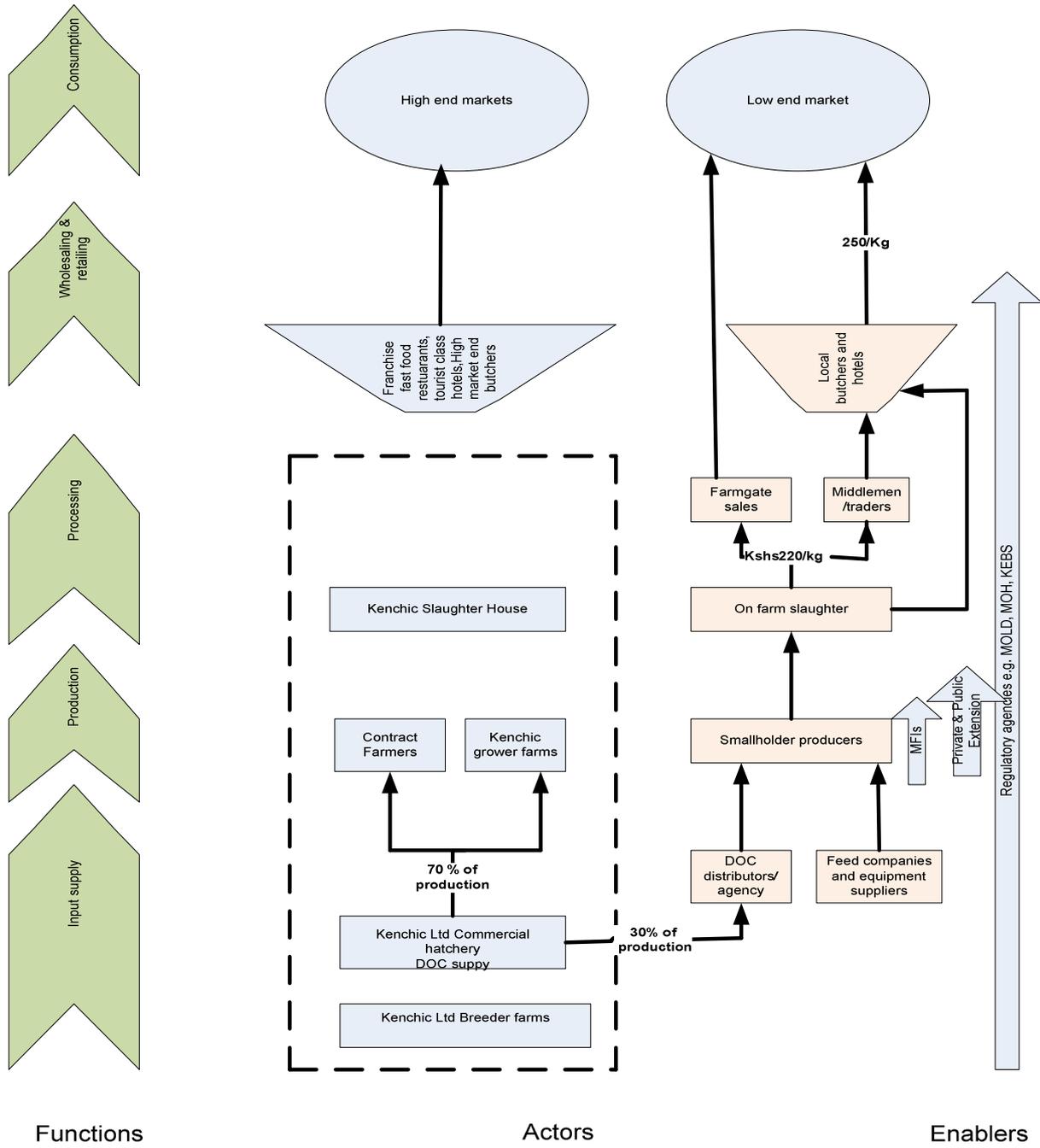


Figure 2 Broiler Subsector Chain map

3.2.3 SWOT Analysis of the Broiler Subsector Chain

Table 3 SWOT Analysis of the Broiler Subsector

Strength	Weaknesses
(a) Ready market that caters for different market segments (b) Readily available inputs such as DOC and feeds	(a) Poor farmer organization – KEPOFA has weak support at grassroots level (b) Poor compliance and enforcement with existing food safety laws by smallholder
Opportunities	Threats
(a) Possibilities exist for private public partnership e.g. contract farming smallholder Possibilities for exporting into larger East African Community(EAC) markets	(a) Threat of disease outbreak .e.g. HPAI (b) High feed costs due to the fact that maize which is also a staple in Kenya is a major feed ingredient

3.2 Results of the farmer survey in Nairobi and Thika districts

3.2.1 Background Information of the Respondents

This section outlines the smallholder broiler characteristics namely: Gender, education background, number of broilers reared, production cycles per year as well as other sources of income. These basic characteristics of the smallholder broiler producers are important as they will help to tailor interventions to match the circumstances of broiler farmers.

A total of forty farmers (n=40) from Nairobi and Thika districts were interviewed in which twenty three were from Nairobi and seventeen from Thika.



Picture 1 A field officer and a farm worker stand in front of a broiler house on a resting period. Close by is zero grazing unit and residential house

3.2.2 Characterization of Smallholder broiler Producers

a) Proportion of male and female respondents per farmer location

Table 4 Proportion of male and female respondents per farmer location

Farmer location	sex		Total
	Female	Male	
Nairobi peri urban areas	19 (83%)	4(17%)	23
Thika peri urban areas	11 (65%)	6 (35%)	17
Total	30 (75%)	10 (25%)	40

The survey results generally showed that the portion of female respondents was high in each district, 83% in Nairobi and 65% in Thika.

b) Education level of respondents in Nairobi per farmer location

Table 5 Education level of respondents per farmer location

Farmer location	Education level			Total
	Primary	Secondary	College	
Nairobi peri urban areas	7 (30%)	11(48%)	5(22%)	23
Thika peri urban areas	1 (5%)	6 (35 %)	10 (60%)	17
Total	8 (20%)	17(43%)	15 (37%)	40

Generally as can be observed from table 5, both districts have quite high literacy levels. However, Nairobi had a higher percentage (30%) of respondents with primary level education whereas Thika had only 5%. In addition, Thika had more respondents who had attained college level education (60%)

c) Number of broilers reared per batch per farmer location

Table 6 Number of Broilers per batch per farmer location

Farmer location	Broilers per cycle				Total
	100-500	501-1000	1001-1500	1501-2000	
Nairobi peri urban areas	14(62%)	4 (17%)	1 (4%)	4(17%)	23
Thika peri urban areas	12(71%)	5 (29%)	0 (0%)	0(0%)	17
Total	26 (65 %)	9 (23%)	1(3 %)	4(9%)	40

As observed in table 6, majority of farmers in both Nairobi and Thika , 62% and 71% respectively were found to be rearing between 100 -500 broilers per batch. Nairobi also was found to have more variations of number of cycles i.e. four while Thika had only two

d) Number of production cycles per year per farmer location

Table 7 Number of production cycles per year per farmer location

Farmer location		Production cycles per year			Total
		3-4cycles	5-6cycles	7 -8 cycles	
Farmer location	Nairobi peri urban areas	8(35%)	10(43%)	5(21%)	23
	Thika peri urban areas	9(53%)	5(29%)	3(18%)	17
Total		17(43%)	15(38%)	8(19%)	40

In general the survey results indicate that a large majority of the farmers, in both districts rear their broilers in 3- 6 cycles per year. Also Thika had more farmers (53%) with 3-4 cycles whilst Nairobi had more famers with 5-6 cycles(43%)

e) Source of income in per farmer location

Table 8 Broiler income versus other income sources

Farmer Location		Broiler farming versus other income earner		Total
		Yes	No	
	Nairobi peri urban areas	6 (23%)	17(74%)	23
	Thika peri urban areas	2 (12%)	15 (88%)	17
Total		8 (20%)	32 (80%)	40

As can be observed from table 8m a large majority of farmers, 74% in Nairobi and 88 % in Thika did not depend on broiler farming as the main source of income. It was revealed that many engaged broiler farming as a side venture to supplement other income sources.

d) Presence of other farm animals on the farm

Table 9 Presence of other farm animals per farmer location

District	Presence of other farm animals				Total
	Yes	%	No	%	
<i>Nairobi</i>	17	74	6	26	23
<i>Thika</i>	11	65	6	35	17
Total	28	70	12	30	40

As can be observed from table 9, 70% of the total respondents had other farm animals farm in addition to the broilers.

It was noticed that the majority those who reared other farm animals had bigger land parcels than those who had did not. The animals reared ranged from dairy cows, dairy goats, indigenous chicken, layers, geese, rabbits, dairy bulls as well as cats and dogs

Conclusion

Women comprise the majority of broiler farmers and they normally tend to keep between 100 – 500 broilers per batch in 3 -6 cycles per year. In addition majority of the farmers do not depend on broiler rearing as a main income earner but rather keep broilers to supplement earnings from other income sources i.e. formal employment and or income from other livestock enterprises such as dairy cows and goats, egg production, local chicken production and rabbit keeping.

3.2 3 Hygienic practices at the smallholder broiler production level

a) Basic hygienic practices per farmer location

With regard to broiler house conditions, farm observation during questionnaire administration, revealed that tidiness outside the broiler house for a large majority of farmers needed improvement in terms of bush clearing and sealing of wall cracks. Earthen floors were observed to be the most common floor types in both Nairobi and Thika while litter condition was found to be in average condition.

b) Replacement of footbath disinfectant per farmer location

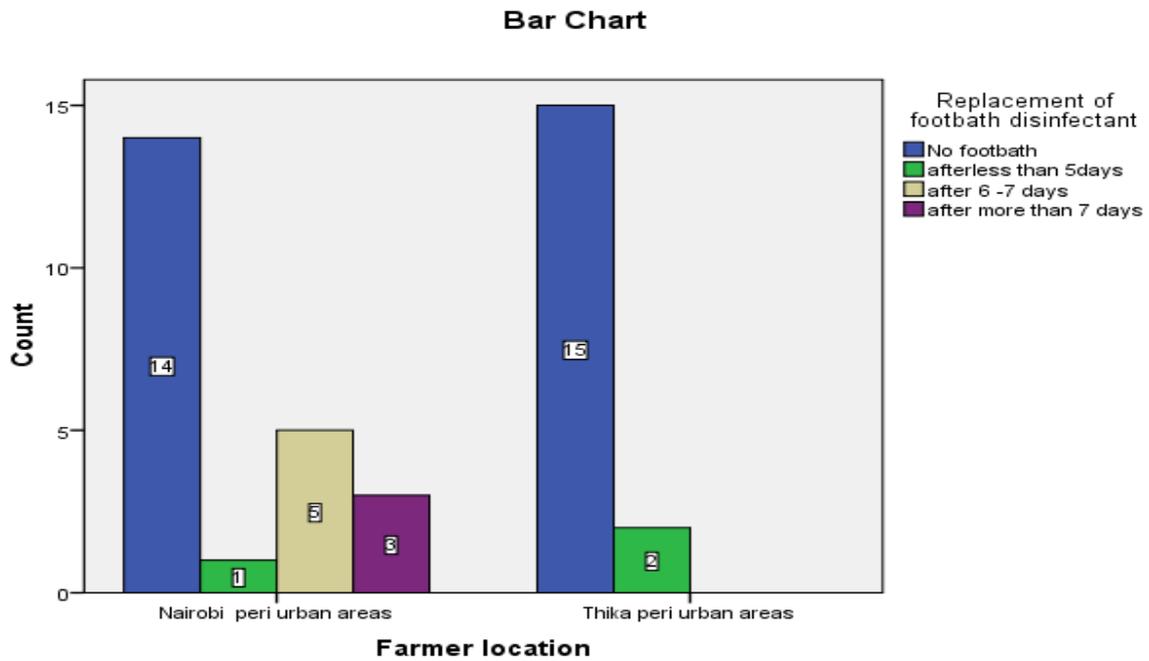


Figure 3 Disinfectant replacement periods per farmer location

As can be seen from Figure 3 there seems to be no difference between farmers in Nairobi and Thika in terms of disinfectant replacement periods, as the survey results revealed that more than half of the respondents i.e. 60 % in Nairobi and 88% Thika, do not have footbaths. In total only 26 % (11) of the farmers surveyed had footbaths.

c) Rest Period between production cycles in the two Nairobi and Thika districts

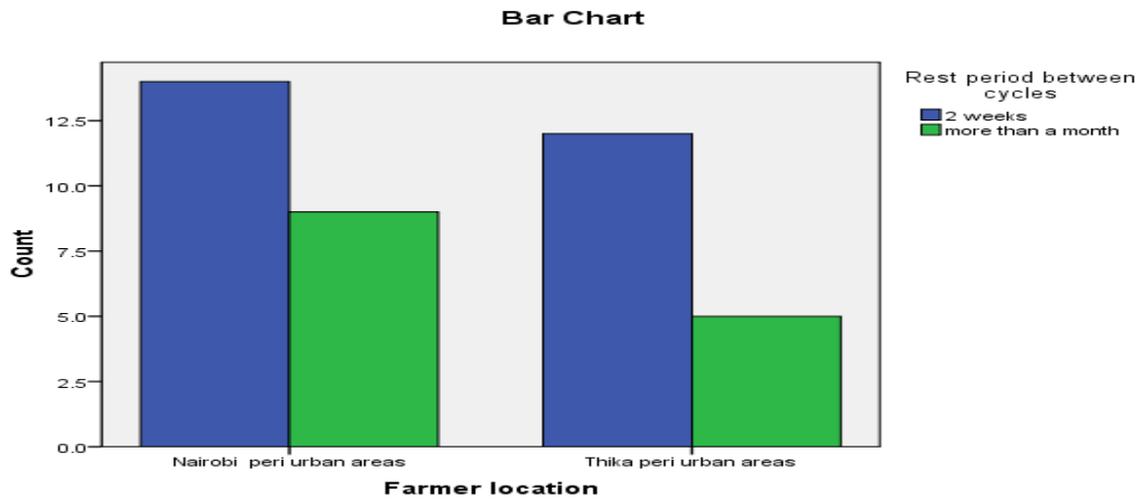


Figure 4 Rest period between broiler production cycles per farmer location

There is no significant difference in rest periods between the Nairobi and Thika($P=0.524$)
The rest period ranged from periods of 2 weeks to more than a month.

d) Rodent menace and control in Nairobi and Thika Districts

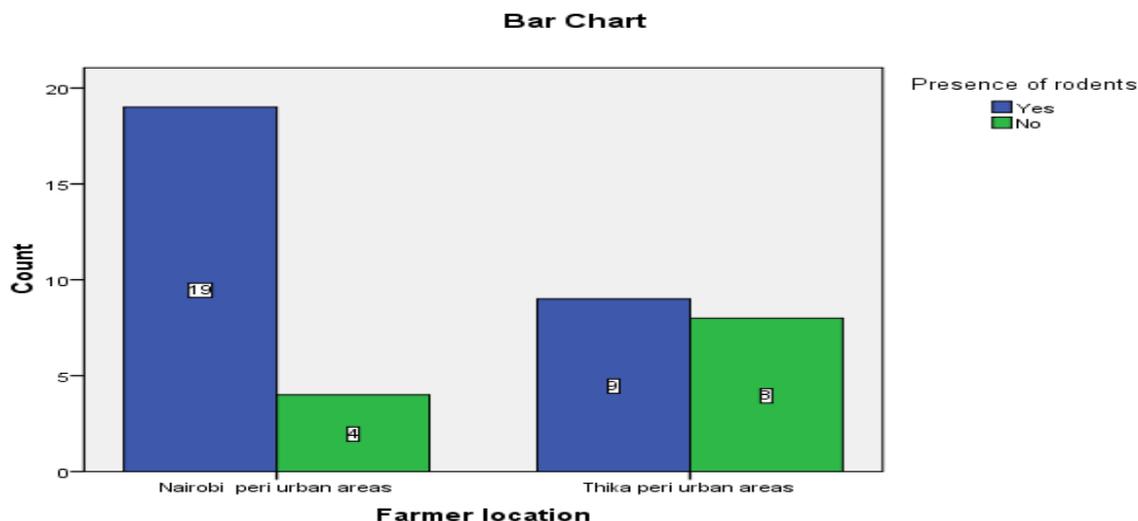


Figure 5 Presence of rodents per farmer location

The results revealed that there was a significant difference with regard to the rat menace ($P=0.043$) between the two peri urban areas with regard to rodent menace. In this regard, Nairobi had 82% of farmers experiencing rat menace while Thika had only 39%. Those that had the rat menace resorted to various strategies as indicated in the table 10 below.

Table 10 Summary of rodent control measures

Rat control method	Count	Percentage
Rat poison	16	57.1
Rat poison and cat	3	11.0
Cat only	6	21.4
Rat trap	1	3.6
None	2	7.1
TOTAL	16	100

e) Common disease during broiler rearing

Table 11 Common broiler diseases per farmer location

		Most common disease symptoms during rearing				Total
		Diarrhoea	Coughing	Lamness	Other	
Farmer location	Nairobi peri urban areas	8(35%)	8(35%)	1(4%)	6(26%)	23
	Thika peri urban areas	6(35%)	10(59%)	1(6%)	0(0%)	17
Total		14(35%)	18(45%)	2(5%)	6(15%)	40

As can be observed from table 11 there seems to be no major difference in occurrence of type of disease symptom between the two peri urban areas. Thika had a slightly higher (59%) occurrence of coughing symptoms compared to Nairobi(35%). The other diseases category comprised of water belly, 2.5(1), navel problems 2.5 %(1), sudden death syndrome 2.5 %(1) and huddling in corners, 7.5% (3).

f) Measures taken to address disease symptoms

Table 12 Disease treatment per farmer location

Farmer Location		Measures taken to address the symptoms		Total
		consult veterinarian	self treat by administering antibiotics	
	Nairobi peri urban areas	18(78%)	5(22%)	23
	Thika peri urban areas	13((76%)	4(24%)	17
Total		31(78%)	9(22%)	40

There seems to be no difference in measures taken to address disease symptoms. 78% and 76% consulted veterinarians in Nairobi and Thika respectively.

Conclusion

The results indicate that there seems to be no major differences between the two areas with regard to level of hygienic practice..

3.2.4 Practices during Pre slaughter period per farmer location

a) Presence of coccidiostat in feeds

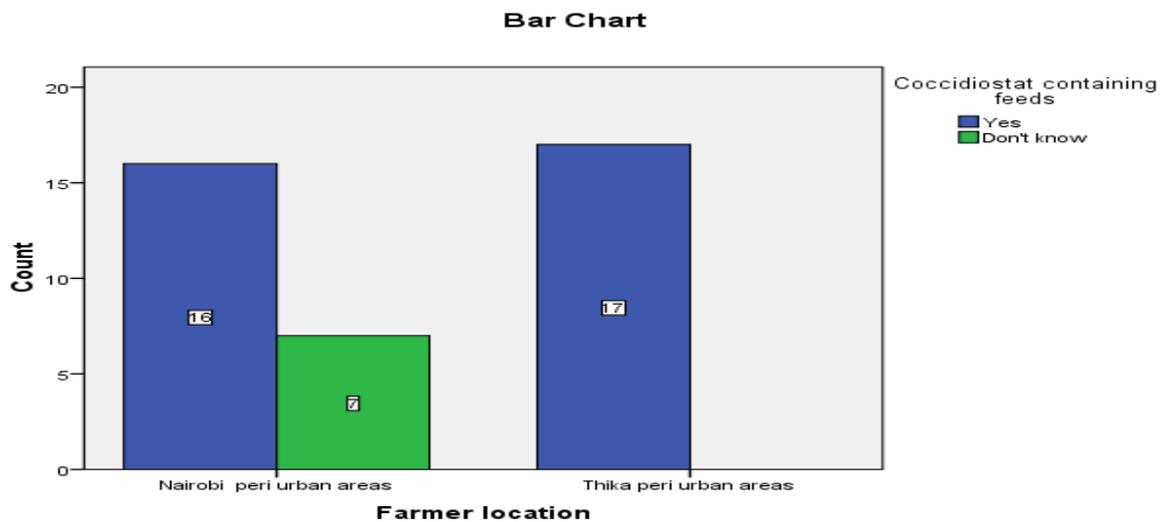


Figure 6 Coccidiostat feeds per farmer location

The results suggest that addition of coccidiostats in feeds is common practice as there seems to be no major difference regarding presence of coccidiostats in feeds in both areas. Hence as can be seen from figure, 100 % (17) of the farmers in Thika affirmed that their broiler finisher feed contained coccidiostat as compared to Nairobi's 30% (7) who stated that they did not know whether the feeds contained coccidiostat. On further observation of the feed bags it was confirmed that the labels indicated that the feeds contained coccidiostat. In Nairobi the farmers were quick to point out that labelling was not a guarantee that the feeds actually contained a coccidiostat.

b) Withdrawal of coccidiostat containing feed prior to slaughter

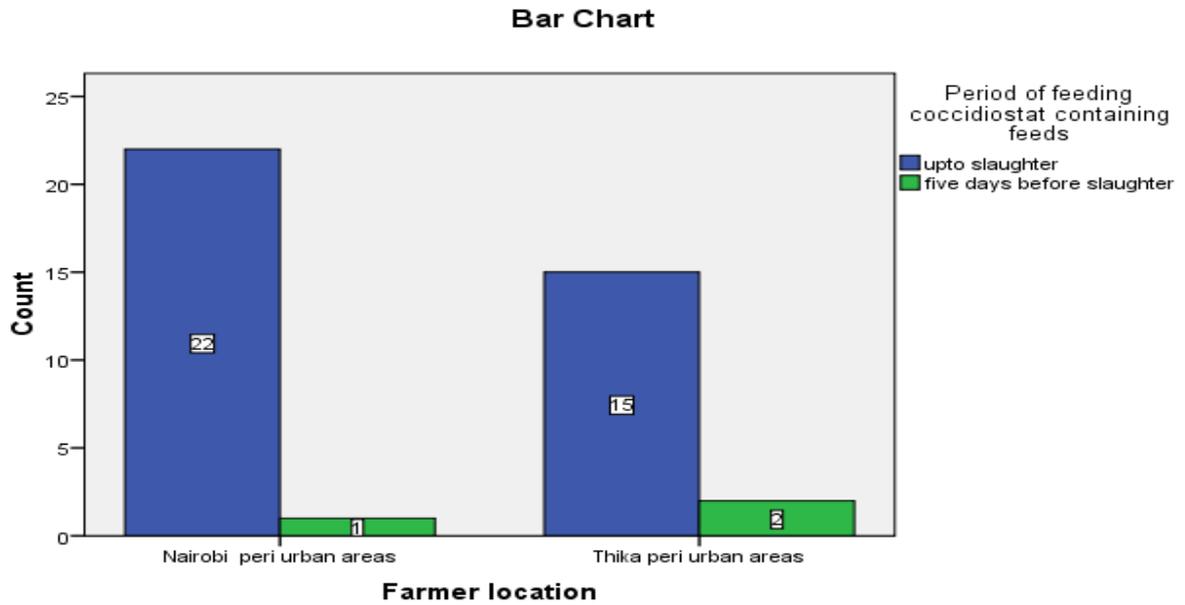


Figure 7 Coccidiostat feeds withdrawal before slaughter

As indicated in figure 7 there seems to be no major difference in period of feeding coccidiostat feed between the two areas. In Nairobi 95% of the farmers fed coccidiostat feeds upto slaughter while in Thika 88%.confirmed the practice. Overall only 7.5 % i.e. 3 farmers in claimed to withdraw coccidiostat feeds five days before slaughter

c) Awareness of and practice of feed withdrawal before slaughter



Figure 8 Awareness of feed withdrawal before slaughter

The results reveal that there seems to be no major difference between the two areas in awareness of feed withdrawal before slaughter (73% in Nairobi and 88 % Thika)

Overall the different feed withdrawal times are as indicated in the table 13 below. However some respondent pointed out that they did not strictly adhere to withdrawal of feeds before slaughter due to urgent demand for broiler meat that makes it impossible for them to impose feed withdrawal.

Table 13 Feed withdrawal times per farmer location

Time in hours	Count	Percentage
6	12	38
8	5	16
12	15	47
Total	32	100

d) Awareness of veterinary drug withdrawal prior to slaughter

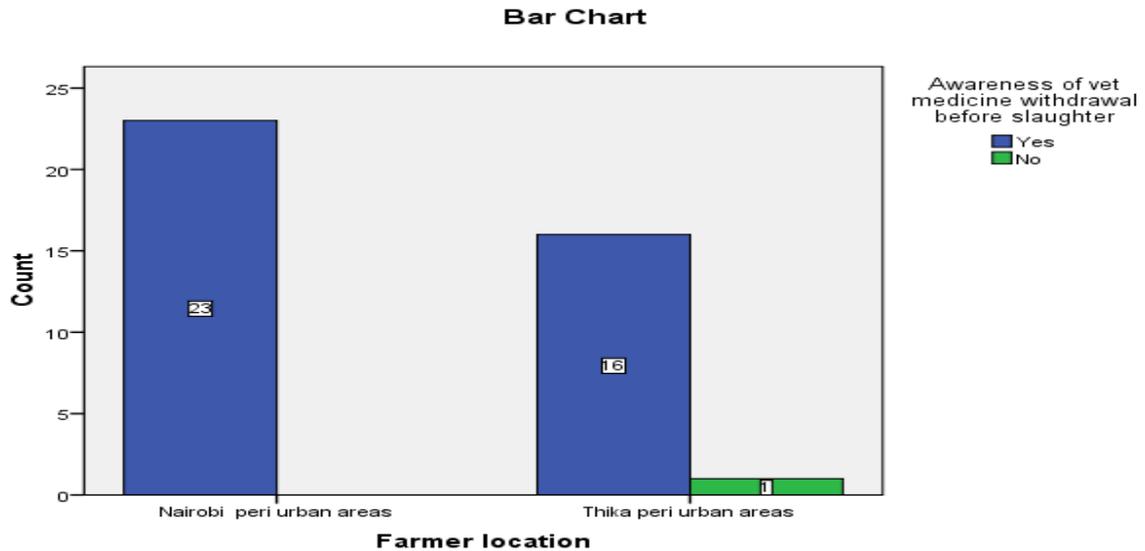


Figure 9 Veterinary medicine withdrawal awareness per farmer location

As observed from figure 9 the results indicate that there seems to be no difference in awareness of veterinary drug withdrawal between the two areas. In total close to 100% affirmed their awareness of the practice. Only one farmer in Thika claimed not to be aware of the practice. The reason given by farmers for withdrawal of veterinary medicine before slaughter was to prevent veterinary medicine residues in broiler meat which is bad for human consumption

Conclusion

The results suggest that there seems to be no differences between the two areas with regard to level of awareness and practice in feed and veterinary drug withdrawal and coccidiostat feed withdrawal.

3.2.5 Slaughter Practices at Small holder Level

a) Place of broiler Slaughter

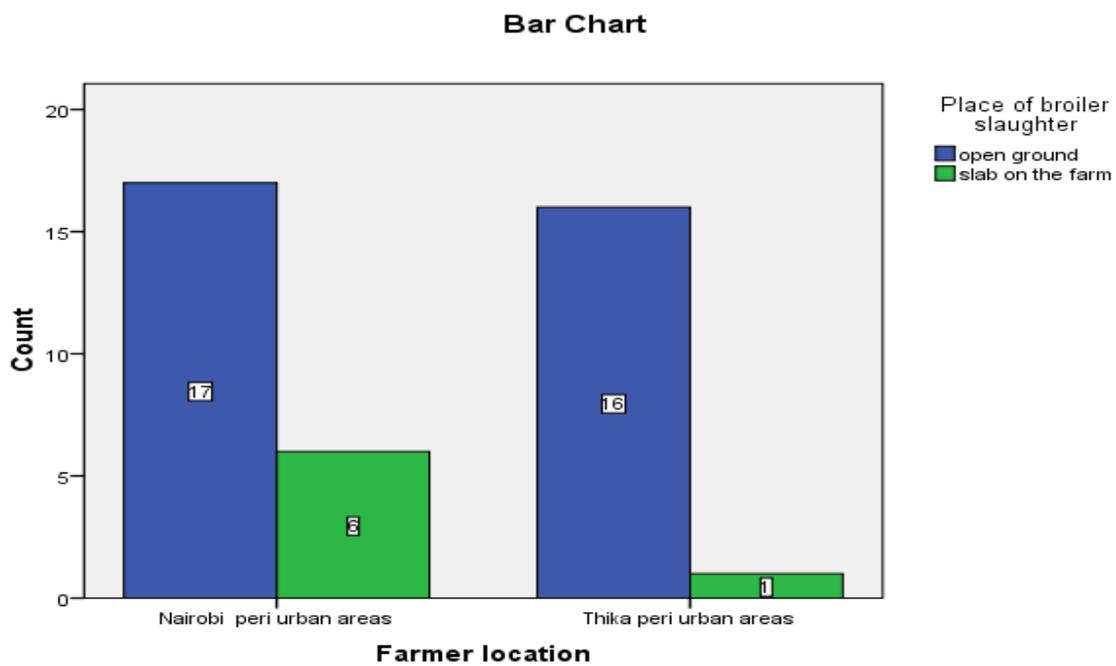


Figure 10 Slaughter place per farmer location

The results indicate that there seems to be no difference in place of slaughter between Nairobi (74%) and Thika (94%). In both areas broiler slaughter is done in an open ground within the farm

b) Persons involved in Slaughter

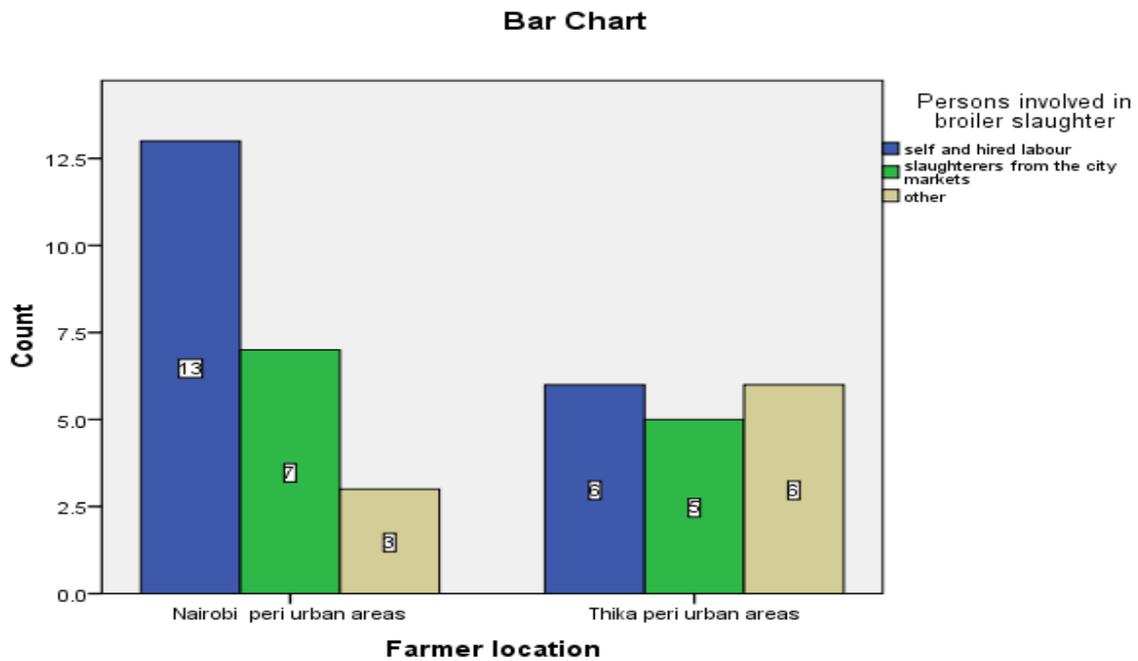


Figure 11 Slaughter personnel per farmer locatiion

The results suggest that there seems to be no difference in slaughter personnel between Nairobi and Thika. In Nairobi 57% of the respondents themselves together with hired labour were involved in the process while in Thika it was 35%. The other category comprised of broiler meat traders in Nairobi (Meatons 13%) and Chicken Choice Ltd, 35% Thika) who came to the farm with their own slaughter personnel to carry out the slaughter. In either case, respondents reported that there was no involvement veterinary personnel involvement.

c) Awareness of slaughter hygiene rules

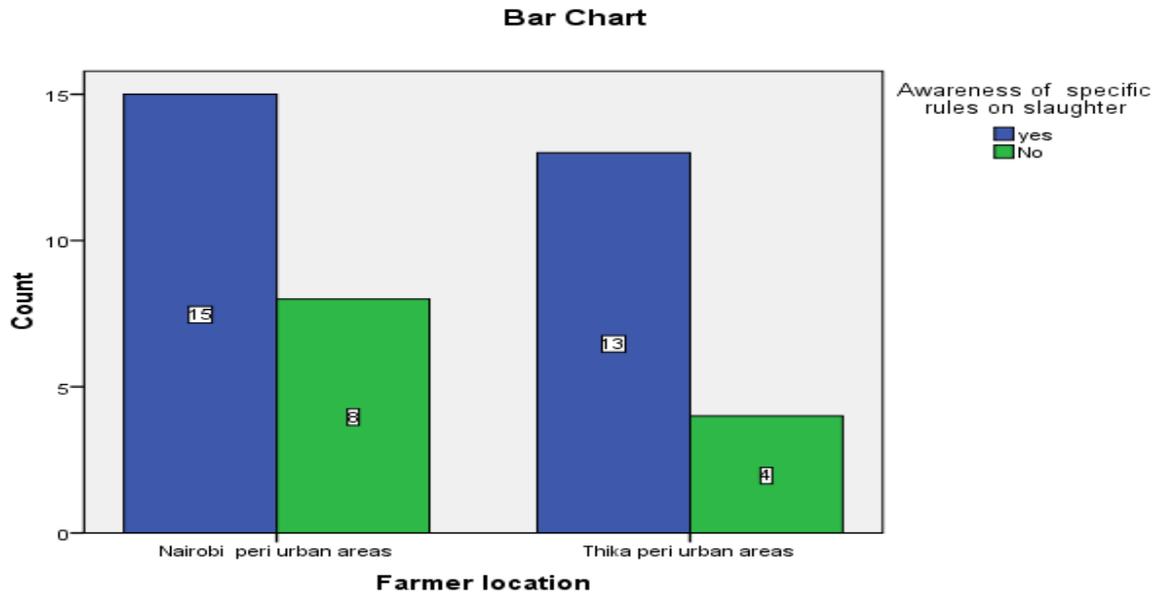


Figure 12 Awareness of slaughter rules per farmer location

The results indicate there is no significant difference between the two areas with regard to awareness of slaughter rules ($P=0.043$, annex). Although, respondents mentioned the most important rules as cleanliness and mandatory medical examination of slaughterers, on further probing they admitted that they did not undergo medical examination nor did they confirm that hired slaughterers had the certificate.

d)Water source during Slaughter

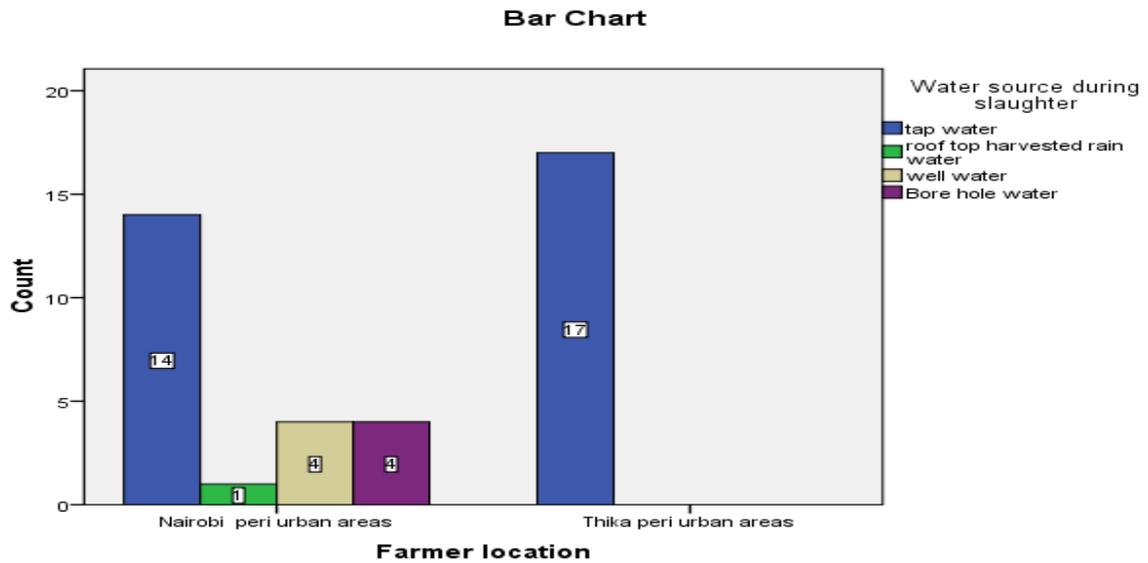


Figure 13 Water source during slaughter per farmer location

From figure 13 it can be observed that there seems to be no difference in water source during slaughter. Tap water was found to be the most commonly used water during slaughter for both areas(Nairobi 62% and 100% in Thika). In addition, Nairobi also reported a small percentage of other water types such as borehole 17 % (4, well water 17% (4) and roof top rain harvested water 4% (1).

e) Presence of cooling facilities per farmer location

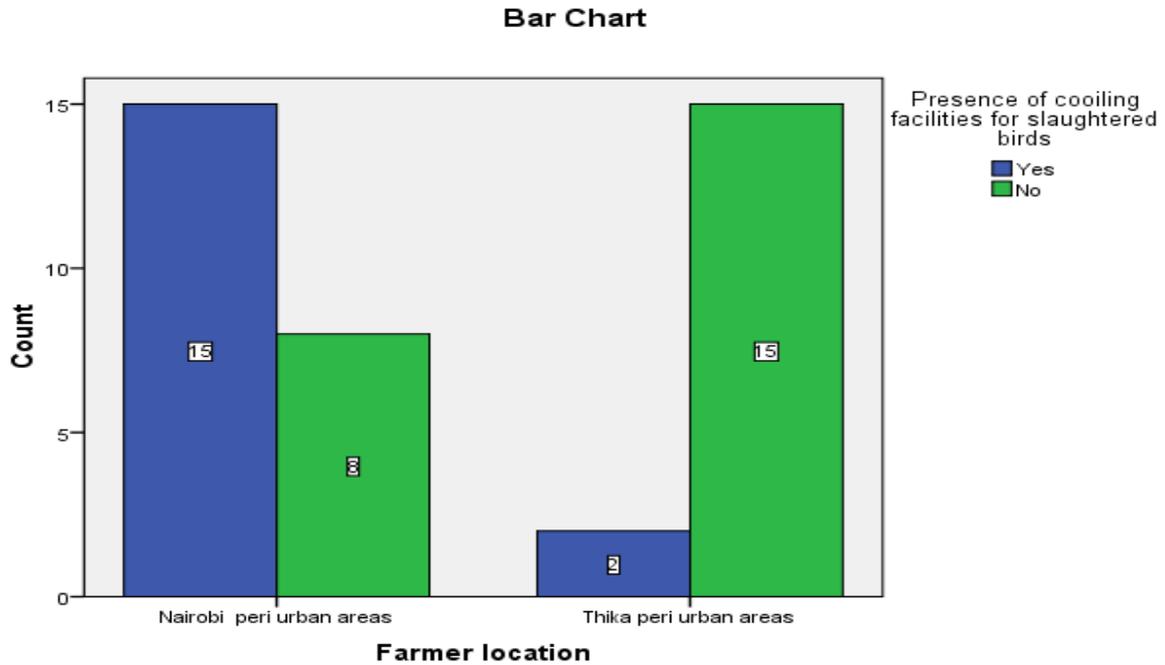


Figure 14 Presence of cooling facilities per farmer location

The results suggest that there is a significant difference ($p=0.01$, table13, annex) between the two areas in terms of presence of cooling facilities at the farm, 65% in Nairobi had cooling facilities while in Thika 655 did not have cooling facilities.

Conclusion

The results suggest that there are no major differences in slaughter practice between the two areas. Thus for majority of farmers in both areas slaughter of their birds was done on the open grounds on their farm. Tap water was also the most commonly used water type during slaughter in both areas. A significant difference was observed between the two areas with regard to cooling facilities with Nairobi having more farmers with more farmers with cooling facilities.

3.2.6 Post Slaughter Handling

a) Broiler delivery times after Slaughter

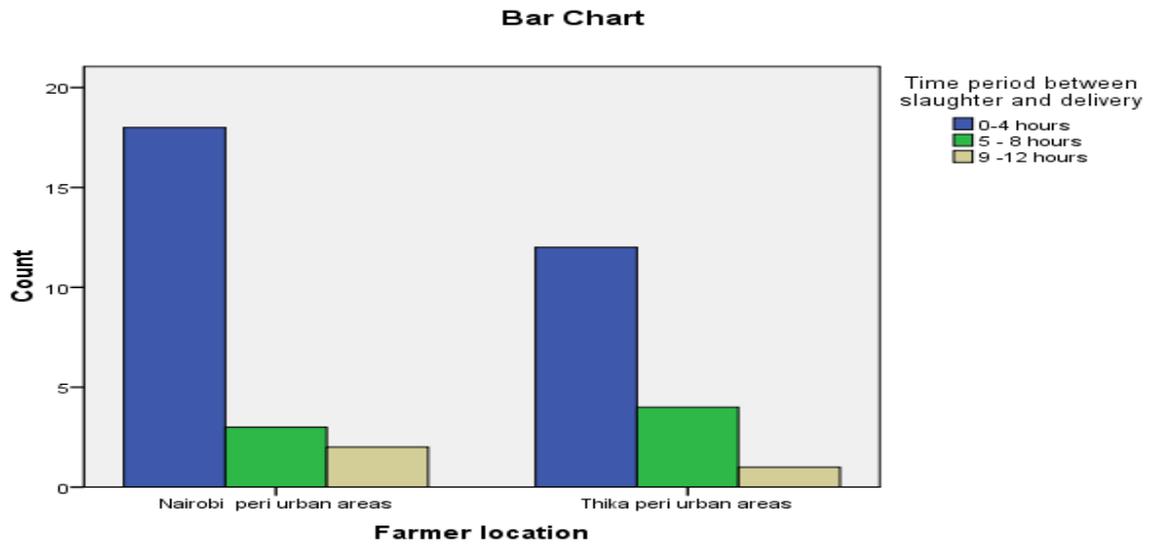


Figure 15 Delivery times per farmer location

From figure 15 it can be observed that there seems to be no difference between the two areas in terms of delivery time of broilers after slaughter (Nairobi and Thika)

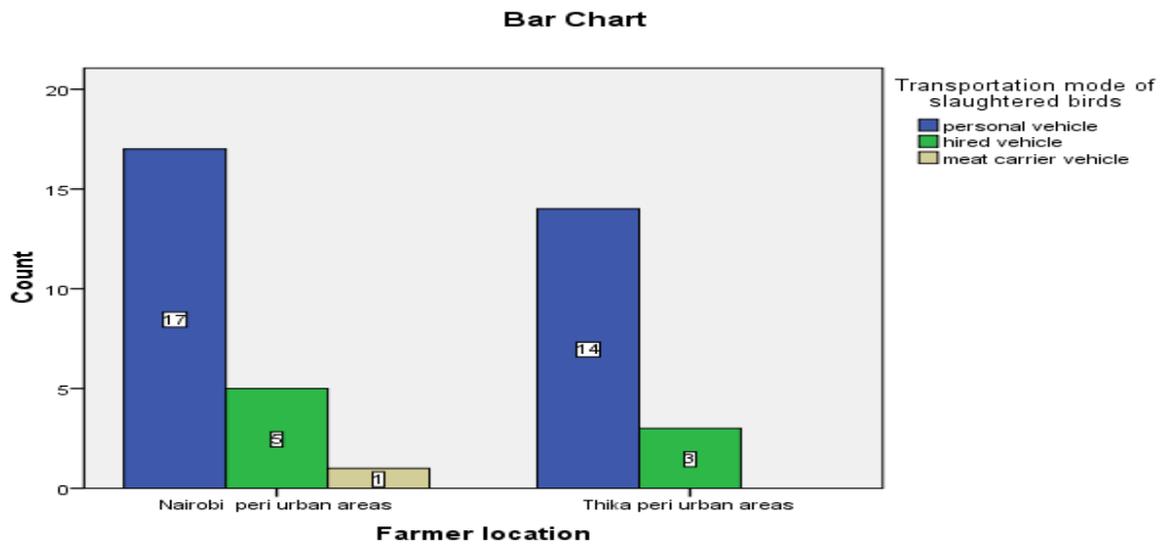


Figure 16 Transportation modes of slaughtered birds per farmer location

Figure 16 suggests that there seems to be no difference between the two districts with regard to in transportation modes of slaughtered birds (74% Nairobi and 82%)

b) Record Keeping

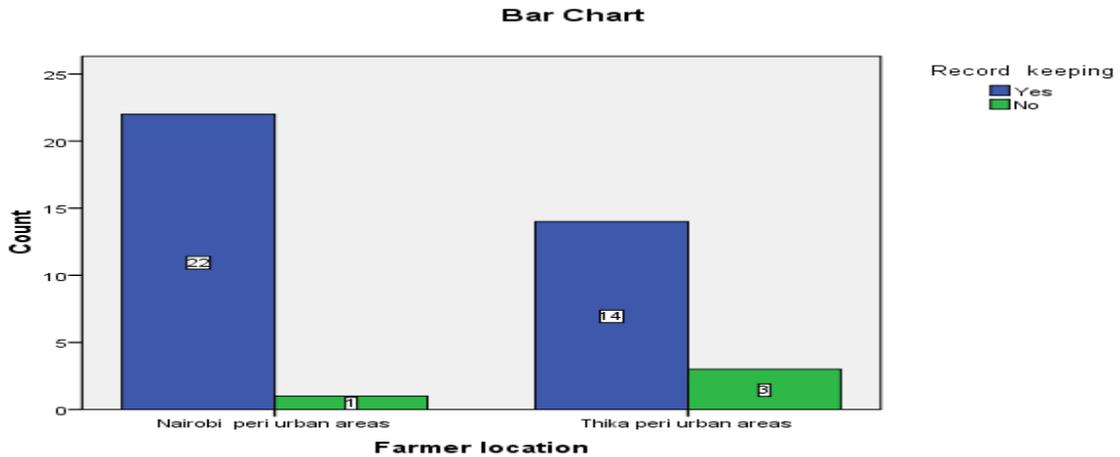


Figure 17 Level of record keeping per farmer location

The results suggest that there seems to be no difference in record keeping as a high majority (96% in Nairobi and 82% Thika), confirmed to be keeping records. These were found to be largely income and expenditure records

c) Opinion on Food Safety Risk

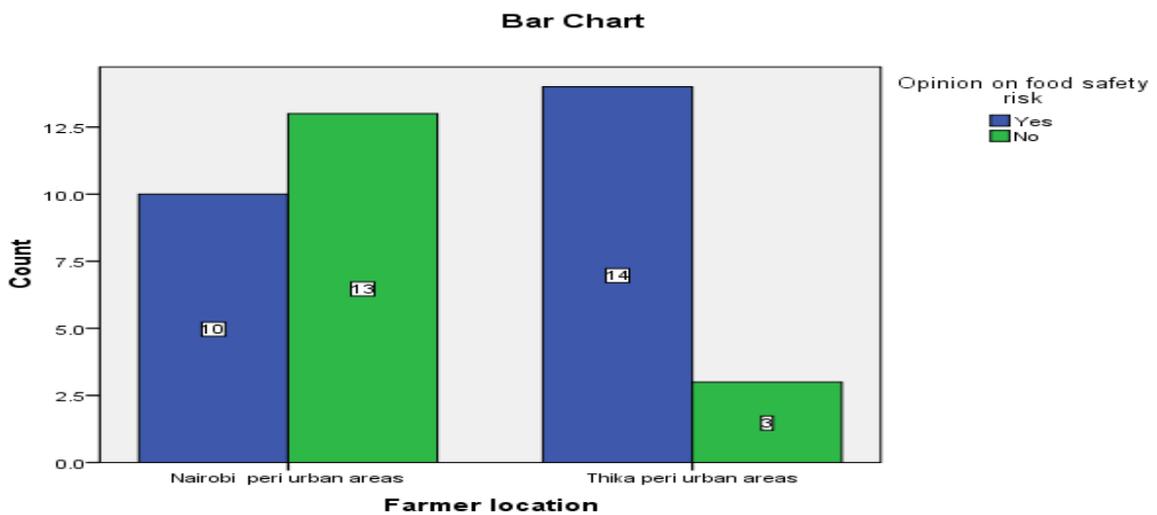


Figure 18 Opinion on food safety risk per farmer location

The results indicate that there was a significant difference ($p=0.013$, annex) on opinion regarding food safety. Thus, Thika district recorded the highest number of respondents, 82% (14), who thought that their practices could pose a food safety risk while in Nairobi 95 % (22) thought that their practices would not pose a food safety risk.

In conclusion it can be said that there seems to be no major difference between the two areas with regard to post slaughter handling practices. Thus farmers in both areas were found to deliver their birds within 0-4 hours after slaughter using personal vehicles. In both areas no chilling of carcasses after slaughter was reported.

3.3 Case Study Results

3.3.1 Perceptions on poultry meat hazards and mechanisms to reduce hazards in broiler meat

The Veterinary Public Health (VPH) office was of the perception that Highly Pathogenic Avian Influenza (HPAI) is currently considered to be the major public health concern in poultry production systems especially due to construction of broiler houses within close range of residential houses and high prevalence of low bio security measures within the sector. In addition to HPAI, the other food safety risks associated with consumption of poultry meat are Salmonella, Campylobacteria, E.Coli and Staphylococci infections. In each of these cases, the risks to public health occur especially during and after slaughter of the broiler chicken due to unhygienic slaughter practices and poor post slaughter handling (transportation and storage).

The VPH department maintains that risks from microbial contamination could be minimized by continuous monitoring and surveillance but this can only occur at the retail level due to inadequate resources (both human and financial)

Food safety regulations are enforceable by both the Veterinary Public Health (VPH) and the Public Health Department of the City Council of Nairobi (CCN). However, the VPH felt that the CCN has more power (human and financial resource) and legal authority to stamp out malpractices in broiler meat but shows a lot of apathy with regard to chicken meat. The VPH attributed this to cultural beliefs in Kenya that have influenced most people to believe that only meat from bovines should be inspected. Poverty also emerged as a major contributor to malpractices. It was revealed that both the VPH department and CCN charge farmers a number of fees for services pertaining to slaughter, transport and trading of slaughtered chicken which many smallholder farmers find prohibitive. Farmers and traders alike have complained that the fees are too high and that they reduce their profit margins further. This is one of the major contributor to low compliance by farmers with existing rules.

The VPH of the Ministry of Livestock Development is only able to enforce the food safety regulations for chicken meat to a small degree due to lack of infrastructure namely, inadequate personnel, transport and low budgetary allocation for monitoring and surveillance. Currently there are 9 districts within Nairobi province but with only 26 staff under veterinary meat inspection.

Thus though the existing regulations are adequate and they can only be said to delivering their outcomes to a small extent as chicken meat from smallholder is not inspected to a large extent. It is also possible for them to be applied consistently nationwide but the infrastructure has to be put in place.

3.3.2 Broiler meat handling practices by traders and retailers/butchers

During the research it emerged that broiler meat traders also doubled up as retailers/butchers and that due to the frequency of business transactions between traders/retailers and broiler producers a relationship had developed sometimes resulting in informal contracts between the two.

Both traders and retailers were aware of food handling practices such as cleanliness of the premise, medical certificates for all personnel working within their premises and complied with the rules. However compliance for these rules was high at retail level but low at the middlemen/trader level especially when the trader was involved during slaughter and transportation of the broiler meat.

With regard to preventing food borne illnesses associated with broiler meat and reducing food safety risks both traders and middlemen pointed out that cleanliness of the premises, refrigeration and medical examination of personnel played a big role in preventing spoilage and in controlling food safety risks respectively. None were aware of any campaigns conducted with regard to safe handling of broiler meat and heaped blame on the government for laxity in this matter. According to them, government agencies are reactionary and tend to carry out campaigns only in the event of disease outbreak. An example was given of the HPAI threat in which the government rolled out a massive campaign to educate poultry chain actors on measures to be taken to minimize risk of HPAI infection. As such they felt that the campaigns do not adequately cover other potential risks associated with poultry meat.

Both traders and retailers reported that the most important aspect considered during the sourcing of broiler meat is cold dressed weight (cdw) which should range between 1.2 and 1.5 Kg, and physical attributes such proper de feathering and good skin appearance. Both traders and retailer affirmed that they trusted that the broiler chicken from the smallholder broiler producers was wholesome and thus they did not need to check for records (feeds and health).

At the retail level, no problems had been experienced with chicken meat received from farmers, but the trader reported an incidence where a consignment of broiler meat delivered to a processor was rejected based on temperature –the carcass temperature at delivery to the processor must be not more than 4°C. The trader had to source for alternative cold rooms to store the consignment before re routing the broiler meat to other outlets.

Both traders and middlemen felt that the VPH were best placed to deal with issues on safe handling of broiler meat.

4.0 DISCUSSION OF SURVEY AND CASE STUDY RESULTS

4.1 Background Information of the respondents

The survey results show that women form the majority of the broiler keepers in both areas. The male respondents in the survey (25% of the total sample) were young men who had been employed as farm hands. These findings support earlier research done by Nyaga, 2007 which showed that chicken farming is normally seen as a women activity

With regard to education level, higher percentage of primary level respondents in Nairobi was attributed to the higher number of male farm hands who had been employed to tend the broilers. The high primary education level in Nairobi is attributed to the high number of farm hands who are employed tend the broilers.

The keeping of broilers in batches of 100 -500 in batches of 3 -6 cycles by majority of farmers in both areas could be attributed to inadequate space as space tends to be limiting Thus rather than keep a large flock farmers prefer to keep many small flocks in specific time periods This has led to broiler cycle (May – July and December – January)in which the market is flooded with broiler meat leading to low market prices. Though most farmers in both areas did not consider broiler farming as a main income earner, they engaged in the business due to it quick return to capital a compared to other enterprises. In addition majority farmers do not depend on broiler rearing as a main income earner as they are engaged in other off farm activities.

The presence of other farm animals e.g. dairy cows and goats, egg production, local chicken production and rabbit keeping are a means of supplementing income. However a previous study by Ostenbach, 2002, indicates that presence of other farm animals as indicated in the results presents a biological risk as it one of the sources of a continuous flow of new salmonella infections to the broiler flock.

4.1.1 Basic Hygienic Practices at the farm level

At the smallholder level there are two basic critical control points that are of importance in minimising spread or introduction of disease to broiler flocks i .e. rest period between production cycles and presence of disinfectant filled footbaths Thus the observance of rest periods between production cycles in both areas is a critical control point that beneficial to farmers in terms of productivity losses However the different rest periods, 2 weeks and more than a month, are due to the fact that most farmers depend on payments from traders/ middlemen before they can bring in the next flock. Thus the longer the traders take to pay farmers, the longer the rest period. However the total lack of foot baths by a large majority of farmers in both areas is suggestive of a low awareness on the importance of footbath in minimising disease causing pathogens to bird flocks. The high prevalence of diarrhoea is attributed to the high occurrence earth floors observed in majority of the houses. Earthen floors are difficult to clean and disinfect and disease causing coccidia to stay hidden in the earth thus re infecting subsequent flocks.

The small percentage of farmers(22.5%) who administered antibiotics without veterinary prescription pose a potential risk of contaminating broiler meat with drug residues.

4.1.2 Pre slaughter practices

During the survey it was not possible to ascertain the type of coccidiostat in the feed due to improper labeling. Thus the possibility of drug residues in broiler meat cannot be suggested as some coccidiostats such as Saccox do not have a withdrawal period.

The fact that farmers in Nairobi stated that labeling does not prove presence of coccidiostat in feeds was seen by the researcher to be an indication of the poor regard that farmers have of the feed manufacturers.

Though there seemed to be high awareness of the need for feed and veterinary drug prior to slaughter, compliance was difficult to ascertain due to either improper record keeping or absolute lack of records. In addition, case study results indicate random monitoring for chemical residues and microbial contamination by the veterinary department is rarely done. Hence with no monitoring or surveillance it is difficult to know the scale of veterinary drug residues in carcasses if any remedial action is to be instituted.

Hence at smallholder level proper record keeping by the farmers would aid in traceability whilst continuous monitoring and surveillance by the VPH would provide information for critical control points

4.1.3 Slaughter Practice at Small holder Level

Majority of farmers in both areas slaughter their birds open spaces on their farm due to the absence of poultry abattoirs. Only one municipal poultry abattoir exists in Nairobi, Kariokor market, but it restricted to slaughter of layers and indigenous chicken only. During slaughter the farm hand together with the farmer and, or with hired help perform the slaughter. It was revealed that professional slaughterers charge a service fee of Kshs.5 per bird which contributes further to production costs.

Despite the fact that there was high awareness on knowledge concerning government slaughter rules, none of the farmers checked for proof of medical examination for slaughterers nor was veterinary department involved during the process as mandated by the meat hygiene act. Farmers avoided involving the veterinary personnel in order to escape paying veterinary inspection fees

Table evisceration was the only method in use in both areas and though cheap it is not particularly clean as it increases the risk of carcass contamination.



Picture 2 A wooden evisceration table with an iron sheet table top at a one of the farms – in some parts the iron sheet was rusty

The high use of tap water during the slaughter process by farmers in both areas is commendable as tap water is clean and potable. However it emerged during the survey that the tap water is collected in not more than two drums of 200 litres in which carcass are rinsed before being packed and distributed. This use of stagnant rather than running water for carcass rinsing is a potential cause of microbial build up that leads to cross contamination of all subsequent carcasses. Moreover it would be difficult at farm level to have chlorine levels of 1 to 5 parts per million chlorine required at final rinse for reduction of microbial populations(National council for Chicken,1992)



Picture 3 An old bathtub used for rinsing carcasses during slaughter process.

The use of borehole and well water by a small percentage of farmers also poses a potential food safety risk as the hardness of these two water types have been shown to affect removal of bacteria on the skin of chicken (Hinton & Rusell, 2009). Further to this the possibility well water being contaminated with E. coli and other chemical contaminants e.g. pesticides and thereby contaminating poultry carcasses is considerably higher..

Thus at the farm level the major critical control checks applicable at smallholder level would be evidence of medical examination of slaughterers, evisceration place., water source and type

4.1.4 Post Slaughter Handling

Although farmers in Nairobi had the highest percentage of cooling facilities, none of them used the facility for post slaughter chilling as most delivered the slaughtered birds within 0-4 hours after slaughter. Nevertheless, farmers admitted to using cooling facilities for freezing purposes in cases when they failed to get market for their mature birds.

Most farmers in both areas used personal vehicles for transportation as cost of acquiring a carrier was too seen to be too prohibitive. The short delivery time is though laudable, is rendered

ineffective, as without prompt chilling of carcasses immediately after slaughter and during transportation, the growth of *Staphylococcus aureus* and *Campylobacter jejuni* to undesirable levels (FAO, 2003) is promoted, rendering the meat unsafe.

Thus though farmers in both areas admitted to keeping records these were mainly for profit calculation making issues of traceability difficult. In addition poor record keeping by farmers of farm processes renders risk profiling difficult at farm level

4.2 Discussion of the trader/ middlemen results

At the retail/ trader level the results indicate that there is high awareness and compliance of safe food handling practices and where they could source for information if need be. Reduction of food safety risks at this level is achieved through use of refrigerated display cabinets for broiler meat, cleaning and sanitizing premises and storing unsold carcasses under refrigeration at the close of business. The high compliance especially of e.g. medical certificates for personnel, was due to the fact that the local authorities were strict in enforcing this particular requirement and would close down a business for lack of it.

As indicated earlier, none of the broiler meat had been inspected. The traders/retailers claimed that both the VPH and local authority were aware of matter and were not to blame due to the absence of poultry slaughter facilities. According to them, the laxity of VPH and local authority was due to the failure of the central government to provide adequate infrastructural support with regard to slaughter facilities.

For traders/ retailers, the most important aspect they considered during sourcing of broiler meat was weight and intrinsic characteristics such as skin appearance and smell. Thus as was illustrated in the broiler chain map, the category of consumers targeted by retailers/ traders is not quality sensitive.

5.0 CONCLUSION

The study concludes that women comprise the majority of broiler farmers and tend to keep between 100 – 500 broilers per batch in 3 -6 cycles per year. In addition majority of the farmers do not depend on broiler rearing as a main income earner but rather keep broilers to supplement earnings from other income sources i.e. formal employment and or income from other livestock enterprises such as dairy cows and goats, egg production, local chicken production and rabbit keeping.

At the production function and with regard to basic hygienic practices at the farm level, the study concludes that no major differences exist between the two areas.

With regard to pre slaughter practices, the study concludes that there were no major differences between the two areas the two areas with regard to level of awareness and practice, in feeds, veterinary drug and coccidiostat feed withdrawal before slaughter.

Slaughter practices: The results suggest that there are no major differences in slaughter practice between the two areas. Thus, majority of farmers in both areas slaughter were found to slaughter their birds on the open grounds on their farm. Tap water was also the most commonly used water type during slaughter in both areas. However, significant difference was observed between the two areas with regard to cooling facilities with Nairobi having more farmers with more farmers with cooling facilities.

Post slaughter practices: It can be concluded that there seems to be no major difference between the two areas with regard to post slaughter handling practices. Thus farmers in both areas were found to deliver their birds within 0-4 hours after slaughter using personal vehicles. In both areas no chilling of carcasses after slaughter was reported.

The overall conclusion is that there are no major differences between the two areas in hygienic practices at the production and processing function of the chain. This can be attributed to poor interaction and cooperation between the smallholder broiler producers and the government. In addition, as seen from the case study poverty and cultural beliefs have also contributed to hygienic malpractices.

A comparison between Kenchic and small producers chain, shows that major differences are exist with regard to hygienic practices at all levels of the chain, with Kenchic farmers exhibiting compliance while small producers are not. The difference in compliance as led to Kenchic exerting more market control.

At the trader/ retailer level, concludes that there is high awareness and compliance with regard to specific hygienic requirements, cleanliness of premises and medical examination of personnel, This was attributed to strong enforcement by local authorities due to sporadic checks for medical certificates for personnel working within the premises.

5.1 Recommendations

As the study was only conducted over a six week period a further scientific risk assessment needs to be carried out to determine what the risks are, and where they lie within the chain in order to improve the safety of broiler meat from small producers. Such an assessment would also enable the MOLD to respond to any and new emerging threats.

In the meanwhile, some steps that could be taken in the short run and can result in high impact are as follows;

- The government through MOLD should make maintenance of adequate records mandatory with periodic checks be carried on the farm and the trader/ retail level to ensure compliance. This would require the involvement of the extension department in training of the broiler meat chain actors
- Construction of regional poultry abattoirs through public and private partnerships in which the role of private sector would be to construct the abattoirs while the government's role would be that of a regulator i.e. abattoir licensing and meat inspectorate services. However for this to be effective the government will need to review its fees and make it affordable for smallholders. As mentioned earlier a farmer organization, KEPOFA is in existence but it needs more support from the grassroots for it to succeed. The leadership of KEPOFA should focus on sensitization and farmer recruitment campaigns in order to increase its membership. High farmer membership will strengthen ability to lobby for abattoirs with private partners and to demand for and improvements in feed quality, better producer prices and seek for opportunities for contract farming with private institutions.
- Since food safety is a public good, MOLD should develop and employ a statistically valid program for random monitoring for hazards in broiler meat at all levels in the broiler chain
- MOLD through the VPH and the livestock extension department should ensure constant reinforcement on the good hygienic practices at all level of the broiler meat chain through education campaigns. These basics include such procedures as personnel hygiene practices and training programs, cleaning, sanitation, provisions for safe water supply, and procedures for handling product throughout the broiler meat chain.
- The feed industry also has a role to play in ensuring feed safety. KEBS in consultation with MOLD should develop local standards for raw feed ingredients to enhance safety within the chain.
- Finally, food safety issues should be handled by a single public institution preferably MOLD in order to avoid passing the buck. As seen from the case study results, the VPH felt that the local authorities were to blame for widespread hygienic malpractices. Though massive restructuring of the nation's food regulatory agencies may not be politically or economically feasible, at least in the short term, attention can and should be focused on strengthening VPH department's capabilities in areas where greatest risks lie i.e. at the farm level

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APPENDICES

Table 1 Chi square table on education levels in Nairobi and Thika peri urban

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.892 ^a	2	.032
Likelihood Ratio	7.350	2	.025
Linear-by-Linear Association	6.651	1	.010
N of Valid Cases	40		

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 3.40.

Table 2 Chi square table on broilers per cycle in Nairobi and Thika peri urban

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.465 ^a	3	.215
Likelihood Ratio	6.293	3	.098
Linear-by-Linear Association	2.543	1	.111
N of Valid Cases	40		

a. 5 cells (62.5%) have expected count less than 5. The minimum expected count is .43.

Table 3 Chi square table on production cycles per year in Nairobi and Thika peri urban

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.239 ^a	2	.538
Likelihood Ratio	1.246	2	.536
Linear-by-Linear Association	.772	1	.379
N of Valid Cases	37		

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 3.46.

Table 4 Chi square test on rest period between production in Nairobi and Thika districts

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.406 ^a	1	.524		
Continuity Correction ^b	.091	1	.763		
Likelihood Ratio	.410	1	.522		
Fisher's Exact Test				.739	.384
Linear-by-Linear Association	.396	1	.529		
N of Valid Cases ^b	40				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.95.

b. Computed only for a 2x2 table

Table 5 Chi square test on rat menace in Nairobi and Thika districts

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.097 ^a	1	.043		
Continuity Correction ^b	2.806	1	.094		
Likelihood Ratio	4.107	1	.043		
Fisher's Exact Test				.079	.047
Linear-by-Linear Association	3.995	1	.046		
N of Valid Cases ^b	40				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.10.

b. Computed only for a 2x2 table

Table 6 Chi square table on replacement of footbath disinfectant

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.640 ^a	3	.054
Likelihood Ratio	10.561	3	.014
Linear-by-Linear Association	5.687	1	.017
N of Valid Cases	40		

a. 6 cells (75.0%) have expected count less than 5. The minimum expected count is 1.28.

Table 7 Chi square table on common diseases during rearing

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.737 ^a	3	.125
Likelihood Ratio	7.924	3	.048
Linear-by-Linear Association	2.494	1	.114
N of Valid Cases	40		

a. 4 cells (50.0%) have expected count less than 5. The minimum expected count is .85.

Table 8 Chi square table on feeding coccidiostat containing feeds

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.775 ^a	1	.379		
Continuity Correction ^b	.075	1	.785		
Likelihood Ratio	.769	1	.381		
Fisher's Exact Test				.565	.385
Linear-by-Linear Association	.756	1	.385		
N of Valid Cases ^b	40				

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 1.28.

b. Computed only for a 2x2 table

Table 9 Chi square table on withdrawal of coccidiostat feeds

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.253 ^a	1	.263		
Continuity Correction ^b	.518	1	.472		
Likelihood Ratio	1.315	1	.252		
Fisher's Exact Test				.428	.239
Linear-by-Linear Association	1.222	1	.269		
N of Valid Cases ^b	40				

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 3.40.

b. Computed only for a 2x2 table

Table 10 Chi square on awareness level of veterinary medicine withdrawal in Nairobi and Thika peri urban

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.388 ^a	1	.239		
Continuity Correction ^b	.024	1	.878		
Likelihood Ratio	1.746	1	.186		
Fisher's Exact Test				.425	.425
Linear-by-Linear Association	1.353	1	.245		
N of Valid Cases ^b	40				

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is .43.

b. Computed only for a 2x2 table

Table 11 Chi square table on awareness slaughter rules in Nairobi and Thika peri urban

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.589 ^a	1	.443		
Continuity Correction ^b	.175	1	.675		
Likelihood Ratio	.599	1	.439		
Fisher's Exact Test				.505	.341
Linear-by-Linear Association	.575	1	.448		
N of Valid Cases ^b	40				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.10.

b. Computed only for a 2x2 table

Table 12 Chi square table on slaughter personnel in Nairobi and Thika peri urban

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.082 ^a	2	.214
Likelihood Ratio	3.092	2	.213
Linear-by-Linear Association	2.996	1	.083
N of Valid Cases	40		

a. 1 cells (16.7%) have expected count less than 5. The minimum expected count is 3.83.

Table 13 Chi square table on presence of on farm cooling facilities in Nairobi and Thika peri urban

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	11.429 ^a	1	.001		
Continuity Correction ^b	9.346	1	.002		
Likelihood Ratio	12.513	1	.000		
Fisher's Exact Test				.001	.001
Linear-by-Linear Association	11.143	1	.001		
N of Valid Cases ^b	40				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.23.

b. Computed only for a 2x2 table

Table 14 Chi square table on transportation mode of slaughtered birds

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.794 ^a	2	.672
Likelihood Ratio	.788	2	.674
Linear-by-Linear Association	.061	1	.805
N of Valid Cases	40		

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is 1.28.

Table 15 Chi square table on time period between slaughter and delivery

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.911 ^a	2	.634
Likelihood Ratio	1.279	2	.528
Linear-by-Linear Association	.656	1	.418
N of Valid Cases	40		

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .43.

Table 16 Chi square table on opinion of food safety risk in Nairobi and Thika Peri urban

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6.155 ^a	1	.013		
Continuity Correction ^b	4.642	1	.031		
Likelihood Ratio	6.505	1	.011		
Fisher's Exact Test				.022	.014
Linear-by-Linear Association	6.001	1	.014		
N of Valid Cases ^b	40				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.80.

b. Computed only for a 2x2 table

Questionnaire to assess good hygienic practices among Smallholder Broiler Producers in Peri urban Nairobi and Thika

Respondent No.....

Date.....

Location.....

Sex.....

Production information

1. What is your education background?
a) Never been to school b) Primary c) Secondary d) College
2. How many broilers do you keep per production cycle?
3. How many production cycles do you have per year?
4. What is the time period between your production cycles?
a) 2 weeks b) a month
5. Is broiler farming your main income earner?
a) Yes b) No
5. What other farm animals or birds do you rear on your farm?.....

Hygiene Practices

6. How often do you replace your footbath disinfectant?
a) No footbath b) less than 5days c) 6 - 7days d) after more than 7days
7. Do you experience rodent problem in your broiler house?
a) Yes b) No

If yes, how do you control rodents?

8. What are the most common disease symptoms that you encounter during the broiler rearing period?
a) Diarrhoea b) coughing c) lameness d) other, specify.....
9. What measures do you take to address the symptoms?
a) consult veterinarian b) isolate and treat sick birds c) slaughter and consume at home

Pre slaughter and post slaughter practices

10. Do your broiler feeds contain coccidiostats?
a) Yes b) No c) don't know
If yes up to what stage to you feed your broilers with this feeds?
a) up to slaughter time b) two weeks before slaughter c) other, specify.....
11. Are you aware of the practice of withdrawing feeds before slaughtering of broiler chicken?
a) Yes b) No
If yes, how long is your withdrawal period?

Checklist for Veterinary Public Health officer

1. What are the major public health and safety risks associated with poultry meat from small holders?
2. Which stages of the smallholder broiler chain have the food safety risks been associated with? How have you gone about minimizing these risks? Are there any regulatory measures that in place to help minimize these risks?
3. To what extent are current food safety regulations enforceable in the smallholder broiler chain?
4. What effect does resource constraints have on enforcement of food safety regulations? Could anything be put in place to ease resource constraints (if applicable)?
5. To what extent are the current food safety regulations delivering the outcomes they were designed for? Could any other measures be used to help deliver the outcome?
6. Can current regulations be consistently applied nationally? If not what new strategies would help achieve national consistency

II Checklist for traders and retailers

1. Do you know what safe food handling practices are? Where would you go to find out about safe food handling practices?
2. Which practices are the most important for preventing food-borne illness associated with poultry meat products?
3. How are food safety risks controlled in your operation?
4. Are you aware of any education campaigns regarding safe food handling practices? Do you think these adequately cover the risks potentially associated with poultry meat?
5. What aspects do you consider when sourcing for chicken meat?
6. Have you experienced any problems with chicken meat received from farmers? If so, what kind, what percentages and what action do you take?