# PRODUCTION SYSTEMS, LOCAL FEED RESOURCES AND MAJOR FACTORS AFFECTING INDIGENOUS CHICKEN IN NYAMIRA COUNTY, KENYA

**BY**

**JOHN KIPLANGAT CHERUIYOT (*B.SC. IN ANIMAL PRODUCTION)***

**REG. NO.: A150/OL/NKU/26036/2019**

**SIGNATURE: ……..  DATE:…….**

**RESEARCH THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN ANIMAL NUTRITION AND MANAGEMENT IN THE SCHOOL OF AGRICULTURE AND ENVIRONMENTAL SCIENCES OF KENYATTA UNIVERSITY**

**NOVEMBER 2025**

## DECLARATION

I **John Kiplangat Cheruiyot,** declare that this thesis is my original work and has not been presented for a degree in any other University or any other award.

Signature: ……. Date: ……

**Declaration by supervisors**

We confirm that the work reported in this thesis was carried out by the candidate under our supervision

1. **Prof. Purity Nguhiu**

   Signature: ……. Date: …….
   Department of Animal Sciences
   School of Agriculture and Environmental Sciences
   Kenyatta University

2. **Prof. Lucy Kamau**

   Signature: ……. Date: ……
   Department of Animal Sciences
   School of Agriculture and Environmental Sciences
   Kenyatta University

## DEDICATION

To my beloved wife Edith Cheruiyot for her continued support. My daughter Joy Cherono. My sons Clinton Kiprotich and Adrian Kipngeno for their patience and encouragement.

Thank you for your moral support. God bless you abundantly.

## ACKNOWLEDGEMENT

I am highly grateful to my supervisors Prof. Purity Nguhiu and Prof. Lucy Kamau for their professional guidance and support throughout my research project and thesis development. I am greatly indebted to their advice and encouragement.

I am indebted to Kenyatta university for giving me an opportunity to study and carry out research at the institution.

I acknowledge the support by the staff at Kenyatta University Food and Nutrition laboratory during feed analysis led by Mr. John Gachoya.

I also acknowledge the support by the staff in the Department of Agriculture, Livestock and Fisheries in Masaba North Sub-county, Nyamira County and particularly the technical officers who assisted me during data collection.

I give thanks to our heavenly father for the good health and favor during the entire research period.

## TABLE OF CONTENTS

## LIST OF TABLES

## LIST OF FIGURES

## ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| **AOAC** | Association of Official Analytical Chemists |
| **ASDSP** | Agricultural Sector Development and Support Project |
| **CBO** | Community Based Organizations |
| **CF** | Crude Fiber, |
| **CIG** | Common Interest Group |
| **CP** | Crude Protein |
| **DCP** | Di-Calcium phosphorous |
| **DM** | Dry Matter |
| **EE** | Ether Extract |
| **FFS** | Farmers Field School |
| **FGD** | Focus Group Discussion |
| **GDP** | Gross Domestic Product |
| **IC** | Indigenous Chicken |
| **K** | Potassium |
| **KG** | Kilogram |
| **KNBS** | Kenya National Bureau of Statistics |
| **MC** | Moisture Content |
| **Mg** | Magnesium |
| **N** | Nitrogen |
| **NACOSTI** | National Commission for Science, Technology and Innovation |
| **NARIGP** | National Agricultural and Rural Inclusive Growth Project |
| **NFE** | Nitrogen Free Extract |
| **NGO** | Non-Governmental Organization |
| **NRC** | National Research Council |
| **P** | Phosphorous |
| **PRA** | Participatory Rural Appraisal |
| **PWDs** | People Living with Disabilities |
| **SCLPO** | Sub County Livestock Production Officer |
| **SPSS** | Statistical Package for Social Scientists |
| **TIMPS** | Technologies, Innovations and Management Practices |

## ABSTRACT

Indigenous chicken (IC) production is an important contributor to food security, income generation and rural employment in Kenya. However, productivity remains low due to limited of optimal production systems, underutilization of local feed resources and inadequate understanding of socioeconomic factors influencing production in Masaba North Sub-County, Nyamira County. Indigenous chicken remains key livelihood source yet empirical data on feed resource value, production practices and influencing factors are scanty. This study sought to determine the production systems, assess the nutritive value of local feed resources and establish the major factors influencing indigenous chicken production. Data were collected from 169 farmers selected using simple random sampling method from 300 farmers in all 20 Common Interest groups (CIG) of indigenous chicken farmers in Masaba North Sub-County. In addition, all 10 indigenous chicken traders, 8 feed stores attendants and 9 Sub-County technical extension officers were recruited into the study after informed written consent and their data collected by focus group discussions using checklist for each category. Formal survey was carried out in the month of September 2023 by interviewing selected indigenous chicken farmers using a structured and semi-structured questionnaire. Proximate and mineral analysis of nine selected feed resource (Fish meal, Kales, Cabbages, Sweet potatoes, Cassava, Maize, Sorghum, Finger millet, Kikuyu grass) were conducted at Kenyatta University. Descriptive and multivariate analysis were done using statistical package for social scientists (SPSS version 22). Results revealed that most indigenous chicken farmers were youth (54.6%) and women (58%) operating under extensive system (61.5%), characterized by scavenging and supplemented with local feed resources. Newcastle, coccidiosis and chronic respiratory diseases were the most prevalent. The mean crude protein (CP) content was 18.9% and fish meal had the highest crude protein (CP) content (65.63%). The mean carbohydrate content was 47.1% and Cassava root had high carbohydrate content of 80.94%. Fish meal and maize had high ether extract (EE) content (9.86% and 4.07%). Crude fiber (CF) content was high on maize (36.13%) followed by kales (36.08%) and kikuyu grass (34.66%). Calcium content was high in Cabbage (1.71%). Kikuyu grass and finger millet had high Phosphorous content (0.67% and 0.64% respectively). Experience, family size and training significantly influenced egg production and mortality ($p < .05$). The study recommends promotion of locally available feed resource utilization, enhanced farmer training and strengthen disease control programs. The findings provide framework for formulating policies to enhance sustainable indigenous chicken productivity in Nyamira County and similar settings.

# CHAPTER ONE: INTRODUCTION

## 1.1: Background to the Study

Indigenous chicken production plays a significant role in rural livelihoods across Sub-Saharan Africa, especially in Kenya where it contributes substantially to household nutrition, income generation and food security. These birds are highly adaptable to harsh environmental conditions and require relatively low inputs compared to exotic breeds (Anyona *et al*., 2023). They are kept by a majority of the households for meat, eggs and source for quick cash during emergencies. Beyond economic importance, indigenous chickens also hold socio- cultural value, being used in traditional ceremonies and as gifts (Esatu *et al*., 2023). Despite their potential, the productivity of indigenous chicken remains low due to several constraints. Production systems are often extensive or free range, characterized by minimal housing, low biosecurity and reliance on scavenging for food. These conditions expose birds to predators, diseases and feed shortages (Liswaniso *et al*., 2024). Additionally, there is little knowledge of the nutrient composition of locally available feed resources that could enhance productivity (Kiptui *et al*., 2024). The most dominating poultry production system in rural areas of Africa is extensive system based on local indigenous types and relying on scavenging feeding systems (Mohammed *et al*., 2016). Kenya has an estimated population of 47.6 million people (KNBS, 2019) and over 70% of the population lives in the rural areas where they practice agriculture for subsistence and commercial purpose. Masaba North Sub-County is predominantly a rural area which has a poverty index of 32% compared to national average of 36% (KNBS, 2018).

Kenya has estimated 15.76 M cattle, 19.3M sheep, 28M Goats, 4.6M Camels, 1.18M Donkeys, 443,000 pigs, 30.3M indigenous chicken, 5.6M exotic layers, and 2.9M broilers (KNBS, 2019). Masaba North Sub-County in Nyamira County has a human population of 110,914 and the farming population of 20,678 households and poultry population of 12,810 out of which the indigenous chicken are 11,684, exotic layers 867 and exotic broilers 259 (KNBS, 2019).

Kenya's main indigenous poultry production system is the free range (backyard) system where birds are left to scavenge for feed during the day and confined at night. Birds of all

ages live and scavenge together. The flock sizes are usually small less than 30 adult birds and are kept for meat and eggs for home consumption and are kept with minimal care and no supplementation (Kingori *et al*., 2010).

The second production system is semi-intensive whereby the birds are confined and fed during morning hours and left to scavenge during afternoon and confined in shelters of moderate cost at night. Water and supplementary feeds are provided and birds are kept in small flocks of between 5 and 50 birds mainly for consumption and sale and the level of inputs ranges from low to medium (Magothe *et al*., 2012). The third system is intensive (commercial) system, where flock sizes range between 5 and 500 adult birds confined in constructed shelters or runs and provided with commercial feeds or homemade feed rations and health care (Magothe *et al*., 2012).

Poultry production offers opportunity for improved household's income especially for vulnerable members of the society such as youth, people with disability (PWDS), widows, and has other functions such as cultural and nutritional roles. Indigenous poultry production is the first step on the ladder for poor households to tackle poverty (Bangu, 2020). The potential of indigenous chicken as a source of income and food remains poorly exploited (Lubandi *et al*., 2018). The flock size is small, typically less than 100 and the family flock consist of birds of both sexes and different ages making management a demanding task (Desta, 2020). Indigenous chicken production has great potential with changes in production system from scavenging to a semi-intensive system with investment in production inputs (Goromela *et al*., 2006).

Increment in poultry industry have profound effect on demand for feed and raw materials hence there is need of exploring locally available, alternative feed stuffs in feed formulations is required (Mwesigwa *et al.*, 2015). Studies have shown that the current issues of climate change, increased human population coupled with decreased land size and increase in flock size have led to low quality and quantity of scavenge-able feed resources for indigenous chicken, with nutrient content below recommended levels to support growth and egg production. Thus, additional nutrients should be provided through supplementary feeds.

Few studies have systematically assessed the contribution of local feeds resources to indigenous chicken performance under village production systems. Understanding the types, nutritional value, constraints in using these feeds is critical for designing effective feeding strategies and improving productivity of indigenous chicken (Gueye, 2009; Kingori *et al*., 2010).

### 1.2: Statement of the Problem

Indigenous chicken production plays a vital role in the livelihoods and food security of rural households across Kenya and other developing countries. It provides a readily available source of animal protein and income particularly for small holder farmers and women (Anyona *et al*., 2023). Despite this importance, productivity of indigenous chicken remains low due to inefficient production systems, limited inputs and poor management practices (Liswaniso *et al*., 2024). In many areas such as Masaba North Sub-County, most farmers rely on traditional free- range systems characterized by low inputs and high exposure to disease and predation (Anyona *et al*., 2023).

One of the major limitations in indigenous chicken production is inadequate feeding and dependence of locally available but nutritionally uncharacterized feed resources. while these resources are accessible and affordable, little is known about their nutrient composition, seasonal variability and actual utilization efficiency (Kiptui *et al*., 2024). As a result, chicken often experience poor growth rates, reduced egg production, and high mortality (Ginindza, 2023).

Furthermore, indigenous chicken productivity is influenced by multiple interacting factors including disease prevalence, access to veterinary services, market structures and the socio-economic status of farmers (Esatu *et al*., 2023). Comprehensive understanding of these factors in local contexts in Masaba North sub-county is lacking which constraints the design of effective improvement programs and policies. Therefore, this study seeks to assess the production systems, feed resource usage and composition and major factors influencing indigenous chicken production in Masaba North Sub-County, Kenya.

### 1.3: Research questions

i. What are the production systems used for the indigenous chicken production in Masaba North Sub-County?
ii. What are the nutrient composition, usage and constraints of the locally available feed resources for indigenous chicken in Masaba North Sub-County?
iii. What major factors influence indigenous chicken production in Masaba North Sub-County?

### 1.4: Study objectives

#### 1.4.1: General objective of the study

To investigate the production system, assess the nutritive value of the locally available feed resources and the major factors that influence indigenous chicken production in Masaba North Sub-County, Nyamira County, Kenya.

#### 1.4.2: Specific objectives of the Study

i. To determine the production systems used in indigenous chicken production in Masaba North Sub-County.
ii. To determine the nutrient composition, usage and constraints of locally available resources used as indigenous chicken feeds in Masaba North Sub-County.
iii. To assess the major factors that influence indigenous chicken production in Masaba North Sub-County.

### 1.5: Justification of the study

Indigenous chicken farming continues to be a cornerstone of rural livelihoods, yet its potential for poverty reduction and food security is underexploited due to poor productivity. Masaba North Sub-County has high population of smallholder farmers who depend on indigenous chicken for income and nutrition. The increased demand of protein, particularly poultry meat, and the high cost of feeds makes this study necessary to understand the production systems and the nutritive value of locally available feeds.

Additionally, information on their production systems, feed resources and influencing factors is scanty. By providing empirical data on these aspects, this study will fill a gap necessary for designing targeted interventions, feeding strategies, and extension programs that can enhance productivity and sustainability.

### 1.6: Significance of the study

The findings of this research will be beneficial to several stakeholders. Indigenous chicken farmers will gain insight into better utilization and management practices to improve flock performance. Researchers and policymakers will access up to date data for appropriate policies and interventions to strengthen indigenous poultry production systems. Development agencies will use the outcome to design locally adaptable programs to enhance rural livelihoods. Ultimately, the study will contribute to the broader goal of food security and income generation among smallholder farmers in Masaba North Sub-County and similar regions in Kenya.

### 1.7: Conceptual framework

The conceptual framework illustrates how production systems, local feed resources, farmer demographic characteristics and management practices influence indigenous chicken performance in Masaba North Sub-County, Nyamira County. The independent variables were factors expected to directly influence indigenous chicken production and were characterized by type of system, disease control practices, disease and parasite control, market infrastructure, training and extension services, feeds availability and utilization.

The dependent variables were measured by chicken mortality rate, egg production, flock size and income from sale of eggs and birds. The moderating variables are government policies such as subsidies and programs; these variables strengthen or weaken the relationship between the independent and dependent variables. The county led livestock policies were expected to facilitate adoption of improved systems.

The intervening variables are unemployment and poverty levels of the IC farmers. These variables mediate the relationship between independent and dependent variables by

affecting how the causal factors produce outcomes. The presence or absence of poverty and unemployment had positive or negative impact on the IC production The framework therefore guided the research design by showing how different categories of factors interact to influence indigenous chicken production outcomes, while anticipating external conditions such as policy support and moderate these relationships. Figure 1.1 shows the conceptual framework of this study.

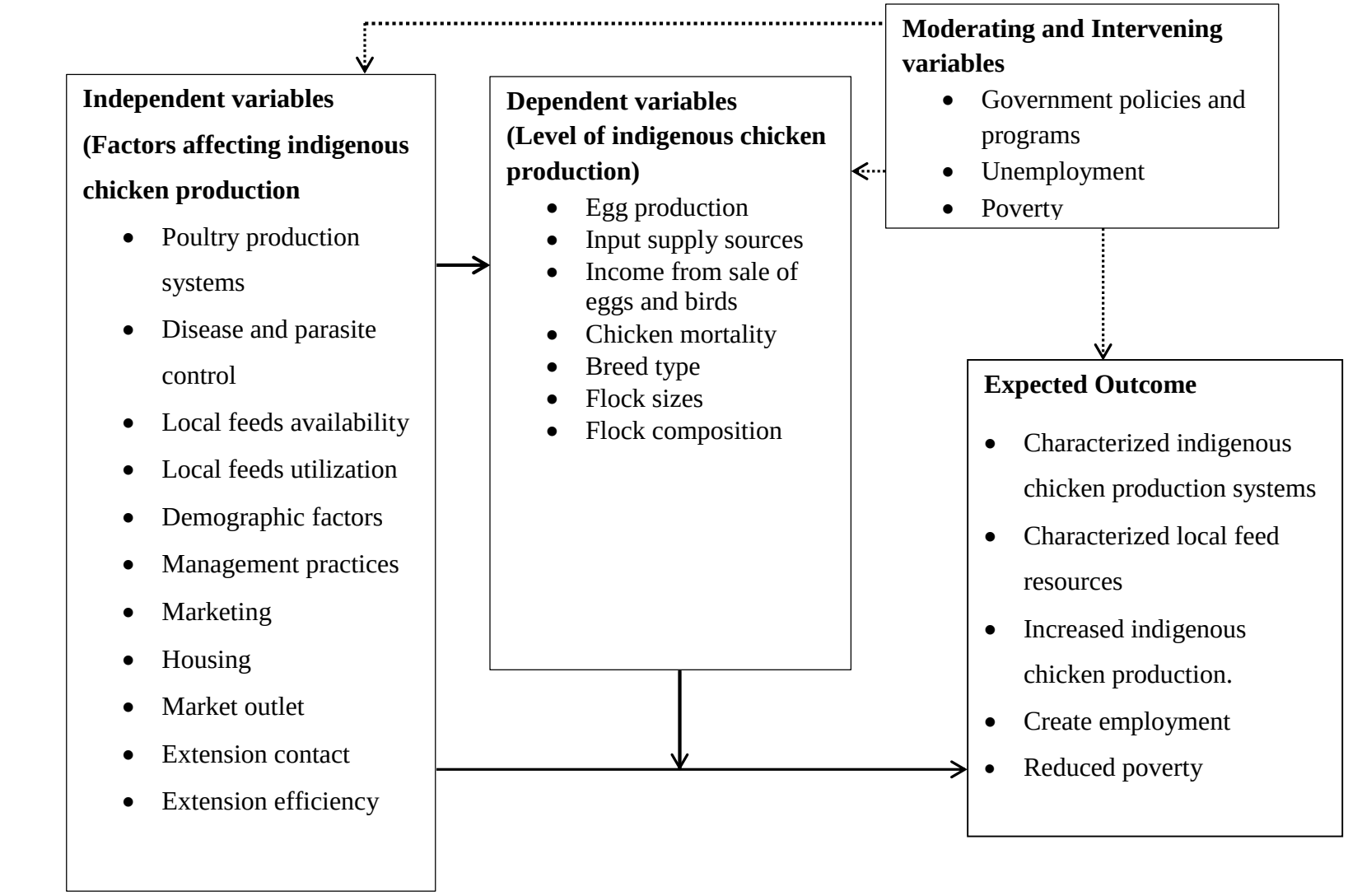



**Figure 1.1:** Conceptual Framework of the Study

**Source:** Adapted from Nduthu, 2015

# CHAPTER TWO: LITERATURE REVIEW

## 2.1: Global overview of indigenous chicken production

Indigenous chicken production remains an important component of rural livelihoods globally, particularly in Asia, Africa and parts of Latin America, where it contributes significantly to food security, nutrition and income for low-income households (Msoffe *et al*., 2023). Globally more than 80% of rural households in developing countries keep indigenous chicken under low-input, smallholder systems characterized by scavenging, minimal housing and seasonal feed supplementation (FAO,2019).

In Asia, countries such as Bangladesh, India and Vietnam have documented rapid growth in indigenous chicken populations due to their adaptability, low maintenance costs and cultural preference for indigenous chicken meat and eggs. In sub-Saharan Africa, indigenous chicken constitutes 70-85% of total poultry population and are valued for their hardiness, disease tolerance and ability to survive under harsh climatic and nutritional conditions (Gueye, 2020). Latin American countries such as Brazil and Peru also maintain genetically diverse native chicken ecotypes that are key to community nutrition and climate resilience.

Free range scavenging poultry production is the most common phenomena among landless and under privileged section of rural world (Islam *et al.*, 2021). Backyard systems contribute 8% of global egg production and 2% of global meat. Backyard systems make significant contributions to eggs and poultry meat production in Eastern Europe, South Asia, Sub-Saharan Africa and to a less extent East Asia and Latin America (Mottet *et al*., 2017).

In Bangladesh, the production system for indigenous chicken is smallholder backyard scavenging in nature each family keeping an average of 6-7 chickens to meet family requirements, from which a cash income can also be derived when necessary (Bhuiyan *et al*., 2005). With the ongoing genetic improvement by selective breeding, along with adequate nutrition and proper management, the future is promising (Das *et al*., 2008).

Despite their importance, global constraints remain common, including high mortality from diseases, limited genetic improvement programs and inadequate feed resources

(FAO, 2021). International initiatives emphasize improving husbandry practices, conserving indigenous chicken breeds and promoting sustainable intensification as pathways for enhancing productivity and resilience of indigenous chicken systems worldwide.

### 2.2: An overview of indigenous chicken production in Africa

The potential of indigenous chicken is not fully exploited in this region when compared to the hybrid industrial chicken despite the growing preference for their meat and eggs (Bebe *et al.*, 2013). It is apparent that scavenging indigenous chicken are the major source of poultry meat produced in most African countries. However, information on the production potential of scavenging chicken is limited (Melesse, 2014).

Generally, in Africa, indigenous chickens are mostly owned and managed by women and children thus forming an integral part of female headed households (Moreki, 2010). In Ethiopia local chicken are characterized by low production and productivity. This is mainly attributed to poor genetic makeup, huge disease burden and poor veterinary services, lack of quality and affordable feeds (Muleta and Sime, 2022)

The proximate analysis of the crop and gizzard contents of the scavenging chickens reared in some African countries indicated that the protein, energy, and mineral contents of the feed consumed was much lower than that of the recommended levels (Sonaiya, 2004). High mortality of chicks due to diseases, parasites and predation are some of major constraints on village chicken production in most African countries (Kingori *et al*., 2010).

### 2.3: Status of indigenous chicken production in Kenya

In Kenya, the common poultry production systems are free range and semi-intensive systems (Kingori *et al*., 2010). The utilization of intensive system should be considered because land availability for practicing free range system is reducing due to ever increasing human population and also genetic improvement of indigenous chicken may also come with need for better management and therefore commercialization of indigenous chicken production (Magothe *et al*., 2012).

The major production system for indigenous chicken production in Kenya is the extensive system of management whereby all age groups are fed together by scavenging with irregular and inconsistent supplementation (mostly cereal grains) and housing mainly provided at night in human dwellings (Olwande *et al*., 2009). Use of local feeds was popular because they are cheap, easily accessible, and affordable and are mixed with commercial rations to keep costs low (Bebe *et al*., 2013).

Productive and reproductive performance of indigenous birds is relatively very low, on average 40-100 eggs and 1.3-1.8 kg meat per bird per year (Kingori *et al*., 2010). The mean flock size per household is small (22) and rate of inbreeding is high (Okeno *et al*., 2015). With the ongoing genetic improvement by selective breeding, along with adequate nutrition and proper management, the future is promising (Das *et al*., 2008).

**2.4: Local feed resources and feeding of the indigenous chicken**

The economics of poultry production primarily depends on the dietary formulation and feeding depending upon the ingredients used as feed account 65-75 percent of the total investment. In order to achieve most economic gains, the knowledge of nutrient requirement of poultry, selection of feed ingredients for ration formulation, feed compounding and feeding system are very important (Kumar *et al*., 2010)

The indigenous chicken productivity in the tropics has been limited by scarcity and consequent high prices of conventional protein and energy sources. There is need to search for locally available source of protein and energy for use as feed supplements for poultry (Bangu, 2020). It is necessary and essential to increase their productivity by improving their feeding strategies through unconventional and local feed resources utilization (Ayssiwede *et al*., 2011).

Supplementation with available feedstuffs is sometimes done by giving cereal grains and their by-products and the household wastes generally in the morning or evening depending on their availability in the households (Goromela *et al*., 2007). Feed formulated from locally available feedstuff like *Balanites orbicularis* seed cakes mixed with ground maize improve the energy and protein content compared to ground maize given alone (Qabale, 2015). Birds fed on supplemented feeds significantly improved production performance,

shell thickness and yolk index compared to birds that are fully on scavenging (Rashid, 2003).

Dietary carbohydrates are important sources of energy for poultry. Cereals grains such as corn, grain sorghum, wheat, barley contain most carbohydrates for poultry diets. Metabolizable energy values are most commonly used to define dietary energy available to poultry. Fats is usually added to the feed for meat type poultry to increase overall energy concentration and in turn improve productivity and feed efficiency. Dietary requirements for protein are actually requirement for amino acids contained in the dietary protein. Minerals are the inorganic part of feeds or tissues. They are divided into two categories based on the amount required in the diet (NRC, 1994).

### 2.5: Major factors influencing indigenous chicken production

Indigenous chicken are good scavengers as well as foragers and have high level of disease tolerance, possess good maternal qualities, and are adapted to harsh conditions and poor-quality feeds as compared to exotic breeds (Guteta, 2021). Several researchers in their studies found that the majority of poultry farmers, especially small-scale farmers ranked high cost of poultry feeds as a major challenge in poultry production (Masole *et al*., 2015).

Diseases (New castle, Infectious bursal disease (Gumboro), and Fowl pox), parasites, high cost and poor-quality feeds are major factors influencing indigenous poultry production (Mutua, 2018). Olwande (2016) identified diseases, predation in chicks and inadequate feeding, in order of importance as the major constraints to indigenous chicken production. Farm inputs, quality of feeds, appropriate vaccines administered to chicken positively influenced poultry production (Ogolla, 2016).

### 2.6: Existing literature and knowledge gaps

A review of past literature work indicates that research concentrated mainly on scavenge on feed resources but few if any studies on local feed resources has been published in Western part of Kenya and Nyamira County. To increase productivity and profitability of indigenous chicken production there is need to establish the current status of IC production in Masaba North Sub-County, identify major factors and constraints influencing IC production and identify locally available feed resources for indigenous chicken and their

nutrient content. These knowledge gaps have been addressed by this study. There is very limited documentation on indigenous chicken production in the sub county and this study has provided the status knowledge on indigenous chicken management practices, nutrient composition of local feed resources and major factors influencing IC production in Masaba North Sub-County.

# CHAPTER THREE: MATERIALS AND METHODS

## 3.1: Study area

The study was carried out in Masaba North Sub-County, Nyamira County, Kenya. Administratively the Sub-County is divided into three wards namely Rigoma, Gachuba and Gesima. It is located 1.5 kilometers west of Keroka town and 20 kilometers to Kisii town. The altitude ranges between 1250-2100 meters above sea level. Rainfall pattern is bimodal and average 1200-2100mm per year. The sub-county was purposively selected for the study due to its proximity to major markets for IC products, high number of IC per household in the county (KNBS, 2019), Nyamira County and other stakeholders such as National Agricultural and Rural Inclusive Growth Project (NARIGP) prioritized IC value chain which justified such a study. Similarly, the sub-county has suitable agro-ecological and climatic conditions suitable for IC production. The map of the study area is as shown in Figure 3.1.

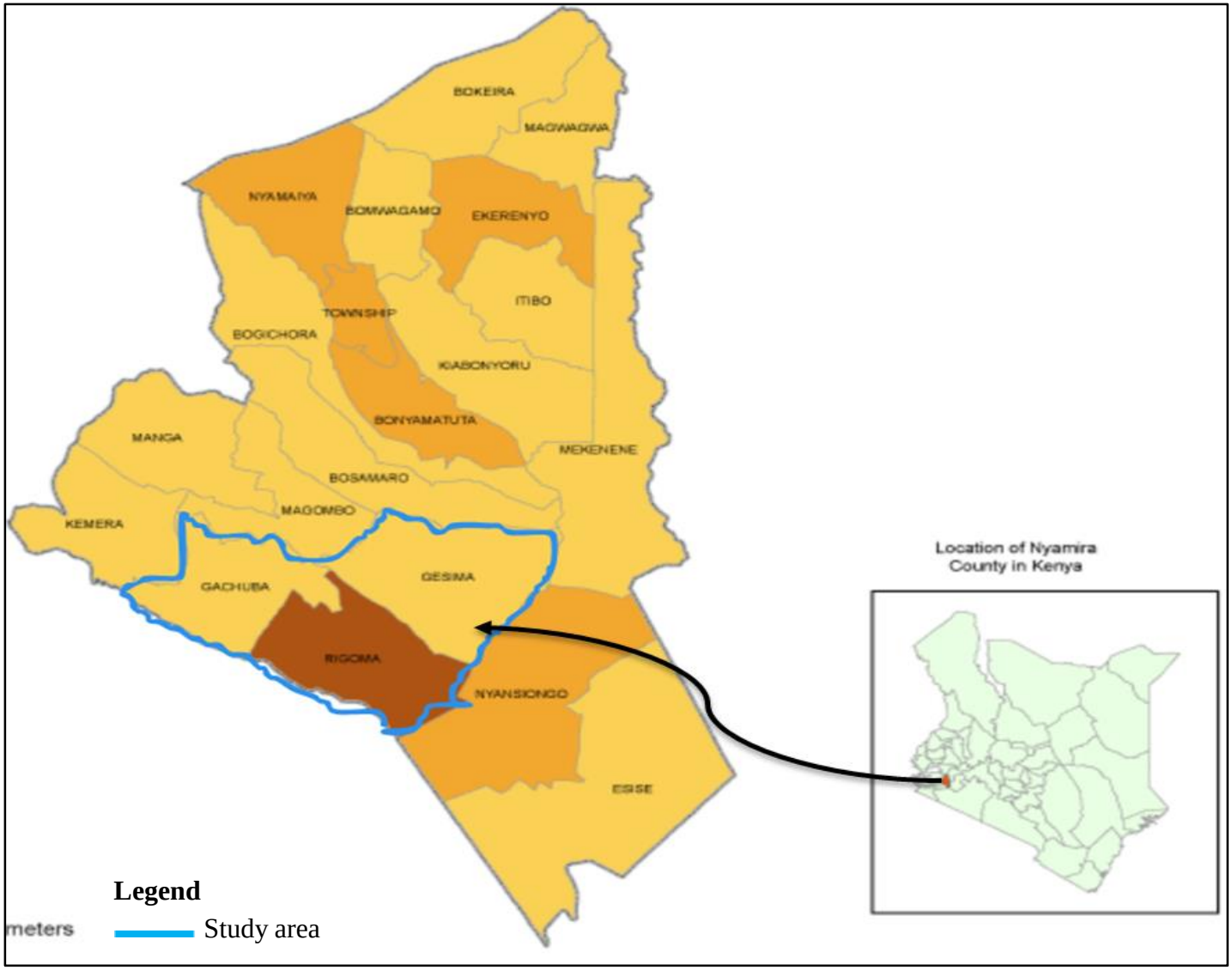



**Figure 3.1: Map of the study area: Masaba North Sub-County**

**Source:** https://nyamiraassembly.go.kje/index.php/about-us/boundaries.html

### 3.2: Study design

This study used a descriptive and analytical research design. Cross-sectional survey was employed because this research was conducted in a timely manner in a small population. Simple random sampling technique was done to obtain representative sample of the IC farmers belonging to indigenous chicken groups (CIGs) in Masaba North Sub-County. Pretested structured and semi-structured questionnaires was used to collect data as Kothari (2004) recommends use of structured instruments for descriptive studies. Focus group discussion (FGD), key informant interview, observation checklist were instruments used to obtain data.

### 3.3: Population

The study populations include all poultry and poultry farmers in Masaba North sub -county. The sub county has a human population of 110,914 persons (males 49, 088, females 55,254) within 27,913 households. The sub county has approximately 109, 380 chicken and 96, 336 were indigenous chicken, 11,312 are exotic layers and 1,732 broilers KNBS (2019).

The study population is comprised of 300 farmers from 20 common interest groups (CIGs) selected from all the three wards of the sub county. The average number of members per CIG were 15 farmers (SCLPO, 2020). The reason for targeting farmers in groups is that this study wanted to get information on indigenous chicken production. Extension officers, poultry traders and feed store attendants were included in this study to reinforce the information obtained from IC farmers (Table 3.1).

### 3.4: Sampling procedure

Households with indigenous chicken were used as sampling frame for this study. The sample size of 169 IC farmers was calculated using the formula by Krejcie and Morgan, (1970);

$S = X^2 NP (1- P) \div d^2 (N -1) + X^2 P (1- P)$.

Where, S is the required sample size, $X^2$ is the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841), N is the population size (300), P is the

population proportion (assumed to be .50), d is the degree of accuracy expressed as a proportion (.05). Therefore;

$$S = \frac{3.841 \text{ X } 300 \text{ X } 0.5(1-0.5)}{0.05^2\ (300-1)+3.841 \text{ X } 0.5(1-0.5)} = 169$$

Secondly, research randomizer was used to randomly sample 169 farmers from 300 farmers from 20 CIG groups of IC farmers in the Sub County. All 8 feed store attendants, 10 chicken traders and 9 extension officers were recruited into the study to obtain more information on the indigenous chicken production.

### 3.5: Sample size

The study used a sample size of 169 farmers, 8 feed store attendants, 10 chicken traders and 9 extension officers.

**Table 3.1: Distribution of poultry traders, feed store attendants, extension staff and farmers in Masaba North Sub-County**

| Category | Gesima ward | Gachuba ward | Rigoma ward | Total (n) |
|---|---|---|---|---|
| Chicken traders | 3 | 2 | 5 | 10 |
| Extension officers | 3 | 2 | 4 | 9 |
| Feed stores attendants | 3 | 2 | 3 | 8 |
| Farmers in 20 CIGs | 57 | 63 | 49 | 169 |

### 3.6: Data collection instruments

#### 3.6.1: Questionnaire

The questionnaire consisted of both closed-ended and open-ended questions. Closed-ended questions were used to obtain standardized responses on demographic information, flock size. production systems, feeding practices, disease occurrence and marketing channels, allowing for easy coding and quantitative analysis. Open-ended questions were included to capture detailed explanations, perceptions and experiences that could not be fully expressed through fixed response options.

The combination of questions types enabled collection of both quantitative and qualitative data, ensuring a comprehensive understanding of indigenous chicken production practices

in the study area (Appendix V). Before start of actual survey questionnaire was pre-tested with 30 farmers in neighboring Manga sub-county to assess clarity, timing and reliability. Mugenda and Mugenda (2003) recommended that 10% of study population to be used for pilot studies to determine validity, reliability and problems in the questionnaire.

Reliability of multi-item scales were tested using Cronbach's alpha, producing coefficients ranging from 0.71 to 0.90. Production system practices ($\alpha$=0.82), Feed knowledge and utilization ($\alpha$=0.87), disease control practices($\alpha$=0.78), Market and input access($\alpha$=0.74), extension and training contact ($\alpha$=0.71), overall management index ($\alpha$=0.90). All values exceeded the acceptable reliability threshold of $\alpha \geq 0.70$ (Field, 2018), confirming satisfactory internal consistency of instrument. Minor adjustments were made to improve question clarity and flow before the final data collection.

### 3.6.2: Checklist

A checklist was used to guide focus group discussions with key informants such as extension staff, feed store attendants and chicken traders. The Checklist had questions on dominant poultry chain actors, major constraints faced in IC production and marketing, challenges faced by extension staff, number of NGO and projects dealing with IC production, number of markets for IC poultry products, potential local feed resources for indigenous chicken (Appendix VI).

## 3.7: Data collection procedure

### 3.7.1: Primary data

Both qualitative and quantitative data were collected from the study area. Data was collected in the three wards of the sub county from IC farmers using a structured questionnaire.

#### 3.7.1.1: Households questionnaire survey

Household questionnaire was used to collect data from indigenous chicken farmers assisted by the trained enumerators with animal husbandry skills. The face-to-face interviews were conducted using physical paper questionnaires administered to the household head. In cases where the household head was absent, the interview was conducted with any

responsible adult members of the household who was directly involved in indigenous chicken management and was knowledgeable about household poultry production activities.

Before data collection three research assistants were trained for two days on the study objectives, questionnaire content, ethical considerations and interviewing techniques to ensure consistency and reduce interview bias. The research assistants introduced the purpose of the study to each respondent, explained the confidentiality and voluntary participation and obtained informed consent from each participant before commencing data collection exercise.

The questionnaire was administered through face to face interviews at the farmer's homestead in English, Kiswahili and Ekegusii depending on respondent's preference to ensure full comprehension. Information collected included household demographics, flock size, production systems, feeding practices, disease prevalence, mortality patterns and marketing practices related to indigenous chicken production. Each interview lasted for 25 to 30 minutes. Responses were recorded directly on printed questionnaire and later coded for entry into SPSS version 22 for analysis.

#### 3.7.1.2: Focus group discussion

Focus group discussion was conducted with the selected key informants involved in indigenous chicken value chain to obtain qualitative insights complementing survey data. The focused groups (FGDs) enabled researchers to explore farmer's perceptions, experiences and shared challenges that may not be captured through structured questionnaires. According to Nyumba et al. (2018), FGDs are effective in collecting in depth qualitative information, encouraging group interaction and consensus building among participants with shared experiences. Similarly, Guest et al. (2020) emphasize the FGDs provide contextual understanding and triangulation of qualitative data ensuring validity and richness of information.

Extension officers played a critical role in both sampling and data collection stages of the study, they possess comprehensive knowledge of poultry keeping households, common interest groups, production challenges and disease trends in the sub-county. Data were

collected from nine extension officers on prevalent diseases affecting indigenous chicken in the sub-county, seasonal trends in mortality and morbidity, common production system practiced by farmers, availability of feed resources and extent and impact of extension services, challenges faced by farmers, policy or institutional gaps and recommended interventions and improvement.

Poultry traders were engaged as key informants because they occupy a strategic position in the indigenous chicken value chain. The interact with farmers, buyers, brokers and market actors giving firsthand knowledge of marketing trends, pricing dynamics and supply challenges. Data on seasonal demand for indigenous chicken in local markets, average buying and selling price, factors influencing price fluctuations, supply trends such as major sources of birds, marketing channel and actors, constraints faced by traders, opportunities and value addition.

Feed store attendants were included as key informants because they interact directly with poultry farmers purchasing feeds, supplements and veterinary products. Their perspectives provided market based evidence on feeding patterns, feed demand and challenges affecting feed access. Data collected from eight feed store attendants were type of poultry feeds stocked, most commonly purchased feeds, availability of feed, sales volumes changes over time, demand trends for commercial feeds during different seasons.

In this study, FGDs were guided by a structured checklist focusing on production constraints, disease prevalence, marketing challenges and opportunities for improvement. The three FGDs were conducted within the three wards of Masaba North Sub-County (Rigoma, Gachuba and Gesima) where indigenous chicken production is common. Each discussion session involved 8-10 participants, giving a total of 27 participants across the three FGDs. The groups were purposely composed to represent main actors in the indigenous chicken value chain., they were county extension officers, feed store attendants and poultry traders.

Participants were selected through the assistance of the sub-county livestock production officer to ensure representation from all value chain categories. The discussions were conducted in venues that were accessible and familiar to the participants (chief's offices

and ward agricultural offices) in a quiet and relaxed settings to encourage open dialogue. The discussions were audio recorded and later transcribed for thematic analysis. This approach aligns Krueger and Casey (2015), who recommend small homogenous groups to allow deeper participation and generation of collective insights and with Hennik et al. (2020) who note that 3-4 well-structured FGDs are sufficient to reach thematic saturation in agricultural and social research.

#### 3.7.1.3: Locally available feed resources

During the survey observations were made to collect data on the type of production systems, local feed resources and feeding practices in the farm (Outhen, 2014). Nine local feed resources were identified as potential during household survey (maize, millet, sorghum, wheat, cassava, sweet potato tubers, kales and cabbages). The feed samples were collected within markets in all the three wards of Masaba North sub-county. One sample for each feed resource weighing approximately one kilogram was collected for proximate analysis from the three wards. The samples were oven dried and finely grounded before chemical analysis (proximate and mineral).

#### 3.7.1.4: Nutritional quality of the collected feed resources

Proximate analysis to determine the dry matter (DM), ash, crude protein (CP), ether extract (EE), crude fiber (CF), nitrogen free extracts (NFE), according to AOAC procedures of (2005). Moisture in the sample was obtained by loss in when sample was heated at 100℃ (in an oven) to constant weight. Ash was determined by heating the sample at 500℃ (in a furnace) until carbon has been removed and the residue was ash.

Crude protein was determined by Kjeldahl method as described by Kamya et al. (2022) comprise of sulphuric acid digestion which convert nitrogen present to ammonia. Ammonia is released by addition of sodium hydroxide. Released ammonia is trapped in acid. It is assumed that nitrogen derived from protein containing 16% nitrogen hence multiplying the nitrogen figure by 6.25(100/16) to obtain approximate crude protein content in the feed sample.

Ether extract was determined by subjecting the sample to continuous extraction with petroleum ether (diethyl ether) for a defined period. The residue after evaporation was the ether extract (crude fat) since it contains other type of lipids. Crude fiber was obtained by sequential treatment of samples with dilute acid and dilute alkali. The NFE will be solubilized. The residue will consist of fiber and in organic matter. The residue is burned in the furnace and the loss in weight is crude fiber. NFE is obtained as the difference between weight of feed sample and the sum weight of moisture, ash, crude protein, crude fiber and ether extract. Calculate % NFE as 100- (%CP+%EE+%CF + ash+ moisture).

Mineral analysis was done to establish the content of calcium, magnesium, potassium, phosphorous and sodium in the digested feed sample. Digestion in tubes was done by oxidizing the larger part of the organic matter using hydrogen peroxide at relatively low temperature. After decomposition of the excess hydrogen peroxide and evaporation of water the digestion was completed by concentrated sulphuric acid at elevated temperature under the influence of selenium as a catalyst.

Magnesium and calcium were determined using flame AAS method as described by Sahlemedhin and Taye (2000). The sample is nebulized into an air-acetylene flame, where it is vaporized. Ca and Mg compounds are atomized and their atoms are thus formed and absorbed radiation from a hollow cathode lamp. The absorption is measured at wavelength of 422.7nm and 285.2nm respectively.

Potassium and sodium were determined by flame photometer method. The sample was nebulized into an air-propane flame where it is vaporized. K and Na compounds are atomized and their atoms are thus formed and emit radiation of which the intensity is measured by flame photometer. Phosphorous was determined using spectrophotometry method. In the coloration process the phosphate in the digest forms a blue colored complex with reduced molybdenum salts. Its absorption was measured by UV spectrophotometer at a wavelength of 880nm.

### 3.7.2: Secondary data

Secondary data were obtained from reliable institutional sources to complement primary data and provide historical contextual understanding of indigenous chicken trends.

Secondary data include annual livestock reports from department of livestock production for the period between 2013 to 2023, Kenya National Bureau of Statistics (KNBS, 2019), census data and policy documents from state department of livestock.

The use of secondary data allows researchers to contextualize primary findings, identify patterns and enhance the robustness of conclusions. According to Johnston (2017) secondary data analysis provide cost effective means of leveraging existing datasets to support interpretations and supplement field data. Similarly, Heaton (2021) underscores that combining primary and secondary data enriches the reliability of research outcomes through triangulation and temporal depth.

Moreover, secondary data are essential in agricultural and livestock research where government institutional records provide baseline indicators for productivity, disease incidence and demographic changes (Vartanian, 2020). This mixed data approach enhances validity by comparing field observations against official statistics.

### 3.8: Data analysis

Data were entered and coded in Microsoft Excel software (version 16) and were analyzed using statistical package for social sciences (SPSS version 22). Frequency distribution and percentages was used to summarize data on demographic factors such as age, sex, marital status, level of education and household characteristics. Constraints facing the IC production and diseases were analyzed by ranking analysis using weighted ranking method (Olwande *et al*., 2016). Data from key informant's interview was analyzed using a calculator for percentages and trends.

The first objective on the IC production systems was achieved by analyzing data on breeds, flock size and structure, mortality rates, egg production, disease control and constraints, opportunities of production, income, production cost, sales and marketing, production cost and extension services. The data was analyzed using descriptive statistics such as mean, range, ranking, standard deviation and percentage

The second objective on assessing the nutrient composition, usage and constraints of locally available resources used as indigenous chickens' feeds in Masaba North sub-county

was analyzed by comparing the nutrient content and mineral concentrations required by different age group of poultry (NRC, 1994).

The third objective on major factors that influenced IC production was analyzed using multivariate analysis to determine which independent variables influence indigenous chicken production in Masaba North sub-county. Wilks' lambda values were obtained to establish the relationships the identified dependent variables (breed, source of drugs, source of birds, feeding system, source of feeds, egg production, mortality rate, and extension services) and independent variables (age, gender, level of education, experience, family size, and training). The test was carried out at 95 percent level of confidence.

### 3.9: Study variables

Table 3.2 shows the objectives of the study, dependent and independent variables of this study, indicators, scale of measurement and data analysis to be done.

**Table 3.2: Operationalization of the study variables**

| Objectives | Variables | Indicators | Scale | Analysis |
|---|---|---|---|---|
| 1. To determine status of indigenous chicken in Masaba North sub-county | Flock size | Number of birds | Interval | Mean<br>Percentage<br>Standard deviation<br>Range<br>Scoring<br>Ranking<br>Cross tabulation<br>ANOVA |
| | Production system | Intensive /Extensive | Nominal | |
| | Marketing | Market outlet | Nominal | |
| | Income | Amount of money | Interval/Ratio | |
| | Constraints/opportunities | Score /rank | Nominal | |
| | Egg production | Number of eggs | Nominal/ratio | |
| | Diseases | Scores/rank | Nominal | |
| | Production cost | Cost of inputs | Interval/ratio | |
| | Extension services | Sources of extension | Nominal | |
| 2. To assess the nutrient composition, usage and constraints of locally available resources used as indigenous chicken feeds in Masaba North sub-county | Nutrient composition of local feeds<br>Constraints/usage of local feed | Nutrient/Mineral composition of local feeds | Interval/ratio | Mean<br>Percentages<br>Standard deviation |
| 3. To determine major factors which influence indigenous chicken production in Masaba North sub-county | Age | Years | Interval | Correlation analysis<br>Multivariate analysis |
| | Training | Trained/Not trained | Interval | |
| | Level of Education | Level of education | Interval | |
| | Family size | Household members | Interval | |
| | Experience | Years | Interval | |

### 3.10: Ethical Review and Logical Considerations

Clearance was sought from Kenyatta University Graduate School to carry out this research after submitting of proposal (Appendix I). Research permit was also sought from National Commission for Science, Technology and Innovation (NACOSTI) after getting clearance from Kenyatta University graduate school (Appendix II). Clearance was also sought from County government of Nyamira to conduct research in the County (Appendix III). Informed written consent was sought from all study participants (Appendix IV) and were assured of confidentiality of the information they provide and that the information provided was used for academic purpose and the research findings from this study would be for their benefit.

# CHAPTER FOUR: RESULTS

## 4.1: Characteristics of production systems of indigenous chicken production in Masaba North Sub-County, Nyamira County, Kenya

The study was conducted to establish the state of IC production in Masaba North Sub-County. This was done by establishing the demographic characteristics of the household head, production system practiced, flock size and composition, management systems such as type of housing, Source of feeds, feeding, supplementation, source of vaccines and drugs, source of lighting and heating, source of water, mortality rate, type of breeds and their sources, source of labor, production cost, sales and marketing.

### 4.1.1: Demographic characteristics of the indigenous chicken farmers

The results of demographic characteristics of IC farmers age, sex or gender, level of education, number of years in indigenous chicken production, family size, and if attended any special training on poultry production are presented on Table 4.1.

More than half of the IC farmers were youth (53.25%) and nearly two third were women (58%). Over two third of the indigenous chicken farmers had primary level of education and above (68.7%) and more than half of the farmers had five years' experience in chicken farming (55%). Nearly three quarter (74%) of the interviewed households had up to five family members, which is generally regarded as a small family size. Two thirds of the IC farmers had some basic training on poultry production by the County extension staff (60.4%) and only a few by the Farmers Field School (0.6%) and nearly four fifth of the farmers did not have any training.

**Table 4.1: Demographic characteristics of indigenous chicken farmers in Masaba North Sub-County, Nyamira County, Kenya**

| Demographic Characteristic | Frequency N | Percent (%) |
|---|---|---|
| **Age** | | |
| Less than 20 years | 2 | 1.19 |
| Between 20-35 years | 90 | 53.25 |
| 36 years and above | 77 | 45.56 |
| **Sex** | | |
| Male | 71 | 42.00 |
| Female | 98 | 58.00 |
| **Education level** | | |
| No education | 16 | 9.40 |
| Primary | 28 | 16.60 |
| Secondary | 90 | 53.30 |
| Tertiary/ University | 35 | 20.70 |
| **Experience in poultry farming** | | |
| Less than 2 years | 3 | 1.80 |
| Between 2-5 years | 68 | 40.20 |
| Between 6-10 years | 52 | 30.80 |
| Between 10-20 years | 36 | 21.30 |
| More than 20 years | 10 | 5.90 |
| **Number of members in a family** | | |
| Less than 2 | 30 | 17.80 |
| Three members | 32 | 18.90 |
| Four members | 33 | 19.50 |
| Five members | 30 | 17.80 |
| More than 5 members | 44 | 26.00 |
| **Trained/Training attended** | | |
| County/Farmers field schools | 103 | 61.00 |
| None | 66 | 39.00 |

### 4.1.2: Production system used to rear indigenous chicken

The results of the production system practiced are presented on Table 4.2. The study shows that extensive system (scavenging) was the most preferred system in the study area with about three fifths of farmers are practicing it. This was followed by semi-intensive production system which accounted for a third of the studied farmers. Less than a tenth of the farmers practiced intensive production system which was limited to exotic breeds.

**Table 4.2: Production systems used to rear Indigenous Chicken in Masaba Sub-County**

| Production System | Frequency | Percent |
|---|---|---|
| Extensive system | 104 | 61.5 |
| Intensive system | 13 | 7.7 |
| Semi intensive system | 52 | 30.8 |
| **Total** | **169** | **100.0** |

### 4.1.3: Flock size and composition

The results of the flock size and composition are presented in Table 4.3. Majority of respondents interviewed kept smaller flock sizes less than forty indigenous chicken. The results also show that most households had cock to hen ratio of 1 to 9.

**Table 4.3: Flock size and composition of indigenous chicken reared in Masaba North Sub-County, Nyamira County, Kenya**

| Production System | Frequency | Percent |
|---|---|---|
| **Flock size** | | |
| Less than 40 | 131 | 77.5 |
| Between 40-55 | 32 | 18.9 |
| Between 56-70 | 5 | 3 |
| Between 71-85 | 1 | 0.6 |
| **Flock composition** | | |
| Chicks | 3 | 1.8 |
| Cocks | 11 | 6.5 |
| Growers | 62 | 36.7 |
| Hens | 93 | 55 |

There was a strong positive correlation between flock size and flock composition (r=0.67, $p<.05$), indicating farms with low hen to cock ratio tend to have high flock numbers.

The results of cross tabulations of age and flock sizes are presented in Table 4.4. Majority (53.2%) of indigenous chicken farmers were aged 20-35 years, while 24.3% were aged between 36-50 years only 1.2% were below 20 years. Most young farmers (20-35 years kept small flock sizes of fewer than 40 birds.

**Table 4.4 Cross tabulation between age of indigenous chicken farmer and flock size**

| | | **Flock Size in Numbers** | | | | **Total** |
|---|---|---|---|---|---|---|
| | | Less than 40 | Between 40-55 | Between 56-70 | Between 71-85 | |
| **Age of respondent** | Less than 20 years | 2 | 0 | 0 | 0 | **2 (1.2%)** |
| | Between 20-35 years | 73 | 16 | 1 | 0 | **90 (53.2%)** |
| | Between 36-50 years | 30 | 8 | 3 | 0 | **41 (24.3%)** |
| | Over 50 years | 26 | 8 | 1 | 1 | **36 (21.3%)** |
| **Total** | | **131 (78%)** | **32 (18.9%)** | **5 (3.0%)** | **1 (0.1%)** | **169 (100%)** |

The results of cross tabulation of sex of the IC farmer and flock sizes are presented in Table 4.5. The results show that 58% of farmers were women compared to 42% men. Most female farmers (78%) kept small flocks of less than 40 birds, similar to their male counterparts.

**Table 4.5: Cross tabulation between sex of indigenous chicken farmer and flock size**

| | **Flock size in Numbers** | **Total** |
|---|---|---|

| | | Less than 40 | Between 40-55 | Between 56-70 | Between 71-85 | |
|---|---|---|---|---|---|---|
| **Sex** | Male | 53 | 15 | 3 | 0 | **71 (42%)** |
| | Female | 78 | 17 | 2 | 1 | **98 (58%)** |
| **Total** | | **131(78%)** | **32(18.9%)** | **5(3.0%)** | **1(0.1%)** | **169 (100%)** |

The results of cross tabulation of experience and flock size are presented in Table 4.6. Finding show that 58% of farmers had more than five years of experience in indigenous chicken production and this group also maintained slightly larger flocks (40-55 birds) compared to less experienced farmers. Farmers with less than two years of experience formed only 1.7% of the respondents.

**Table 4.6: Cross tabulation between experience in indigenous chicken farming and the Flock size**

| | | **Flock size in Numbers** | | | | **Total** |
|---|---|---|---|---|---|---|
| | | Less than 40 | Between 40-55 | Between 56-70 | Between 71-85 | |
| **Experience** | Less than 2 years | 3 | 0 | 0 | 0 | **3(1.7%)** |
| | Between 2-5 years | 60 | 7 | 1 | 0 | **68(40.3%)** |
| | More than 5 years | 68 | 25 | 4 | 1 | **98(58.0%)** |
| **Total** | | **131(78%)** | **32(18.9%)** | **5(3.0%)** | **1(0.1%)** | **169(100%)** |

The results of cross tabulation of age and flock size are presented in Table 4.7. the findings indicate that 55.7% of households had 3-5 members. Farmers with smaller families (3-5 members) kept slightly larger flocks than those with very small or large families.

**Table 4.7: Cross tabulation between family size and Flock size**

| | | Flock size in Numbers | | | | |
|---|---|---|---|---|---|---|
| | | Less than 40 | Between 40-55 | Between 56-70 | Between 71-85 | **Total** |
| **Family size** | Less than 2 members | 28 | 2 | 1 | 0 | **31(18.3%)** |
| | Between 3-5 members | 80 | 13 | 1 | 0 | **94(55.7%)** |
| | More than 5 members | 23 | 17 | 3 | 1 | **44(26.0%)** |
| **Total** | | **131(78%)** | **32(18.9%)** | **5(3.0%)** | **1(0.1%)** | **169(100%)** |

The results of cross tabulation of the level of education and flock size in the interviewed households are presented in Table 4.8. Results show that most respondents (53.5%) had secondary education,16.6% had primary and 15.4% had tertiary education. The majority across all education levels maintained small flock sizes of less than 40 birds.

**Table 4.8: Cross tabulation between the Level of education and Flock size**

| | | **Flock Size in Numbers** | | | | |
|---|---|---|---|---|---|---|
| | | Less than 40 | Between 40-55 | Between 56-70 | Between 71-85 | **Total** |
| **Education level** | No education | 10 | 4 | 1 | 1 | **16 (9.4%)** |
| | Primary | 23 | 5 | 0 | 0 | **28 (16.6%)** |
| | Secondary | 73 | 15 | 2 | 0 | **90 (53.3%)** |
| | Tertiary | 16 | 8 | 2 | 0 | **26 (15.4%)** |
| | University | 9 | 0 | 0 | 0 | **9 (5.3%)** |
| **Total** | | **131(78%)** | **32(18.9%)** | **5(3.0%)** | **1(0.1%)** | **169(100%)** |

The results of cross tabulation between training attended and flock size in the interviewed households are presented in Table 4.9. Results show that 61% of farmers had received some

form of poultry training mostly from county extension staff while 39% had none, Trained farmers maintain larger flocks (40-55 birds) and reported lower mortality.

**Table 4.9: Cross tabulation between training attended by IC farmer and flock size**

| | | **Flock size in Numbers** | | | | |
|---|---|---|---|---|---|---|
| | | Less than 40 | Between 40-55 | Between 56-70 | Between 71-85 | **Total** |
| **Training** | Trained | 79 | 20 | 4 | 0 | **103 (60.9%)** |
| | Not trained | 52 | 12 | 1 | 1 | **66 (39.1%)** |
| **Total** | | **78%(131)** | **32(18.9%)** | **5(3.0%)** | **1(0.1%)** | **169 (100%)** |

### 4.1.4: Management systems

The results of the housing system, feeding, source of feeds, amount of feeds used per flock, feed supplements used by the IC farmers in the study area are shown in table 4.10. Respondents in the study area use three housing systems namely deep litter, slatted or raised and traditional structures. Of these, deep litter system was the most preferred as nearly half of the respondents used it followed by traditional system used by third of the respondents. Majority of the houses are made of wooden walls and other locally available materials. The common feeding system was found to be scavenging and supplementation with local feed resources. The study also found that 64.5% of farmers supplement their chicken using green vegetables.

**Table 4.10: Housing system, feeding system, source of feeds and supplement type**

| Management System | Frequency | Percent |
|---|---|---|
| **Housing system** | | |
| Deep litter | 86 | 50.9 |
| Slatted/raised | 30 | 17.8 |
| Traditional | 53 | 31.3 |
| **Feeding system** | | |
| Scavenging | 32 | 18.90 |
| Scavenging and supplementation local feeds | 125 | 71.00 |
| Local feeds only | 5 | 3.00 |
| Commercial feed only | 7 | 4.10 |
| **Source of feeds** | | |
| Agro-vet | 78 | 46.20 |
| Homemade | 53 | 31.40 |
| Other sources | 18 | 10.60 |
| None | 8 | 11.80 |
| **Daily amount of feeds (kilograms)** | | |
| Less than 5 | 144 | 85.20 |
| Between 5-10 | 23 | 13.60 |
| Between 11-50 | 2 | 1.20 |
| **Feed supplementation** | | |
| Multi-vitamins | 4 | 2.40 |
| DCP | 44 | 26.00 |
| Insects | 3 | 1.8 |
| Green vegetables | 109 | 64.50 |
| Fishmeal | 1 | 0.60 |
| None | 8 | 4.70 |

The results of source of lighting and heating are presented in Figure 4.1. The respondents predominantly use electricity as a source of lighting their homes and chicken houses. This

suggests that access to electricity is widely spread which enhances chick brooding efficiency and night time management. This was followed in a distant second and third by solar (12%) and kerosene (4%) respectively.

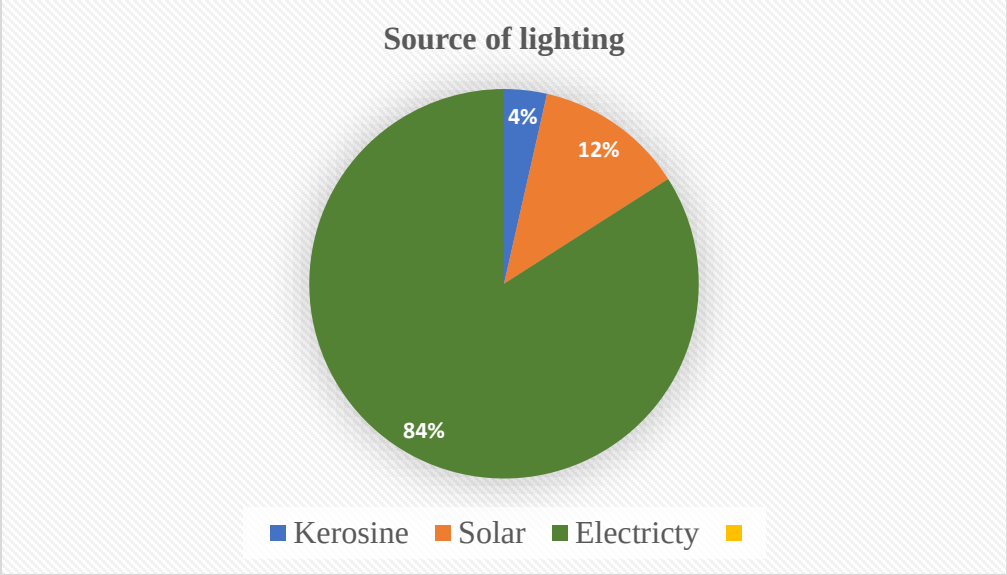



**Figure 4.1: Sources of lighting and heating**

The results of sources of water used for indigenous chicken production are presented in Figure 4.2. The study also show that the majority of households use rain water (80.5%) as the main source of water followed by streams and few uses boreholes. Dependence on rainwater indicates vulnerability to seasonal fluctuations especially during dry spells which can limit feed intake and egg production.

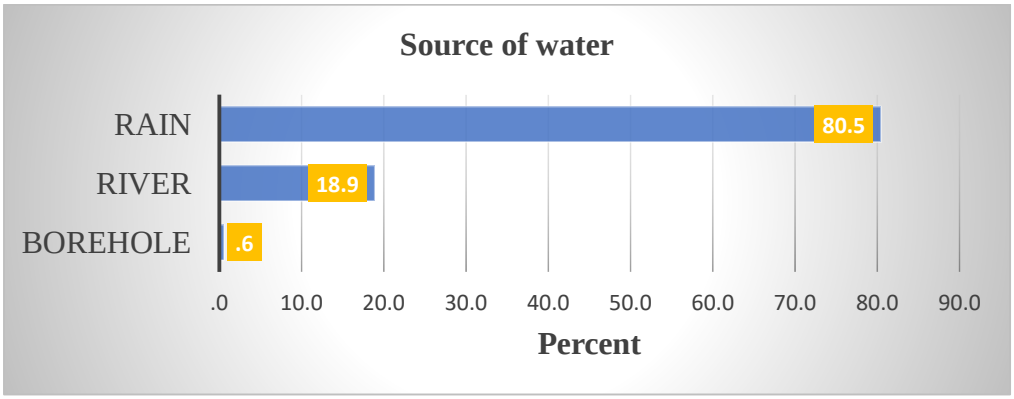



**Figure 4.2: Sources of water**

### 4.1.5: Disease control, constraints and opportunities of production

The study established the common disease reported by interviewed farmers, sources of drugs and vaccines the number of chicken mortalities reported in the past one year, mortality groups, month of occurrence and constraints and opportunities faced by IC farmers during production in Masaba North Sub-County.

The results of sources of drugs and vaccines used by IC farmers are presented in Table 4.11. Agro-vet shop was the most common outlet of veterinary drugs and vaccines used use to treat and prevent indigenous chicken diseases in Masaba North Sub-County and few other farmers source drugs private veterinarian and local markets within the sub-county.

**Table 4.11: Sources of drugs and vaccines used by interviewed households**

| Parameter | Frequency | Percent |
|---|---|---|
| **Source of drugs and vaccines** | | |
| Agro-vet shop | 161 | 95.2 |
| Private veterinarian | 6 | 3.6 |
| Local market | 2 | 1.2 |
| **Total** | **169** | **100.0** |

Results of the diseases and parasites ranking by the extension officers are presented in Table 4.12. Newcastle, Coccidiosis and chronic respiratory diseases were ranked highest at 96, 89 and 78 respectively.

**Table 4.12: Diseases and parasites ranking by the extension service providers based on occurrence incidences**

| Diseases and Pests | Score | Rank |
|---|---|---|
| Newcastle disease | 96 | 1 |
| Coccidiosis | 89 | 2 |
| Chronic respiratory disease | 78 | 3 |
| Fowl pox | 68 | 4 |
| Infectious coryza | 62 | 5 |
| Infectious bursal disease (Gumboro) | 52 | 6 |
| Fowl typhoid | 42 | 7 |
| Salmonellosis | 31 | 8 |
| Fowl cholera | 29 | 9 |
| **Parasite** | | |
| Mites | 33 | 1 |
| Lice | 18 | 2 |

Figure 4.3 shows the annual mortality rates in the interviewed households. More than three quarter of the farmers reported low mortality rate of less than 10 birds per year. This implies that most farmers have fair disease management practices possibly due to vaccination and extension support.

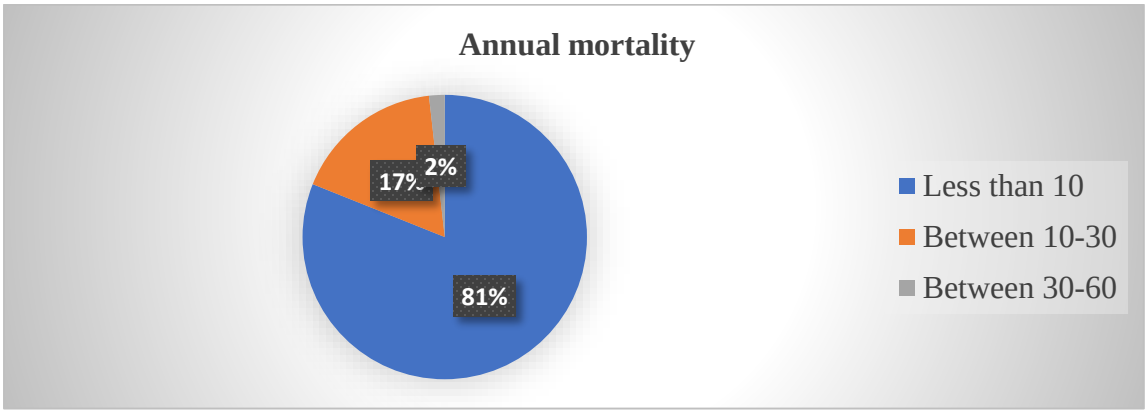



**Figure 4.3: Annual mortality rates in interviewed households**

The results of the mortality groups are presented in table 4.13. Three quarter of the farmers reported high mortality in chicks and nearly one third in growers and few (11%) on adults.

**Table 4.13: Response on the level of mortality in different age groups of indigenous chicken**

| Chicken Category | Frequency | Percent |
|---|---|---|
| Chicks (0-9) weeks | 129 | 76.3 |
| Growers (10-20 weeks) | 29 | 17.2 |
| Adults (20 weeks or older) | 11 | 7.7 |
| **Total** | **169** | **100.0** |

The results of the month with the highest mortalities are presented in Table 4.14. The results show that mortality was highest during months of November, June and April

**Table 4.14: Response on month with highest mortality**

| Month | Frequency | Percent |
|---|---|---|
| January | 2 | 1.2 |
| February | 1 | 0.6 |
| March | 4 | 2.4 |
| April | 20 | 11.8 |
| May | 2 | 1.2 |
| June | 23 | 13.6 |
| July | 17 | 10.1 |
| August | 11 | 6.5 |
| September | 19 | 11.2 |
| October | 18 | 11.2 |
| November | 45 | 26.6 |
| December | 7 | 4.1 |
| **Total** | **169** | **100.0** |

The results of the constraints and suggested solutions by the indigenous chicken farmers are presented in Table 4.15. The results show that diseases and parasites were the most important constraints faced by indigenous chicken farmers followed by the high cost of farm inputs and predation this may be attributed to inadequate animal health measures adopted by IC farmers and poor housing used by IC farmers. Other important constraints were theft and lack of credit facilities. The IC farmers suggested opportunities in IC production such as vaccination, biosecurity, use of local feeds and ethno veterinary drugs, collective marketing and formation of producer organizations to address the constraints faced by IC farmers.

**Table 4.15: Constraints and suggested solutions of indigenous chicken production by farmers**

| Constraint | Suggested solution | Frequency | Percent |
|---|---|---|---|
| Diseases and parasites | Vaccination and biosecurity | 56 | 33.1 |
| Lack of market | Collective marketing | 10 | 5.9 |
| Lack of know how | Farmers training | 5 | 3 |
| High cost of feeds, drugs and vaccines | Use of local feed resources and government support | 46 | 27.2 |
| Lack of credit | Linking farmers with financial institutions | 18 | 10.7 |
| Predation and Theft | Proper housing | 34 | 20.1 |
| **Total** | | **169** | **100** |

The results of the constraints and opportunities ranking by IC traders are presented in Table 4.16. The study established that lack of sales yard for live birds, lack of capital and credit and chicken mortalities during transportation were ranked highest. The study found that chicken markets was not well developed and sale of live birds and eggs are done in livestock auctions where there are no cages for birds and they are sold on roadsides during market days. There were also challenges of poor handling and transportation equipment's leading to high mortalities reported during transportation.

**Table 4.16: Constraints and suggested solution ranking by indigenous chicken traders**

| Constraint | Suggested solution | Score | Rank |
|---|---|---|---|
| Poor roads infrastructure | Improve road network | 21 | 5 |
| Chicken mortalities | Proper transport facilities | 33 | 4 |
| High cost of transportation | Collective marketing | 34 | 3 |
| Inadequate capital and credit | Linking with financial firms | 35 | 2 |
| Inadequate sales yard for live birds | County to build poultry markets for live birds | 36 | 1 |

The results of the constraints and opportunities by feed traders are presented in Table 4.17. High cost of raw materials used to manufacture IC feeds was ranked highest followed by seasonal availability of the feed resources were major constraints with score.

**Table 4.17: Constraints and suggested solutions ranking by poultry feed traders**

| Constraint | Suggested solutions | Score | Rank |
|---|---|---|---|
| High cost of raw materials | Zero rating VAT and importation to address supply gaps | 20 | 1 |
| Seasonal availability of feed resources | Stocking when available and outsourcing when scarce | 16 | 2 |
| Inadequate equipment for processing of feeds | County government support and linking with suppliers and creditors | 11 | 3 |

The results of the constraints and opportunities by extension officers (9 officers) from department of livestock production Masaba North Sub-County and fisheries are presented in Table 4.18. Lack of facilitation and lack of motorized transport were ranked as major constraints by the county extension service providers.

**Table 4.18: Constraints and suggested solutions ranking by extension officers**

| Constraint | Suggested solutions | Score | Rank |
|---|---|---|---|
| Inadequate facilitation by county government | County to provide subsistence allowances. | 22 | 1 |
| Inadequate motorized transport | County to provide motorized transport and fuel | 18 | 2 |
| Poor staffing levels | County to employ more staff | 14 | 3 |

### 4.1.6: Breeds of the indigenous chicken and their sources

The results of the indigenous chicken reared are presented in Figure 4.4. The study shows that local indigenous chicken dominates flocks with minimum adoption of improved chicken types. The local indigenous chicken was found be hardy, disease tolerant breeds and well adapted to scavenging system practiced by most farmers.

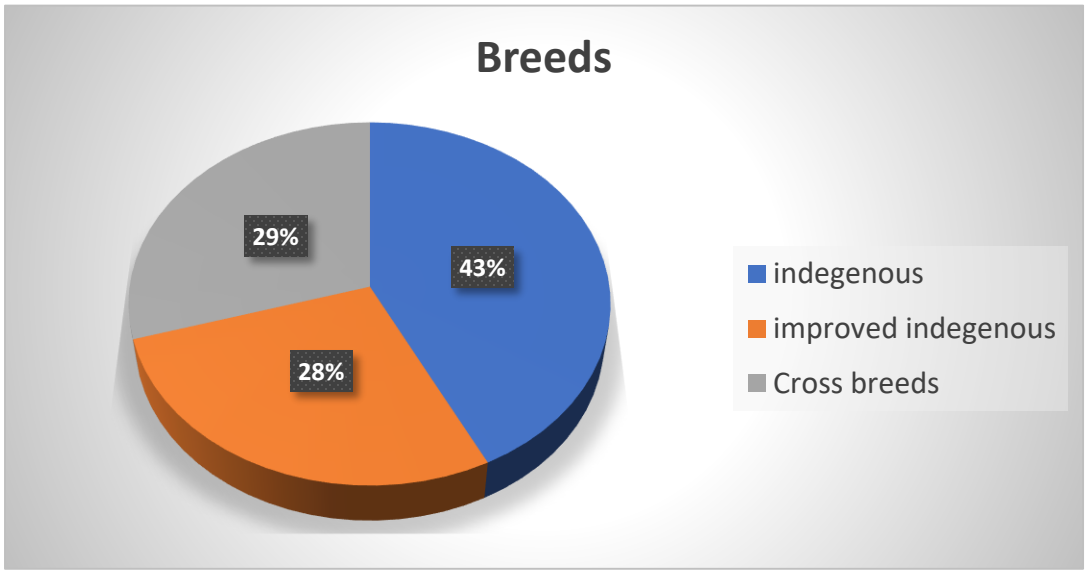



**Figure 4.4: Breeds of indigenous chicken reared**

The results of the sources of the indigenous chicken is presented in table 4.19. More than three fifth of the farmers do own hatching at home and quarter of the farmer's source chicken from poultry farms and few buy from local markets.

**Table 4.19: Sources of indigenous chicken for breeding**

| Source | Frequency | Percent |
|---|---|---|
| Own hatching | 117 | 69.2 |
| Local markets | 10 | 5.9 |
| Poultry farms | 42 | 24.9 |
| **Total** | **169** | **100.0** |

### 4.1.7: Labour

The results of the type of labor is presented in Figure 4.5. Nearly all households relied on family labor with few used hired workers in their farms. This indicates that indigenous chicken remains a family managed activity providing employment for women and youth.

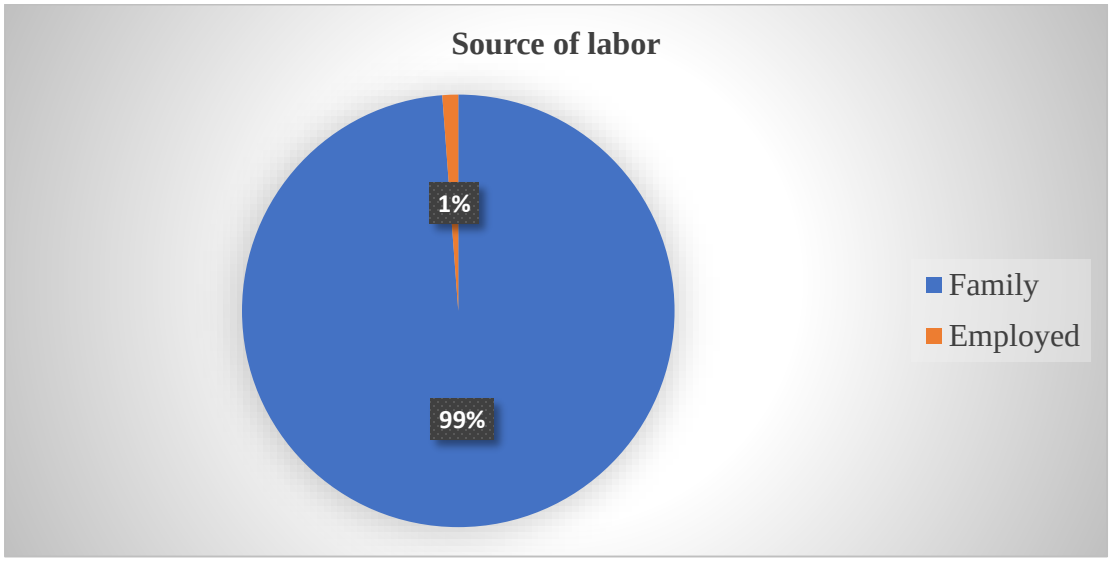



**Figure 4.5: Sources of labour**

### 4.1.8: Egg production

The results of daily and monthly egg production are presented in Table 4.20. The mean daily egg production was 6 eggs per day.

**Table 4.20: Descriptive statistics of egg production**

| Parameter | N | Minimum | Maximum | Range | Mean | SD |
|---|---|---|---|---|---|---|
| Eggs per day | 34 | 1 | 34 | 33 | 6 | 2 |
| Eggs per month | 169 | 30 | 850 | 820 | 224 | 181 |

The results in Table 4.21 below show that the level of education of the IC farmer had significant association with the number of eggs produced.

**Table 4.21: ANOVA test between the level of education of the indigenous chicken farmers and numbers of eggs produced per day**

| | Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 421.098 | 4 | 105.274 | 2.666 | .034 |
| Within Groups | 6474.831 | 164 | 39.481 | | |
| **Total** | **6895.929** | **168** | | | |

The results of the influence of source of feeds in egg production are presented in Table 4.22. Source of feeds for IC had significant influence on egg production (p=0.003).

**Table 4.22: ANOVA test between source of feeds and egg production**

| | Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 719.468 | 5 | 143.894 | 3.797 | .003 |
| Within Groups | 6176.461 | 163 | 37.892 | | |
| **Total** | **6895.929** | **168** | | | |

The results of the month with maximum egg production are presented in Figure 4.6. The study shows that January, February, July and August recorded the highest egg production. These corresponds to period of feed abundance from post harvest residues and reduced rainfall allowing better scavenging opportunities

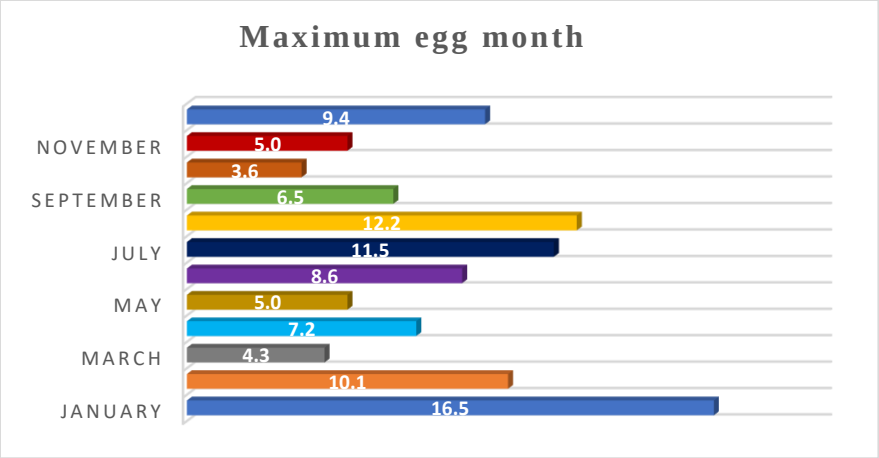



**Figure 4.6: Month with maximum egg production**

The results of the month with minimum egg are presented in Figure 4.7. The study shows that the months of April, June, September and November had the lowest egg production coinciding with heavy rainfall and cold weather. During this period scavenging is restricted and diseases such as Newcastle and coccidiosis are prevalent.

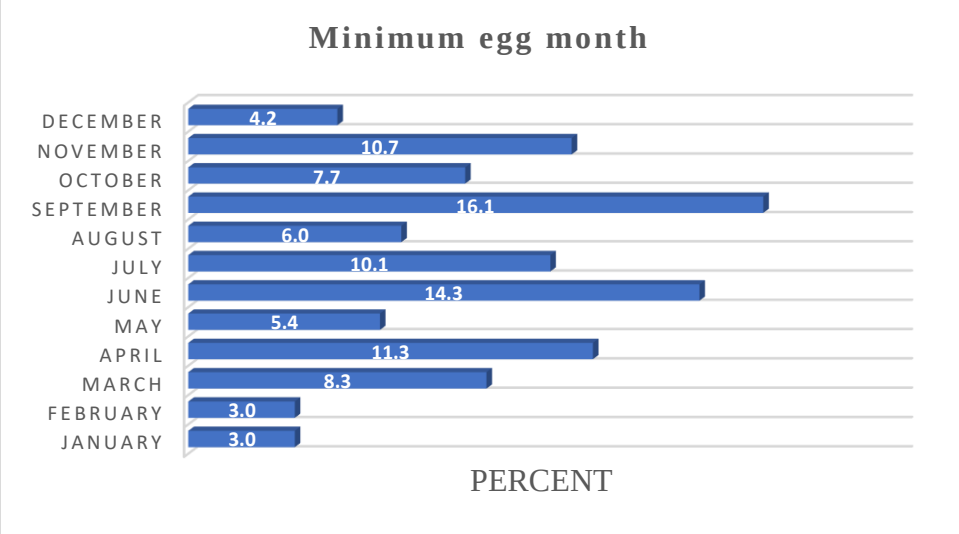



**Figure 4.7: Month with Minimum egg production**

### 4.1.9: Sales and marketing

The results of the income and production costs are presented in Table 4.23. Eggs sold per day ranges from 1-34. Most eggs produced are consumed at home as protein source while

others are used for breeding purposes. The cost of an egg ranges from 15-20 shillings depending on market demand forces, the cost of hen ranges from 300-700 and the cost of cock ranges from 500-1000 shillings. The study finds that the major cost incurred by farmers were the cost of feeds ranging from 300 to 7500 shillings in the interviewed farmers and high standard deviation.

**Table 4.23: Volume of eggs sold, income and input costs in the interviewed households.**

| **Number of eggs sold** | **N** | **Minimum** | **Maximum** | **Range** | **Mean** | **SD** |
|---|---|---|---|---|---|---|
| Eggs sold per day | 34 | 1 | 34 | 33 | 6 | 2 |
| Eggs sold per month | 169 | 30 | 850 | 820 | 224 | 181 |
| **Income (kshs.)** | | | | | | |
| Cost of egg | 169 | 15 | 20 | 5 | 17 | 3 |
| Cost of hen | 169 | 300 | 700 | 400 | 488 | 100 |
| Cost of cock | 169 | 500 | 1000 | 500 | 735 | 103 |
| **Cost of inputs (Ksh.)** | | | | | | |
| Feeds | 169 | 300 | 7500 | 7200 | 1965 | 1352 |
| Vaccines and drugs | 169 | 300 | 2800 | 2500 | 797 | 445 |
| Egg trays | 169 | 15 | 405 | 390 | 97 | 84 |
| Wages | 169 | 600 | 4000 | 3400 | 1356 | 1067 |
| Electricity | 169 | 80 | 800 | 720 | 226 | 125 |

The results of market outlets for eggs and chicken are presented in Table 4.24. The study establishes that retailers and the village are the major outlets for the sale of the poultry products. The eggs and live birds are sold to retailers who come and collect products at farm gate. Other farmers take their products to hotels and retail shops in town and market centers in the sub-county.

**Table 4.24: Markets for eggs and chicken**

| Market category | Frequency | Percent |
|---|---|---|
| Village | 92 | 54.4 |
| Retailers | 71 | 42.0 |
| Local market | 6 | 3.6 |
| **Total** | **169** | **100.0** |

### 4.1.10: Extension services

The results of the source of extension services are presented in Table 4.25. County source of extension was the most dominant (90.5%) and a few farmers use other sources such as village and non-governmental organization (NGOs) in the area.

**Table 4.25: Source of extension services**

| Source of extension | Frequency | Percent |
|---|---|---|
| None | 1 | 0.6 |
| Villagers | 9 | 5.3 |
| County | 153 | 90.5 |
| NGO's | 6 | 3.6 |
| **Total** | **169** | **100** |

The results of the efficiency of the extension services are presented on figure 4.8. Two thirds of the farmer's rate county extension services as good and nearly two fifth rate the services as fair and few (6%) rates it as poor. This demonstrates the positive role of county extension officers in supporting poultry production though some gaps in outreach coverage.

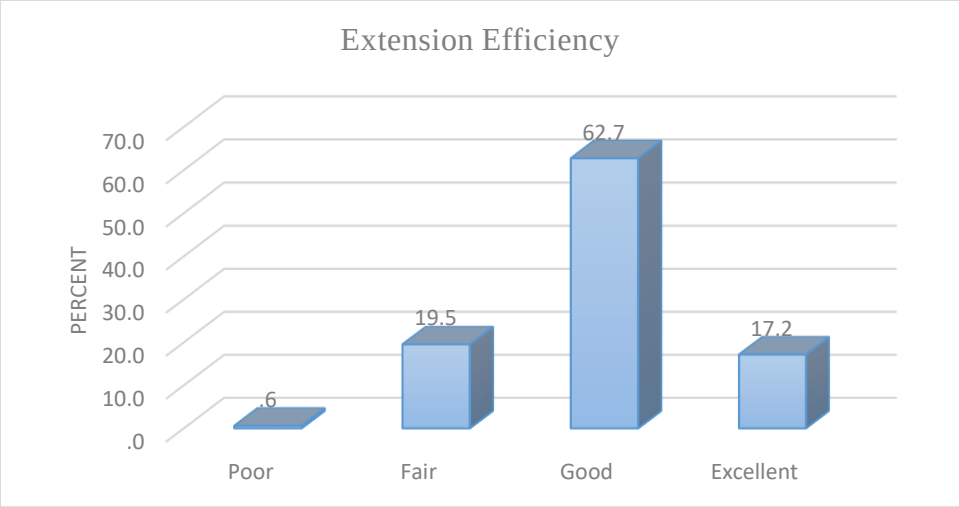



**Figure 4.8: Efficiency of the extension services**

### 4.1.11: Indigenous chicken value chain map of the study area

The results of the indigenous chicken value chain of Masaba North sub-county is presented in Figure 4.9. The value chain was found to be short, simple in structure dominated by small scale farmers and few middlemen linking to consumers. Processors are missing indicating little value addition. Farmers sell mostly live birds and eggs at farm gate or village markets; this reflects inefficiency and low bargaining power. The interaction between value chain actors is seasonal and high during festivities such as Easter and Christmas holidays (Figure 4.9).

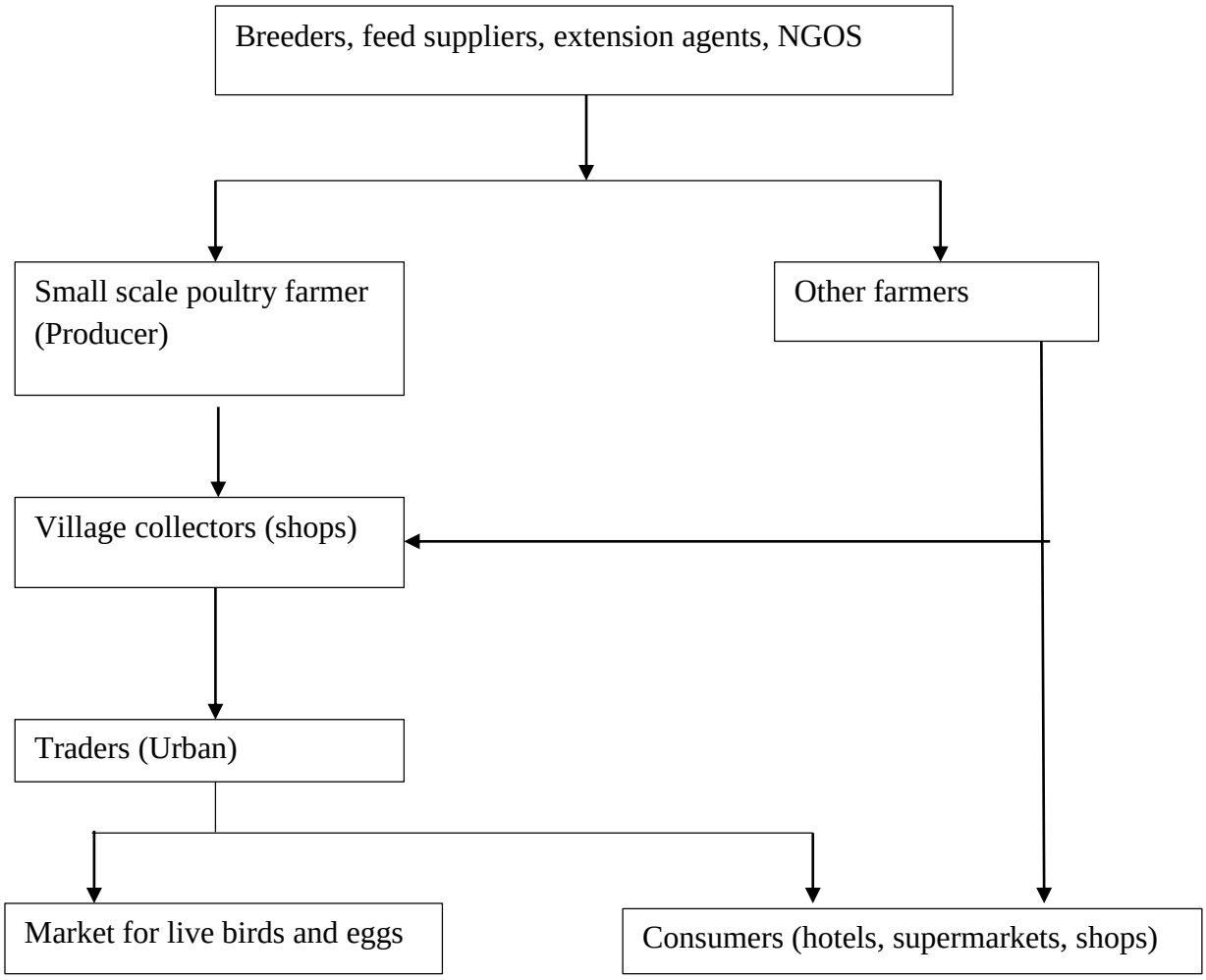



**Figure 4.9: Value chain map for indigenous chicken production in Masaba North Sub-County**

### 4.2: Locally available feed resources and their nutrient contents

#### 4.2.1: Locally available and potential feed resources

This results of the availability of nine identified local feed resources are presented in Table 4.26. Identified feed resources in order of priority are maize, sorghum, kales, finger millet, fish meal, kikuyu grass, sweet potato tubers, cassava roots and cabbages.

**Table 4.26: List of locally available and potential feed resources**

| **Feedstuff** | **Number of respondents reporting availability (N=169)** |
|---|---|
| Maize (*Zea mays*) | 154 |
| Sorghum *(Sorghum vulgare*) | 148 |
| Kales (*Brassica oleraceae var. acephela*) | 138 |
| Finger millet (*Panicum miliacem*) | 106 |
| Fish meal *(caridina nilotica)* | 37 |
| Kikuyu grass *(Pennisetum clandestinum)* | 12 |
| Sweet potato tuber (*Ipomea batatas*) | 9 |
| Cassava root (*Manihot esculenta*) | 4 |
| Cabbage (*Brassica oleraceae var. capitata)* | 3 |

#### 4.2.2: Chemical analysis

A total of nine feed resources were identified as potential during households' survey and were sampled for chemical analysis (proximate and mineral) to determine their nutrient content. They were maize, sorghum, finger millet, fish meal (*Caridina nilotica*), kikuyu grass, sweet potato tubers, cassava roots, kales and cabbage as shown in the above Table 4.26 above.

#### 4.2.2.1 Proximate analysis of the Local Feed Resources

The results of nutrient composition of the nine identified feed resources are presented in Table 4.27. Fish meal (*Caridina nilotica*) had highest protein content (65.63%) hence excellent protein source for IC but should not exceed 8% inclusion level in IC feed formulation. Cassava roots and sweet potato tubers was found to have high energy levels (80.94 and 67.93 respectively) and can be used to complement maize in IC feeds and require processing before use such as chopping, drying and grounding before use to reduce hydro cyanide content in cassava meal and trypsin inhibitors content in sweet potato meal. Cassava root and sweet potato tubers were found to have low crude protein and fat contents this could be compensated with proper feed formulation. Maize, sorghum and finger millet were also found to be good source of energy.

**Table 4.27: Nutrient composition of identified local feed resources in Masaba North Sub-County on dry matter basis**

| Feedstuff | % DM | % Ash | %Crude Protein | %Crude fiber | %Crude fat | %NFE |
|---|---|---|---|---|---|---|
| Fish meal (*Caridina nilotica*) | 91.72 | 11.09 | 65.63 | 2.39 | 9.86 | 2.76 |
| Maize (*Zea mays*) | 86.04 | 0.91 | 10.94 | 36.13 | 4.07 | 34.00 |
| Finger millet (*Panicum miliacem*) | 85.00 | 1.90 | 7.29 | 3.73 | 1.84 | 70.23 |
| Sorghum *(Sorghum vulgare*) | 83.97 | 1.38 | 12.40 | 8.79 | 2.70 | 58.71 |
| Kikuyu grass *(Pennisetum clandestinum)* | 96.03 | 0.86 | 10.94 | 34.66 | 2.51 | 47.28 |
| Cabbage (*Brassica oleraceae var. capitata)* | 88.00 | 1.34 | 23.33 | 15.14 | 0.83 | 47.35 |
| Kales (*Brassica oleraceae var. acephela*) | 83.89 | 1.21 | 30.63 | 36.08 | 1.36 | 14.61 |
| Cassava root (*Manihot esculenta*) | 89.79 | 2.97 | 2.92 | 2.09 | 0.83 | 80.94 |
| Sweet Potato tuber (*Ipomea batatas*) | 83.12 | 3.48 | 5.83 | 3.70 | 2.17 | 67.93 |
| **Mean (%)** | **87.51** | **2.79** | **18.88** | **15.86** | **2.91** | **47.09** |
| **Recommended nutrient requirements for poultry (%)*** | | | | | | |
| Chicks (0-6 weeks) | - | - | 18 | 5 | 1 | - |
| Growers (6-18 weeks) | - | - | 15-16 | 5-8 | 1 | - |
| Layers (>18 weeks) | - | - | 17 | 10 | 1 | - |

* NRC (1994), DM=Dry matter content (100-%MC), NFE=Nitrogen free extracts (100-%MC+%Ash+%+CP+%EE%+CF%).

The results of the descriptive analysis are presented in Table 4.28. The moisture content was minimum in kikuyu grass and maximum on sweet potato tuber. The minimum ash content was found in maize and was maximum in fishmeal. The crude protein was minimum in cassava root and maximum in fish meal. The crude fiber was minimum in fishmeal and maximum in maize. The crude fat was maximum in both cabbage and cassava root and maximum in fish meal

**Table 4.28: Descriptive statistics on nutrient contents of the local feed resources**

| Nutrients contents (%) | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Moisture content | 9 | 3.75 | 16.88 | 12.48 | 6.68 |
| Ash | 9 | 0.91 | 11.09 | 2.79 | 5.42 |
| Crude protein | 9 | 2.92 | 65.63 | 18.88 | 32.59 |
| Crude fiber | 9 | 2.09 | 36.13 | 15.90 | 17.12 |
| Crude fat | 9 | 0.83 | 9.84 | 2.90 | 4.72 |
| Carbohydrates | 9 | 2.76 | 80.94 | 47.09 | 39.21 |

### 4.2.2.2: Mineral analysis

The results of mineral composition of the nine identified feed resource are presented in Table 4.29. Maize, sorghum, cassava and sweet potato had low levels of calcium hence need to supplement calcium in feed formulations. This study has also found that cabbage, kikuyu grass, kales had high levels of minerals (magnesium, calcium, potassium, sodium and phosphorous) should be used to supplement mineral deficit in maize, sorghum and finger millet meals which are excellent energy sources but deficient in calcium and other minerals.

**Table 4.29: Mineral composition of identified local feed resources (dry matter basis)**

| Feedstuff | % Mg | %Ca | % K | %Na | % P |
|---|---|---|---|---|---|
| Fish meal (*Caridina nilotica*) | 0.79 | 0.49 | 0.66 | 1.82 | 0.59 |
| Maize (*Zea mays*) | 0.12 | 0.04 | 1.19 | 0.71 | 0.63 |
| Finger millet (*Panicum miliacem*) | 0.96 | 0.14 | 0.5 | 0.74 | 0.64 |
| Sorghum *(Sorghum vulgare*) | 0.64 | 0.04 | 1.57 | 0.81 | 0.60 |
| Kikuyu grass *(Pennisetum clandestinum)* | 1.11 | 0.73 | 8.45 | 0.91 | 0.67 |
| Cabbage (*Brassica oleraceae var. capitata)* | 0.84 | 1.71 | 3.65 | 0.69 | 0.46 |
| Kales (*Brassica oleraceae var. acephela*) | 1.68 | 0.5 | 8.45 | 1.09 | 0.59 |
| Cassava root (*Manihot esculenta*) | 0.42 | 0.04 | 1.16 | 0.78 | 0.44 |
| Sweet potato tuber (*Ipomea batatas*) | 0.46 | 0.05 | 1.49 | 0.81 | 0.35 |
| **Mean %** | **0.78** | **0.42** | **3.01** | **0.93** | **0.55** |
| **Recommended levels of minerals for poultry (%) *** | | | | | |
| Chicks (0-6 weeks) | 600 mg | 0.9 | 0.25 | 0.15 | 0.40 |
| Growers (6-18 weeks) | 500 mg | 0.8 | 0.25 | 0.15 | 0.35 |
| Layers (>18 weeks) | 400 mg | 2.0 | 0.25 | 0.15 | 0.32 |

*NRC (1994), Mg-magnesium, Ca-calcium, K-potassium, Na-sodium, p-phosphorous

Table 4.30 shows the mineral content of the identified local feed resources. magnesium, calcium and phosphorous and sodium was minimum in maize and maximum in kales, cabbage and kikuyu grass and fish meal respectively. Phosphorous was minimum in sweet potato tuber and maximum in kikuyu grass.

**Table 4.30: Descriptive statistics on mineral content of the local feed resources**

| Mineral content (%) | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Magnesium | 9 | 0.12 | 1.68 | 0.73 | 0.79 |
| Calcium | 9 | 0.04 | 1.71 | 0.42 | 0.88 |
| Potassium | 9 | 0.04 | 0.16 | 0.10 | 0.06 |
| Sodium | 9 | 0.02 | 0.11 | 0.07 | 0.05 |
| Phosphorous | 9 | 0.35 | 0.67 | 0.55 | 0.16 |

### 4.3: Major factors which influence indigenous chicken production in Masaba North Sub-County, Nyamira County, Kenya

#### 4.3.1: Correlation analysis

The results of correlation analysis among independent variables are presented in Table 4.31. The Pearson correlation analysis carried out to determine the relationship among study variables. The findings show that there was moderate and significant positive correlation (≥0.50) between age of the farmer and the years of experience in chicken production and also between family size and years of experience in chicken production. This study also found low and positive correlation (≤0.30) between sex of the farmer and the years of experience in IC production and training attended by IC farmers. Training also had low negative correlation with level of education.

The findings show that all the independent variables used to determine farmer characteristics (age, sex, education level, training and family size) show significant correlations hence were subjected to multivariate analysis to assess their combined influence on production outcomes. This stepwise approach follows recommendations by Kothari (2004) that correlation analysis provides the necessary foundation for building robust multivariate models by reducing redundancy and ensuring statistical validity.

**Table 4.31: Correlation matrix table for independent variables**

| | **Age** | **Sex** | **Experience** | **Family size** | **Education level** | **Training** |
|---|---|---|---|---|---|---|
| Age | 1 | 0.023 | 0.541** | 0.384** | -0.350** | 0.019 |
| Sex | 0.023 | 1 | 0.106 | 0.182* | -0.274** | 0.085 |
| Experience | 0.541** | 0.106 | 1 | 0.590** | -0.350** | 0.058 |
| Family | 0.384** | 0.182* | 0.590** | 1 | -0.325** | 0.032 |
| Education level | -0.350** | -0.274** | -0.350** | -0.325** | 1 | -0.035 |
| Training | 0.019 | 0.085 | 0.058 | 0.032 | -0.035 | 1 |

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

### 4.3.2: Multivariate analysis to determine major factors that influence indigenous chicken production

The results of normality test of the independent variables are presented in Table 4.32. Lambda values range from 0.00 and 1.00 and an independent variable with smaller Wilks' lambda value was an important variable. Wilks lambda was significant by F test of all independent variables. The analysis shows that the age, sex and level of education obtained *p values* greater than 0.05, indicating that they had no influence on indigenous chicken production. Furthermore, the level of experience, family size and training had *p values* less than 0.05, indicating that they had significant influence on indigenous chicken production.

**Table 4.32: Normality analysis for independent variables**

| Variables | | Wilks' Lambda value | F | Significance value obtained |
|---|---|---|---|---|
| Age | Less than 20 years<br>Between 20-35 years<br>Between 36-50 years<br>Over 50 years | 0.86 | 0.78 | 0.80 |
| Sex | Male<br>Female | 0.94 | 1.34 | 0.23 |
| Level of education | No education<br>Primary<br>Secondary<br>Tertiary<br>University | 0.71 | 1.38 | 0.06 |
| Experience in poultry farming | Less than 2 years<br>Between 2-5 years<br>Between 6-10 years<br>Between 10-20 years<br>More than 20 years | 0.67 | 2.08 | 0.00* |
| Family size | Less than 2<br>Three members<br>Four members<br>Five members<br>More than 5 members | 0.67 | 2.08 | 0.00* |
| Training in poultry production | County<br>Farmers Field School<br>None | 0.70 | 1.49 | 0.03* |

*Variable significant at 95% level of confidence.

The results of the multivariate analysis for experience and selected dependent variables are presented in Table 4.33. Years of experience had significant link with source of feeds, mortality rate and egg production *(p < 0.05).* It had no significant association with breeds, source of birds, feeding, source of drugs, and source of extension services *(p >0 .05).*

**Table 4.33: Multivariate analysis for experience and selected dependent variables**

| **Variables** | | **Type III Sum of Squares** | **Df** | **Mean Square** | **F** | **Sig.** |
|---|---|---|---|---|---|---|
| Experience | Breeds | 22.99 | 4 | 5.75 | 2.04 | 0.09 |
| | Source birds | 182.80 | 4 | 45.70 | 0.79 | 0.53 |
| | Feeding | 14.08 | 4 | 3.52 | 1.98 | 0.10 |
| | Source feeds | 851.24 | 4 | 212.81 | 3.82 | 0.01* |
| | Mortality | 2.55 | 4 | 0.64 | 3.35 | 0.01* |
| | Source drugs | 2.43 | 4 | 0.61 | 0.93 | 0.45 |
| | Egg production | 1094.34 | 4 | 273.59 | 7.73 | 0.00* |
| | Extension | 2.87 | 4 | 0.72 | 0.85 | 0.50 |

* Variable significant at 95% level of confidence.

The results of multivariate for analysis family size and selected dependent variables are presented in Table 4.36. Family size had a significant link with the mortality rate and egg production *(p < .05).* It had no link with breeds, source of birds, feeding, source of feeds, source of drugs, and sources of extension services *(p > .05).*

**Table 4.34: Multivariate analysis for family size and selected dependent variables**

| Variables | | Type III Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| Family size | Breeds | 24.18 | 4 | 6.05 | 2.15 | 0.08 |
| | Source birds | 173.67 | 4 | 43.42 | 0.75 | 0.56 |
| | Feeding | 1.94 | 4 | 0.49 | 0.26 | 0.90 |
| | Source feeds | 369.86 | 4 | 92.46 | 1.58 | 0.18 |
| | Mortality rate | 3.06 | 4 | 0.76 | 4.08 | 0.00* |
| | Source drugs | 1.06 | 4 | 0.27 | 0.40 | 0.81 |
| | Egg production | 1561.96 | 4 | 390.49 | 12.01 | 0.00* |
| | Extension | 5.76 | 4 | 1.43 | 1.74 | 0.15 |

* Variable significant at 95% level of confidence.

The results of multivariate analysis for on selected dependent variables are presented in Table 4.35. Trainings attended by IC farmers had significant link with mortality rate and egg production ($p < .05$). It had no significant link with breeds, source of birds, feeding system, source of feeds, source of drugs, and sources of extension services ($p > 0.05$).

**Table 4.35: Multivariate analysis for training and selected dependent variables**

| Variables | | Type III Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| Training | Breeds | 14.80 | 5 | 2.96 | 1.02 | 0.41 |
| | Source birds | 60.76 | 5 | 12.15 | 0.21 | 0.96 |
| | Feeding | 6.28 | 5 | 1.26 | 0.68 | 0.64 |
| | Source feeds | 54.73 | 5 | 10.95 | 0.18 | 0.97 |
| | Mortality | 3.51 | 5 | 0.70 | 3.79 | 0.00* |
| | Source drugs | 0.74 | 5 | 0.15 | 0.22 | 0.95 |
| | Egg production | 1166.99 | 5 | 233.40 | 6.64 | 0.00* |
| | Extension | 0.47 | 5 | 0.09 | 0.11 | 0.99 |

* Variable significant at 95% level of confidence.

# CHAPTER FIVE: DISCUSSION

## 5.1: Objective 1: Production systems

The indigenous chicken production system in Masaba North Sub-County is predominantly extensive (scavenging) system, followed by semi-intensive systems (30.8%) while only small proportions (7.7%) kept chicken under intensive systems. In addition, the majority of the indigenous chicken farmers kept small flocks of fewer than 40 birds with management dominated by women (58%) and youth aged 20-35 years (53.2%). Housing structures were mostly makeshift, and disease outbreaks such as Newcastle (ND) and coccidiosis were frequent.

This study agrees with studies conducted in Kenya and East Africa. For instance, Kingori *et al*. (2010) who in a review of indigenous chicken production systems across several regions of Kenya, reported that indigenous chicken production is mainly extensive and relies on scavenging with minimal supplementation. Similarly, Mwacharo *et al.* (2017) and Okitoi *et al*. (2017) in Western Kenya observed that the majority of the rural households practice free range systems characterized by small flock sizes and low inputs. However, the present study differs slightly from other studies that it found higher participation of youth and greater awareness of the improved housing.

These differences could be attributed to the impact of county level agricultural programs such as National Agricultural and Rural Inclusive Growth Project (NARIGP) which have recently emphasized youth engagement and improved husbandry practices. The presence of active extension officers and farmers field schools in Masaba North Sub-County may have encouraged adoption of better management techniques. The study also revealed that the extensive system remains prevalent due to low resource availability, limited access to inputs and higher feed costs.

These constraints were consistent with findings by Ochieng et al. (2018) in Western Kenya who noted that smallholder poultry keepers face financial limitations that restrict their ability to transition to semi-intensive systems. This study contributes new insights showing that gender, and age dynamics in indigenous poultry keeping is shifting, with younger

female farmers becoming increasingly involved-an aspect earlier highlighted in earlier literature.

### 5.2: Objective 2: To assess the nutrient composition and utilization of locally available feed resources

Nine local feed resources were identified: maize, cassava, sweet potatoes, kales, cabbages, finger millet, kikuyu grass, fish meal and sorghum. Laboratory analysis reveal that fish (*caridina nilotica*) meal contained the highest crude protein (CP) contents (65.63%), ether extract (EE) contents (9.86%) and ash contents (11.09%). These results confirm that fish meal is a superior source of high quality protein, essential amino acids and minerals for poultry. These findings agree with Ayssiwede et al. (2011) and Bangu (2020). Who reported that fish meal is an excellent source of protein for village poultry.

Lower crude protein (CP levels (53-60%) were reported by Ochieng et al. (2018) in Western Kenya and Lubandi et al. (2018) in Tanzania possibly due to differences in processing and source of fish meal being used. Magothe et al. (2012) emphasized that incorporating fish meal in indigenous chicken diets significantly improves growth and egg production. However high costs and limited local availability restricts its regular use among small holder farmers (Mutua, 2018).

Kales (*Brassica oleracea var. acephala*) recorded moderate crude protein (CP) content (30.63%) and high crude fiber (CF) content (36.08%). It was also found to have contents of calcium (0.5%), potassium (8.45%), sodium (1.09%) and magnesium (1.68%). This suggests that kale is a valuable source of protein and minerals particularly potassium, sodium and magnesium. The findings are consistent with Bebe *et al*. (2013) and Magothe et al. (2012) who found similar profiles for leafy vegetables used in scavenging diets in Kenya.

According to Guteta (2021), feeding green vegetables enhances immune response and egg yolk pigmentation. Although high fiber limits digestibility when offered in large amounts. Cabbage (*Brassica oleracia var. capitata*) had slightly lower crude protein content (23.33%) and higher calcium (1.71%). This agrees with findings of Desta (2020) who reported that cabbage leaves are less nutrient dense than other green forages due to their

high water content. Despite this cabbage remains a useful supplementary feed for indigenous chicken because of its availability and micronutrient contribution (especially vitamin A and C) as observed by Liswaniso *et al*. (2024) in similar research in Zambia.

Cassava root contains low crude protein (CP) contents but high nitrogen free extracts (NFE) content (80. 94%). The low crude protein levels (2.92%) aligns with results by Okeno *et al*. (2015) and Desta (2020) who both reported CP values below 5% in cassava tubers. Guteta (2021) in Ethiopia, noted that cassava is an excellent energy source its use in poultry diets should be limited because of cyanogenic glycosides which can cause toxicity if not properly processed. The findings suggest that cassava root is more suitable as an energy supplement rather than primary feed for indigenous chicken.

Sweet potato tuber showed moderate crude protein levels (CP) levels (5.83%) and high NFE (67.93%). These values were slightly lower than those by Magothe *et al*. (2012) who reported CP levels of 6.2% and high starch contents in sweet potato tubers in Central Kenya. Similarly, Liswaniso *et al.* (2024) found that sweet potato tubers are widely used in smallholder poultry in Zambia because of their palatability and availability, despite their low protein value. Supplementation with protein rich feeds such as fish meal or legumes is therefore essential.

Sorghum grain had crude protein (CP) content (12.4%), NFE (58.71) and Crude fiber (CF)content (8.79%). The protein content was higher than those reported by Okeno *et al.* (2015) in Western Kenya and Desta (2020) in Ethiopia who reported 9-10%. Sorghum is a good source of energy but contain tannins, which may reduce digestibility and amino acid availability. Nevertheless, Lubandi et al. (2018) reported that properly processed (dehulled or soaked) sorghum effectively replace maize in poultry diets without adverse performance effects.

Finger millet contains CP of 7.29%, EE of 1.84%, NFE (70.23) and ash content of 1.9%. These results were lower than those of Ochieng et al. (2018) who observed 11% CP and 3% EE in finger millet used by indigenous chicken farmers in Western Kenya. Guteta (2021) noted that finger millet is rich in energy and moderately high in protein making it suitable as a basal feed ingredient in balance rations. Its fine texture makes it easy for scavenging chickens to consume without further processing.

Kikuyu grass (*Pennisetum clandestinum*) atypical tropical grass reported moderate CP (10.94%) and high crude fiber (CF) contents (34.66%). The nutrient profile agrees with Desta (2020) and Liswaniso et al. (2024), who reported that most natural pastures in East and Southern Africa are course and fibrous providing bulk but limited nutrients. Although kikuyu grass is not a primary poultry feed, its availability allows free ranging birds to obtain roughage and minerals. Bebe et al. (2013) noted that inclusion of grasses in scavenging diets support gut health but contribute little to protein intake.

Maize grain recorded CP of 10.94%, EE of 4.07%, and high in nitrogen free extract of 34% confirming its role as the main energy source in poultry diets. The findings are consistent with those of Okeno et al. (2015) in Kenya and Desta (2020) who reported CP 8-10% in Ethiopia. Despite its moderate protein level, maize remain the principal feed base due to high digestibility and energy yield. However, Mutua (2018) observed high cost and competition with human food use limits availability for small scale farmers.

Variations in soil fertility and feed sample collection season could also explain the difference in mineral compositions observed. Despite availability of this feed resources, most farmers underutilize them because of limited knowledge of feed formulation and absence of community feed mixers. This agrees with Nduthu (2015) and Mutua (2018), who highlighted lack of farmer awareness as a barrier to effective feed use.

While other studies relied on farmer recall to estimate nutrient content this research laboratory proximate and mineral analysis using AOAC standards, providing empirical nutrient data on nine feed resources specific to Nyamira County. This adds to scientific evidence to local feed potential and guides formulations of balanced indigenous chicken diets.

### 5.3: Objective 3: To determine the major factors influencing indigenous chicken production

Correlation and multivariate analysis identified training, family size and farming experience as significant factors influencing production *($p < 0.05$)*. Trained and experienced farmers achieved higher egg production, lower mortality, better housing and feed practices. These findings are consistent with Anyona et al. (2023), Ogolla (2016) in

Western Kenya and Nduthu (2015) who reported that technical knowledge and hands on experience are key determinants of indigenous poultry productivity.

Similarly, Mutua (2018) in Eastern Kenya found that trained farmers adopt improved management practices, which reduce losses and improve returns. However, current study disagrees with Lubandi et al. (2018) who found that formal education level was a significant predictor of productivity in Tanzania. In this study education had no significant effect suggesting that practical experience and extension training outweigh formal education in influencing indigenous poultry outcomes. The insignificance of gender and age as predictors also contrasts with Desta (2020), who noted that older farmers tend to have larger flocks. The difference may be due to increased youth involvement in poultry farming in Masaba North, supported by government youth empowerment programs.

This research used cross tabulation and multivariate analysis to statistically test the influence of social and management factors on production outcomes- a methodological advancement over previous purely descriptive studies. It also identified interaction effects between experience and training showing that trained farmers with longer experience achieve the best productivity outcomes.

### 5.4: Summary of discussion

Overall, the findings demonstrate that indigenous chicken production in Masaba North sub-county is dominated by low input extensive systems constrained by diseases, feed shortages and limited training. However, locally available feed resources have high nutritional potential and management related factors such as training and experience significantly influence productivity.

# CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

## 6.1: Summary of Significant Findings

More than half of the IC farmers were youth (53.25%) and nearly two third were women (58%). Over two third of the indigenous chicken farmers had primary level of education and above (68.7%) and more than half of the farmers had five years' experience in chicken farming (55%). Nearly three quarter (74%) of the interviewed households had up to five family members, which is generally regarded as a small family size. Two thirds of the IC farmers had some basic training on poultry production by the County extension staff (60.4%) and only a few by the Farmers Field School (0.6%) and nearly four fifth of the farmers did not have any training.

The findings on objective on the production systems of the indigenous chicken in Masaba North Sub-County shows that the dominant production system was extensive system (61.5%), characterized by small flock sizes with mean of 6 (range of 1-40 chicken) followed by semi-intensive system (30.8%). The common housing system was deep litter housing system (50.9%). Scavenging and supplementation with local feed resources (37.9%) was the major feeding system. Homemade rations (31.4%) was the major source feeds. Agro vet shop (95.3%) is the major outlet for vaccines and drugs. The common breeds reared were local indigenous chicken (42.6%) and majority do own hatching (60. 4%). The number of eggs produced per day ranges from 1-34 with mean of 3.5 eggs. The most common source of extension services was county (90.5). Newcastle (33%), Coccidiosis (27%), and chronic respiratory diseases were the most prevalent diseases.

The findings on assessing the nutrient composition, usage and constraints of local and available feed resources used as IC feeds. Nine feed resources were identified: maize, cassava, sweet potato tuber, kales, cabbages, finger millet, kikuyu grass, fish meal and sorghum. The DM content ranges from 96.03% (kikuyu grass) to 83.12% (sweet potato tuber). Crude protein content was highest in fish meal (65.63%) and lowest on cassava root (2.92%), Ash content was high on fish meal (11.09%) and lowest on maize (0.91%). Cassava had high NFE of 80.94% followed by finger millet (70.23%), sweet potato tuber (67.93), sorghum (58.71%) and lowest on fish meal (2.76%).

Maize, sorghum and cassava had the lowest calcium content (0.04%). Fish meal and maize had highest crude fat content (9.86% and 4.07%) and lowest fat content in cassava root (0. 83%). Crude fiber was high on maize (36.13%) followed by kales (36.08%), kikuyu grass (34.66%) and lower on cassava root (2.09%) and fish meal (2.39%). Calcium content was high in Cabbage, kikuyu grass and fish meal (1.71%, 0.73%, and 0.49% respectively) whereas maize, sorghum and cassava had low calcium content (0. 04%).

Potassium content was high in Kales and kikuyu grass (8. 45%) and was low in sweet potatoes (0.5%). Sodium was high in fish meal and kales (1.82% and 1.09%) and maize had the lowest content of sodium (0.71). Kales and kikuyu grass had the high magnesium (1.68% and 1.11% respectively) but was opposite for maize (0.12%). Phosphorous was high on kikuyu grass and finger millet (0.67% and 0.64%) and low on sweet potato tuber (0.35%). These feeds provide adequate nutrients and minerals comparable to commercial feeds standards (Ayssiwede *et al*., 2011; Bangu, 2020).

The objective to determine major factors influencing IC production in Masaba North Sub-County, training, family size and experience were statistically significant *(p <0 .05)*. Experienced farmers with more than five years recorded higher egg production and lower mortality due to better management and disease control (Nduthu, 2015, Anyona *et al*., 2023). Family size positively influenced productivity with smaller families afforded better care and feeding. Education, age and gender were not significant predictors of production according to Wilks lambda test.

### 6.2: Conclusions

The study drew the following conclusion:

i. Indigenous chicken production in Masaba North Sub-County is predominantly extensive with small flock sizes and high disease prevalence. Housing type was deep litter (58%) and productivity was low due to inadequate inputs and disease challenges.
ii. Nine local feed resources were identified which were shown to contain adequate nutrients comparable to commercial feeds. Their use can reduce production costs and reliance on commercial rations.

iii. The major factors that influence indigenous chicken production in Masaba North Sub-County were; family size, experience and training which significantly affected egg production and mortality while age, sex of household head and education level did not. This underscores the importance of extension support and experiential learning.

### 6.3: Recommendations

i. The department of livestock production, Nyamira County Government in collaboration with extension officers should promote gradual transition from extensive to semi-intensive systems by training farmers on low-cost housing, disease control and feed supplementation. This can be achieved through farmer field schools and demonstration centers where model poultry units show case improved management practices suitable for small holders.

ii. The Kenya Agricultural and Livestock Research Organization and County Livestock department should collaborate to train youth and cooperatives on feed formulation and preservation using locally available ingredients such as sorghum, cassava and fish meal. this should be implemented through community based feed processing units supported by microcredit programs to enhance feed availability and reduce production costs.

iii. The County department of agriculture and livestock development together with non-governmental organizations (NGOs) working in rural development should expand farmers training and mentorship programs and farmer exchange visits focusing on practical management, disease prevention and record keeping to improve on flock productivity.

### 6.4: Further research

i. A study to be carried out to determine whether other socio-economic factors such as land size, source of income and access to credit has influence on IC production in Masaba North Sub-County.

ii. County governments should integrate indigenous chicken development into their livestock policies and allocate funds for farmer capacity building, feed resource research and input subsidies. Collaboration between government agencies, research institutions and farmer groups will enhance productivity, food security and income generation

## REFERENCES


Anyona, O., Atyang, M., Githae, W. (2023). Characterization of indigenous chicken production, management and marketing systems in rural Kenya. *Journal of Agricultural Studies, 11(2):45-57.*

Association of Official Analytical Chemists (AOAC). 1990. Methods of analysis of the association of official analytical chemists, 18th Edition, Washington, DC.

Ayssiwede, S., Zanmenou, Y., Issa, M., Hane, A., Dieng, C., Chyrsostome, M., .Missohou, A. (2011). Nutrient Composition of Some Unconventional and Local Feed Resources. *Pakistan Journal of Nutrition*, 10(8): 707-717.

Bangu, N. (2020). Reviewing locally available chicken feed resources at different agro-ecologies (high, mid and low land), formulating according to growth stage (growers and layers) of chicken and its average price in SNNPR. *Journal of aquaculture and livestock production*, 1(1): 1-6.

Bebe, O., George, O., & Justus, O. (2013). Management practices and challenges in smallholder indigenous chicken production in western Kenya. *Journal of agriculture and rural development in the tropics and subtropics*, 114(1):51-58.

Bhuiyan, A., Bhuiyan, M., Deb, G. (2005). Indigenous Chicken Genetic Resources in Bangladesh: Current Status and Future Outlook. *Journal of Animal Genetic Resources Information*, 36: 73-100.

Carter, N. A., Dewey, C. E., Lukuyu, B., Grace, D. and de Lange, C. F. M. (2015). Nutrient composition and seasonal availability of local feedstuffs for pigs in western Kenya. Can. J. Anim. Sci. 95: 397-406.

Cheruiyot, J.K., Adhiaya, M., (2021). Indigenous Chicken Productivity and Associated Farm Level Attributes Among Producers in the Western Parts of Kenya. *Journal of agriculture and ecology research international*. 22(2): 11-25.

Das, S., Chowdhury, S., Khatun, M., Nishibori, M., Isobe, N., & Yoshimura, Y. (2008). Small-scale family poultry production. *Worlds poultry science journal*, 64: 99-118.

Desta, T.T. (2020). Indigenous village chicken production: a tool for poverty alleviation, the empowerment of women, and rural development. *Tropical Animal Health and production*, 52(7): 3899-3907.

Esatu, W., Dessie, T., Okeyo, A. (2023). Gender and youth involvement in smallholder poultry production in East Africa. *African Journal of Agricultural Economics, 19(1):78-90.*

Food and Agriculture Organization of the United Nations. (2019).*Small scale poultry production: Technical guide.* Rome: FAO.

Food and Agriculture Organization of the United Nations. (2021). *The state of food and agriculture 2021*: *Making agrifood systems more resilient to shocks and stress.* FAO.

Field, A. (2018). Discovering Statistics Using IBM SPSS Statistics (5th ed.).*SAGE Publications Ltd.*

Ginindza, M.M. (2023). Lucern meal in diet of indigenous chicken. *A review. Frontiers in Animal Science, 4, 1274473.*

Goromela, H., Kwakkel, P., Versegen, A., & Katule, M. (2006). Identification, characterization and composition of scavenge able feed resources for rural poultry production in central Tanzania. *Africa journal of Agricultural research*, 2(8): 380-393.

Guest, G., Namely, E., Chen., M. (2020). A simple method to assess and report thematic saturation in qualitative research, *PLoS ONE, 15(5): e0232076*

Gueye, F. (2009). The role of networks in information dissemination to family poultry. *Worlds poultry science journal, 65(1), 115-124.*

Guteta, A. (2021). Dynamics of Poultry Production System, Constraints, Opportunities and Marketing in Ethiopia. *Journal of marketing research*, 77: 1-9.

Hennik, M., Kraiser, N., Weber, B. (2015). What influences saturation? Estimating sample sizes in focus group research. *Qualitative Health Research. 30(10):1483-1496.*

Heaton, J. (2021). Secondary analysis of qualitative data. An overview. Historical social research, 46(4): 191-212.

Islam, R., Kalita, N., Sapcota, D., Sheikh, I., Dev, J., & Sarma, M. (2021). Characterization of free- range Indigenous chicken production system in North East India (Assam). *Journal of animal research,* 11(1): 59-70.

Johnston, M.P. (2017). Secondary data analysis. A method of which the time has come. *Qualitative and quantitative methods in libraries, 3(3). 619-626.*

Kamya, G., Navdeep, S., Shammy, J., Rajwinder, K. and Anju, G. and Rajendra, A. (2022). Kjeldhal Method. *Advanced Techniques of Analytical Chemistry, 1(1): 105-112.*

Kenya National Bureau of Statistics. (2018). *Economic Survey 2018*.Nairobi, Kenya. *Kenya National Bureau of Statistics.*

Kenya National Bureau of Statistics. (2019).Kenya population and Housing census*:* volume iv. Distribubion of populations by socio economic characteristics. *Kenya National Bureau of Statistics, ISBN: 978-9966-102-11-*9.

Kiptui, K., Muriuki, W., Oduho, W. (2024). Nutrient composition of sorghum- based rations and their effect in growth of improved indigenous chicken in Western Kenya. *Journal of Animal Nutrition and Feed Science, 6(1): 22-34.*

Kingori, A., Wachira, A., & Tuitoek, J. (2010). Review, Indigenous chicken production in Kenya. *International Journal of Poultry science,* 9 (4): 309-316.

Kothari, C. (2004). Research Methodology, methods and Techniques, New Delhi, New Age International (P) Limited publishers. *ISBN (13): 978-81-224-2488-1*

Krejcie, & Morgan. (1970). Determining Sample Size for Research Activities. *Sage Journal,* 30(3): 607-610. doi:https://doi.org/10.1177/001316447003000308.

Krueger, R,A.,Casey, M.A. (2015). Focus groups. Apractical guide for applied research.*Sage publications.*

Kumar S.,Niranjan P.S., Chahal S.U.,Srivastava V. (2010). Hand Book of Applied Animal Nutrition. First Edition 2010. Delhi, India, ibdc publishers. ISBN:978-81-8189-492-2.

Liswaniso, C., Muma, B., Banda, F. (2024).Zambian indigenous chicken genetic resources: phenotypic characteristis and production systems. *Frontiers in Veterinary science, 11, 1429869.*

Lubandi, M., Ngeno, K., Maina, N. (2018). Socio economic factors affecting indigenous poultry production in Makueni County, Kenya. *Journal of Animal Production,10(2) : 85-94.*

Magothe, T., Okeno, T., Muhuyi, W., & Kahi, A. (2012). Small –Scale Family Poultry Production. *Words poultry science journal,* 68: 119-132.

Masole, C., Mpothwe, G., & Moreki, J. (2015). Value chain analysis of Botswana poultry industry. *Journal of world's poultry research*, 5(3): 64-72.

Melesse, A. (2014). Significance of Scavenging Chicken Production in the rural Community of Africa for enhanced food security. *World poultry science journal,* 70: 593-606.

Moges, F., Mellese, A., Dessie, T. (2010). Assessment of village chicken production system and evaluation of the productive and reproductive performance of local chicken ecotypes in Bure district, North West Ethiopia. *African Journal of Agricultural Reseach, 5(13): 1739-1748.*

Mohamed, A., Hailemarriam, S., Gebremedin, G., Gebewey, K. (2016). Challenges and Opportunities of Small Scale Poultry Production System in Jigjiga Zone, Somali Regional State, Ethiopia. *Poultry Fish Wildlife Science,* 4(1): 1-7.

Moreki, C. (2010). Opportunities and challenges for the Botswana poultry industry in the 21st century: a review. *Livestock Research for Rural Development,* 22(89): 1-5.

Mottet, A., De Haan, C., Falcucci, A., Tempio, G., Opio, C., & Gerber, P. (2017). *Livestock: on our plates or eating on our table? A new analysis of the feed/food* NRC (Nutrient Requirements of Dairy Cattle), 2001. Seventh Revised Edition. National Academy Press. Washington, D.C, USA. *debate.* Global Food Security.

Msoffe, W., Goraichuk , V., Chiwanga, H., Volkening, D., Kariithi, M. (2023). Molecular characterization of complete genome sequence of an avian coronavirus identified in backyard chicken from Tanzania. *Genes, 14(10), 1852.*

Mugenda and Mugenda. (2003). *Research methods; quantitative and qualitative approaches.* Africa Center for Technology (ACTS), Nairobi Kenya.

Mwacharo, M., Bjonastard, G., Nomura, K., Hanada, H., Amano, T., Jianlin, H., Hanotte, O. (2017). The impact of demographic events on population structure and diversity of East African indigenous chicken. *Journal of Animal Genetics, 48(2): 155-168.*

Mwesigwa, M., Semakula, J., Lusembo, P., Ssenyonjo, J., Isabirye, R., Lumu, R., Namirimu, T. (2015). Small holder local chicken production and available feed resources in Central Uganda. *Uganda Journal of Agricultural Sciences, 16(1):107-113*

Muleta, C., Sime, A. (2022). Current Status of Indigenous Chicken Production Performance, Opportunity and Challenges in Ethiopia, A Review. *https://www.researchgate.net/publication*/360964640.

Mutegi, E., & Gikunda, R. (2015). Opportunities and Challenges facing smallholder participation in indigenous poultry production in Tharaka Nithi county, Kenya. *International Journal ofAgriculure Innovations and Reseach,* 4(2): 295-300.

Mutua, F.K. (2018) Assessment of indigenous poultry systems and performance in Eastern Kenya. *Egerton University Research Report.*

National Research Council. (1994) *Nutrient Requirement of Poultry. Ninth Revised Edition, 1994*. Wahington, D.C: National Academies. Press. https://doi.org/10.17226/2114.

Nduthu, P. (2015). Socio-economics Influence on Indigenous Poultry Production project in Kenya. A case of Machakos Indigenous Poultry. *International Journal of Education and Research*, 3(1): 1-12.

Njue, w., Ochieng, A., Wambugu, S. (2019). Socioeconomic characterization ofv indiigenous chicken farmers in Western Kenya. *Tropical Animal Health and Production, 51(6):1531-1540.*

Nyumba, T.O., Wilson, K.,Derrick, C.J, Mukherjee, N. (2018).The use of focus group discussion methodology: Insight from two decades application in conservation. *Methods in ecology and evolution, 9(1): 10-32.*

Ochieng, J., Obonyo, G., Nyongesa J. (2016). Nutritional profile of feed resources used in Kenyan poultry farms. *African Poultry Journal, 10(2): 99-110.*

Ogolla, A. (2016). Factors Influencing Poultry Production Among Poultry Farmers in Eldoret Town, Uasin Gishu County,Kenya.University of Nairobi. UON repository.

Ogolla, H, O. (2016). Effect of training on smallholder poultry productivity in Kisumu County, Kenya. *Agriculture Research Institute Publication.*

Okeno, T., Kahi, A., Peters, K. (2012). Characterization of Indigenous Chicken Production Systems in Kenya. *Tropical Animal Health Production, 44: 601-608.*

Okitoi, O., Ondwasy, O., Siamba, N.,Nkuruma, M. (2015). Production systems and constraints of indigenous chicken in Western Kenya. *Tropial Animal Health, 47(3): 543-549.*

Olwande, O., Ogara, O., Okuthe, S., Muchemi, G., Okoth, E., Odido, M., & Adhiambo, R. (2009). Assessing Productivity of Indigenous Chickens in an extensive management system in southern Nyanza, Kenya. *Tropical Animal health production*, 42: 283-288.

Olwande, P., Okuthe, S., Ogara, W., & Bebora, L. (2016). Participatory epidemiology assessment of factors that limit indigenous chicken productivity under free-range

system in south western Kenya. *Livestock Research for rural development, 28* (183): 1-20.

Outhen, P. (2014). A survey of Commercial Small-Sale Poultry Production Systems and Nutrient Characterization of Local Feed Ingredients in Laos, Massey University. *Massey University Repository*.

Qabale, D. (2015). Improved Feeding Management of Indigenous Chicken Layers Raised in Semi-Scavenging System by Pastoralist in Marsabit County. *Agricultural and Livestock Research Organization*.

Rashid, M. (2003). Nutritional status of scavenging chickens with special emphasis on energy and protein supplementation under rural conditions in Bangladesh. *Royal veterinary and Agricultural University*.

Sahlemedhin, S. and Taye, B. (2000). Procedures for soil and plant analysis. National Soil Research Centre, Ethiopian Agricultural Research Organization, Addis Ababa, Ethiopia

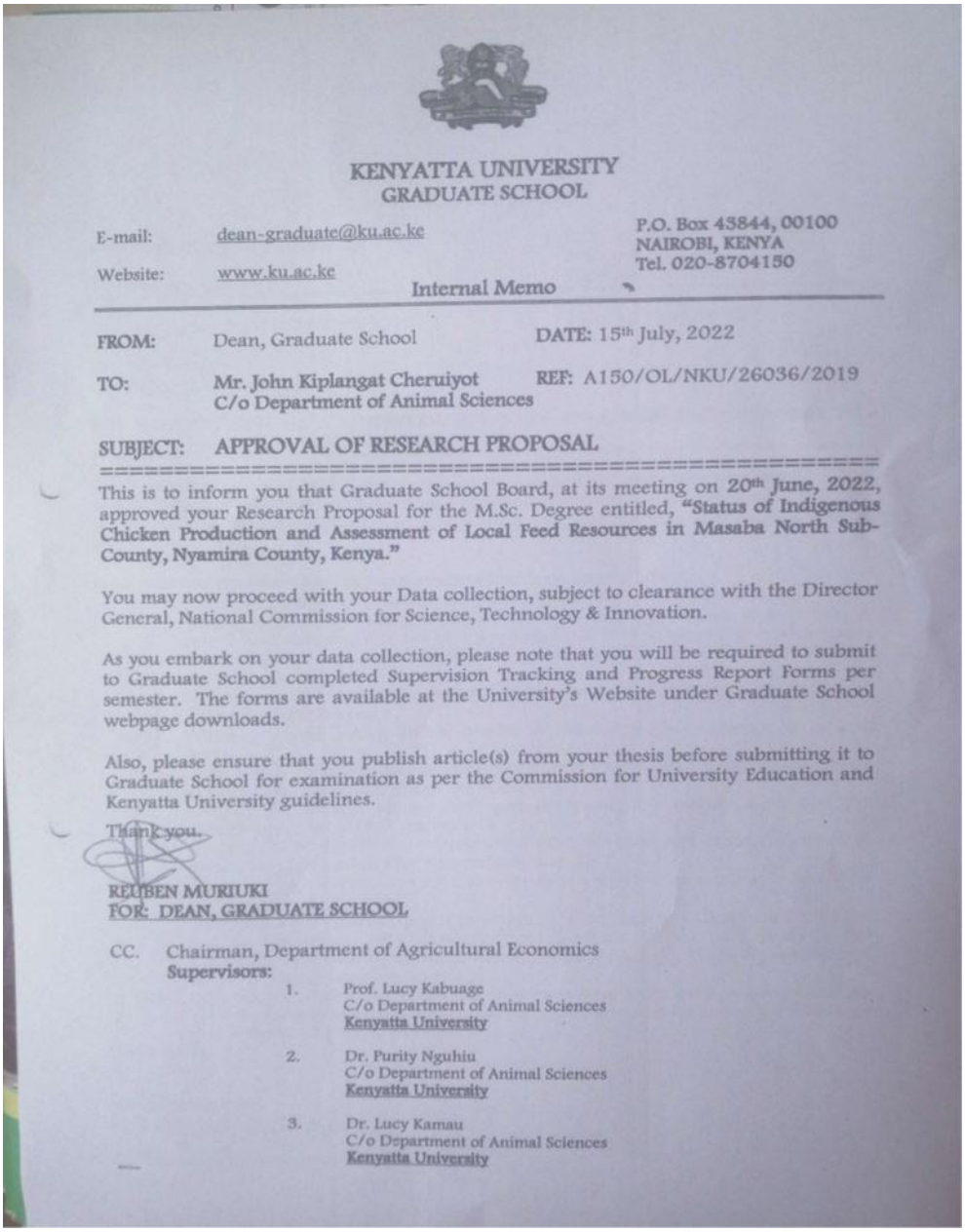
SCLPO. (2020). *Livestock production annual report, Masaba North Sub-County.* Nyamira : Sub-county Livestock Production Officer.

Sonaiya, A. (2004). *Direct assessment of nutrient resources in free range and scavenging systems: Regional report.* Worlds poultry science journal, 60(4): 523-535. Hamisi constituency, Vihiga County, Kenya. *University of Nairobi Repository*.

Vartanian, T.P. (2020). Secondary data analysis. *Oxford University Press*

# APPENDICES

## Appendix I: Research approval letter from Kenyatta University



KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 020-8704150

Internal Memo

FROM: Dean, Graduate School DATE: 15th July, 2022

TO: Mr. John Kiplangat Cheruiyot REF: A150/OL/NKU/26036/2019
C/o Department of Animal Sciences

SUBJECT: APPROVAL OF RESEARCH PROPOSAL

This is to inform you that Graduate School Board, at its meeting on 20th June, 2022, approved your Research Proposal for the M.Sc. Degree entitled, **"Status of Indigenous Chicken Production and Assessment of Local Feed Resources in Masaba North Sub-County, Nyamira County, Kenya."**

You may now proceed with your Data collection, subject to clearance with the Director General, National Commission for Science, Technology & Innovation.

As you embark on your data collection, please note that you will be required to submit to Graduate School completed Supervision Tracking and Progress Report Forms per semester. The forms are available at the University's Website under Graduate School webpage downloads.

Also, please ensure that you publish article(s) from your thesis before submitting it to Graduate School for examination as per the Commission for University Education and Kenyatta University guidelines.

Thank you.

REUBEN MURIUKI
FOR: DEAN, GRADUATE SCHOOL

CC. Chairman, Department of Agricultural Economics
**Supervisors:**

1. Prof. Lucy Kabuage
   C/o Department of Animal Sciences
   Kenyatta University
2. Dr. Purity Nguhiu
   C/o Department of Animal Sciences
   Kenyatta University
3. Dr. Lucy Kamau
   C/o Department of Animal Sciences
   Kenyatta University

## Appendix II: Research Permit from NACOSTI

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **854747**

Date of Issue: **31/October/2022**

**RESEARCH LICENSE**

**This is to Certify that Mr.. john kiplangat cheruiyot of Kenyatta University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Nyamira on the topic: Status of Indigenous Chicken Production and Assessment of Local Feed Resources in Masaba North Subcounty, Nyamira County, Kenya. for the period ending : 31/October/2023.**

License No: **NACOSTI/P/22/21387**

**854747**

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

**See overleaf for conditions**

**THE SCIENCE, TECHNOLOGY AND INNOVATION ACT, 2013 (Rev. 2014)**

Legal Notice No. 108: The Science, Technology and Innovation (Research Licensing) Regulations, 2014

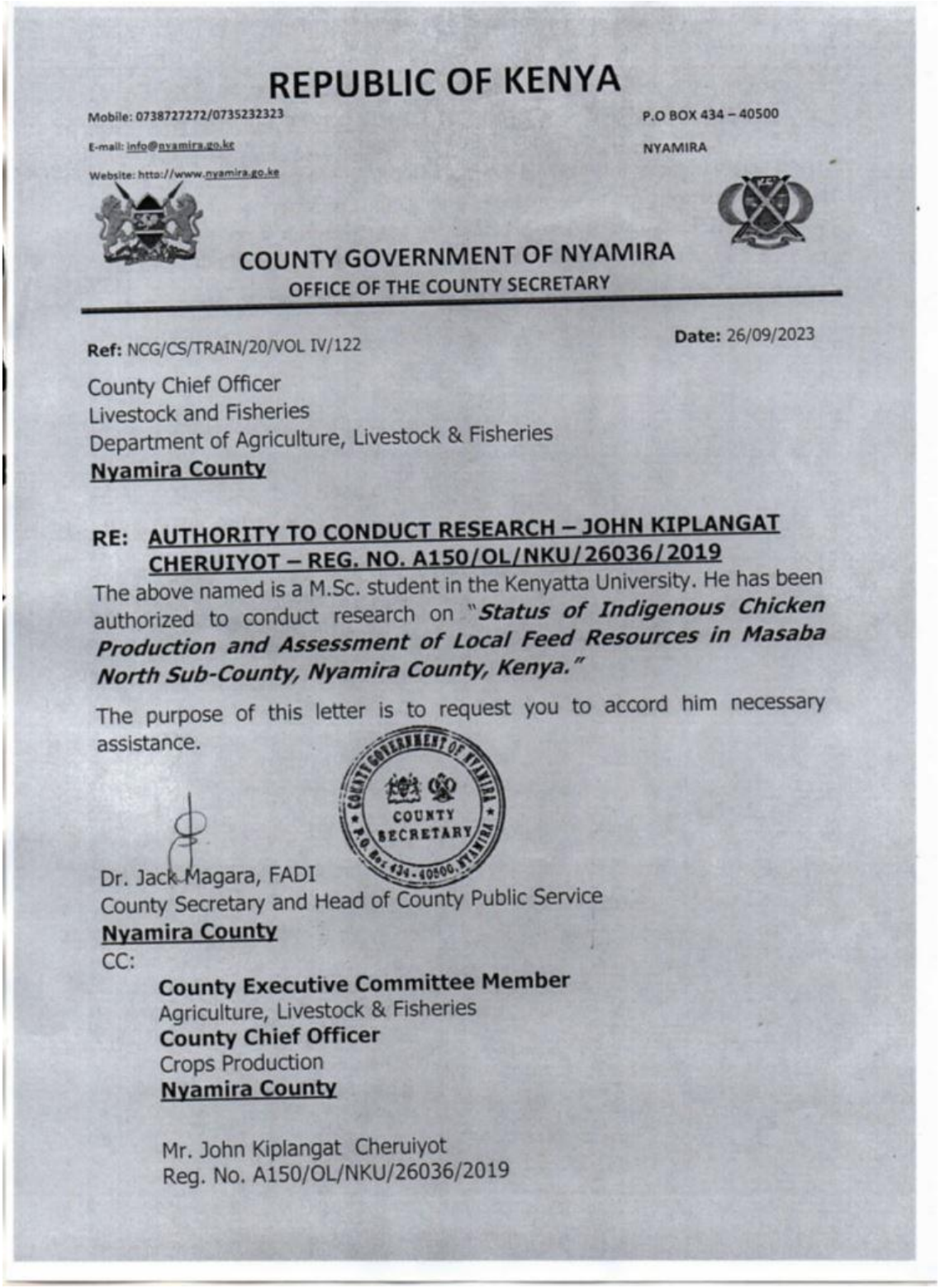
**The National Commission for Science, Technology and Innovation**, hereafter referred to as the Commission, was the established under the Science, Technology and Innovation Act 2013 (Revised 2014) herein after referred to as the Act. The objective of the Commission shall be to regulate and assure quality in the science, technology and innovation sector and advise the Government in matters related thereto.

**CONDITIONS OF THE RESEARCH LICENSE**

1. The License is granted subject to provisions of the Constitution of Kenya, the Science, Technology and Innovation Act, and other relevant laws, policies and regulations. Accordingly, the licensee shall adhere to such procedures, standards, code of ethics and guidelines as may be prescribed by regulations made under the Act, or prescribed by provisions of International treaties of which Kenya is a signatory to
2. The research and its related activities as well as outcomes shall be beneficial to the country and shall not in any way;
    i. Endanger national security
    ii. Adversely affect the lives of Kenyans
    iii. Be in contravention of Kenya's international obligations including Biological Weapons Convention (BWC), Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO), Chemical, Biological, Radiological and Nuclear (CBRN).
    iv. Result in exploitation of intellectual property rights of communities in Kenya
    v. Adversely affect the environment
    vi. Adversely affect the rights of communities
    vii. Endanger public safety and national cohesion
    viii. Plagiarize someone else's work
3. The License is valid for the proposed research, location and specified period.
4. The license any rights thereunder are non-transferable
5. The Commission reserves the right to cancel the research at any time during the research period if in the opinion of the Commission the research is not implemented in conformity with the provisions of the Act or any other written law.
6. The Licensee shall inform the relevant County Director of Education, County Commissioner and County Governor before commencement of the research.
7. Excavation, filming, movement, and collection of specimens are subject to further necessary clearance from relevant Government Agencies.
8. The License does not give authority to transfer research materials.
9. The Commission may monitor and evaluate the licensed research project for the purpose of assessing and evaluating compliance with the conditions of the License.
10. The Licensee shall submit one hard copy, and upload a soft copy of their final report (thesis) onto a platform designated by the Commission within one year of completion of the research.
11. The Commission reserves the right to modify the conditions of the License including cancellation without prior notice.
12. Research, findings and information regarding research systems shall be stored or disseminated, utilized or applied in such a manner as may be prescribed by the Commission from time to time.
13. The Licensee shall disclose to the Commission, the relevant Institutional Scientific and Ethical Review Committee, and the relevant national agencies any inventions and discoveries that are of National strategic importance.
14. The Commission shall have powers to acquire from any person the right in, or to, any scientific innovation, invention or patent of strategic importance to the country.
15. Relevant Institutional Scientific and Ethical Review Committee shall monitor and evaluate the research periodically, and make a report of its findings to the Commission for necessary action.

National Commission for Science, Technology and Innovation(NACOSTI),
Off Waiyaki Way, Upper Kabete,
P. O. Box 30623 - 00100 Nairobi, KENYA
Telephone: 020 4007000, 0713788787, 0735404245
E-mail: dg@nacosti.go.ke
Website: www.nacosti.go.ke

**Appendix III: Permission from the County to carryout Research**



# REPUBLIC OF KENYA

Mobile: 0738727272/0735232323
E-mail: info@nyamira.go.ke
Website: http://www.nyamira.go.ke

P.O BOX 434 – 40500
NYAMIRA

## COUNTY GOVERNMENT OF NYAMIRA
### OFFICE OF THE COUNTY SECRETARY

**Ref:** NCG/CS/TRAIN/20/VOL IV/122

**Date:** 26/09/2023

County Chief Officer
Livestock and Fisheries
Department of Agriculture, Livestock & Fisheries
**Nyamira County**

**RE: AUTHORITY TO CONDUCT RESEARCH – JOHN KIPLANGAT CHERUIYOT – REG. NO. A150/OL/NKU/26036/2019**

The above named is a M.Sc. student in the Kenyatta University. He has been authorized to conduct research on "***Status of Indigenous Chicken Production and Assessment of Local Feed Resources in Masaba North Sub-County, Nyamira County, Kenya.***"

The purpose of this letter is to request you to accord him necessary assistance.

COUNTY GOVERNMENT OF NYAMIRA
COUNTY SECRETARY
P.O Box 434-40500, NYAMIRA

Dr. Jack Magara, FADI
County Secretary and Head of County Public Service
**Nyamira County**

CC:

**County Executive Committee Member**
Agriculture, Livestock & Fisheries
**County Chief Officer**
Crops Production
**Nyamira County**

Mr. John Kiplangat Cheruiyot
Reg. No. A150/OL/NKU/26036/2019

**Appendix IV: Informed consent form**

Please read this consent document carefully before you decide to participate in this study. The researcher will answer any question before you sign this form.

**Study title**: status of indigenous chicken production and assessment of local feed resources in Masaba North Sub-county, Nyamira County, Kenya.

**Principal investigator:** John Kiplangat Cheruiyot (jcheruiyot10@gmail.com) +254723259044

**Purpose of the study:** before you decide to participate in this study.it is important you understand why the research is being done and what it will involve. The purpose of this study is to investigate the status of indigenous poultry production in Masaba North sub-county and generate baseline information on locally available feed resources, their nutrient content, usage and constraints as feed.

**Study procedures:** you are required to participate in focused group discussion with major poultry stakeholders in the sub county. The duration of this discussion is two hours only.

**Potential risk of participating**: you may decline to answer any or all questions and you may terminate your involvement at any time if you choose,

**Potential benefits of participating**: there will be no direct benefit to you for your participation in this study,

**Confidentiality**: all the information taken from the study will be coded to protect to protect each subjects name. No names or other identifying information will be used when discussing or reporting data. Your responses are completely anonymous

**Authorization:** By signing this form, you authorize the use and disclosure of the following information for this research**.**

**Voluntary participation:** your decision to participate in this study is complete voluntary. If you decide to take part in this study you will sign consent form.

**Withdrawal from the study**: If you decide to participate in this study, you may withdraw from your participation at any time without penalty.

**CONSENT**

I have read and understand the provided information and have had the opportunity to ask questions. I understand that my participation is voluntary and that I am free to withdraw any time, without giving a reason and without cost. I understand that I will be given a copy of this consent form. I voluntary agree to take part in this study.

**Participants signature _____Date_____**

**Investigators signature_____ Date_____**

**Appendix V: Study questionnaire**

STATUS OF INDIGENOUS CHICKEN PRODUCTION AND ASSESSMENT OF LOCAL FEED RESOURCES IN MASABA NORTH SUB-COUNTY, NYAMIRA COUNTY

My name is John Cheruiyot, student from Kenyatta University. I am interested in understanding status of indigenous chicken production in Masaba North Sub-county, challenges encountered and available feeds used to feed your chicken. For this study to be successful, I am requesting for your input by filling in this questionnaire. The information you will provide will be treated with confidentiality and will only be used for academic purposes.

The survey takes approximately 30 minutes

Consent (accepted or rejected) ……. Signature…….
Date…….

| | |
|---|---|
| Name of Village | |
| Name of Ward | |
| Name of interviewee | |
| Mobile contact | |
| Questionnaire no. | |
| Signature of interviewee | |
| Date of survey | |

Note: The answer of interviewee represented by tick ()

**Section A: Demographic details**

1. Age in years

| <20 | 20-30 | 31-40 | 41-50 | >50 |
|---|---|---|---|---|
| | | | | |

2. Sex: Male () Female () Intersex ( )

3. Number in your immediate Family

| <2 | 3 | 4 | 5 | >5 |
|---|---|---|---|---|
| | | | | |

4. Number of years involved in poultry production

| <2 | 2-5 | 6-10 | 10-20 | >20 |
|---|---|---|---|---|
| | | | | |

5. Education level

| No education | Primary | Secondary | Tertiary | Others |
|---|---|---|---|---|
| | | | | |

6. Years of schooling

| No | <5 | 5-10 | 10-15 | >15 |
|---|---|---|---|---|
| | | | | |

7. Do you have any special training? If yes from who, which institution or other body_____.

**Section B: Chicken production**

8. How many birds are kept in your farm per year?

| <30 | 40-55 | 56-70 | 71-85 | 86-100 |
|---|---|---|---|---|
| | | | | |

9. What is the current flock composition of your birds?

| Chicks | Cockerels | Pullets | Hen | Cock |
|---|---|---|---|---|
| | | | | |

10. How many different age groups of birds do you have?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| | | | | |

11. Which production system do you practice in your farm?

| Intensive | Extensive | Semi intensive |
|---|---|---|
| | | |

**Section C: Breeds and their sources**

12. What breeds/ strains do you have in the farm?

| Indigenous | Improved Indigenous | Exotic layers | Broilers | Others |
|---|---|---|---|---|
| | | | | |

13. Where do you purchase your birds?

| Own hatching | Local agents | Poultry farms | Others(name) |
|---|---|---|---|
| | | | |

**Section D: Management systems**

14. What type of housing do you use?

| Deep litter | Slatted/raised | Battery/cage | Traditional | Other(name) |
|---|---|---|---|---|
| | | | | |

15. What source of lighting/heating do you use?

| No | Kerosene | Solar | Electricity | Other(name) |
|---|---|---|---|---|
| | | | | |

16. Source of water for your birds?

| Borehole | Tap water | River | Rain water |
|---|---|---|---|
| | | | |

17. Source of feed for birds?

| Scavenging | Scavenging and supplementation local feeds | Scavenging and supplementing commercial feed | Local feeds | Commercial feeds |
|---|---|---|---|---|
| | | | | |

18. What are potential available feed resources in your place? Name then in order of priority.

_____

_____

_____

19. What are factors that limit use of available feed resources?

_____
_____
_____

20. Do you provide any vitamin or mineral supplements to your birds?

Yes ( ) No ( )

If yes, which ones_____

And from which source? _____

21. Where do you purchase your chicken feeds?

| Agro vets | Home made | Local markets | Local agents | Other{name) |
|---|---|---|---|---|
| | | | | |

22. How many kg of feed do you give per flock per day?

| <5 | 5-10 | 10-50 | 50-100 | >100 |
|---|---|---|---|---|
| | | | | |

23. How many birds die per year?

| <5 | 10-30 | 30-60 | 60-100 | <100 |
|---|---|---|---|---|
| | | | | |

24. Which age group is affected?

| Chicks(0-9 weeks) | Growers(10-20weeks) | Adults(>20 weeks) |
|---|---|---|
| | | |

25. Which months of the year do you experience high number of deaths?

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |

**Section E: Labor**

26. What percentage of labor is provided by family?

Family_____

Employed_____

29. What percentage of family labor is provided by?

Women_____

Children_____

**Section F: Disease control, constraints and opportunities of production**

30. What diseases are common in your farm? If any list them in order of priority.

_____
_____
_____
_____

31. Where do you purchase your drugs and vaccines?

| Agro vets | Private veterinarian | Public veterinarian | local market | Other(name) |
|---|---|---|---|---|
| | | | | |

32. Do you have any constraints in indigenous poultry farming _____?

Yes_____ No_____

If yes, name them in order of priority _____

33. In your opinion what can it be done to improve indigenous chicken productivity? List them in order of priority.

_____
_____
_____
_____

**Section G: Production parameters**

34. How many eggs are produced in your farm?

Per day_____ per month_____ per clutch_____

35. Which month of the year do you get maximum egg production?

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |

36. Which month of the year do you get minimum egg production?

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |

**Section H: Sales and marketing**

37. How many eggs are sold per month_____?

38. Where do you sell your products?

| Village | Retailers | Local market | Large towns | Others(name) |
|---|---|---|---|---|
| | | | | |

**Section I: Income**

39. How much do you sell?

An egg_____ hen_____

Cock_____ poultry manure _____

**Section J: cost of production**

40. Total costs per flock of the following:

Feeds_____ Wages _____ vaccines and medication _____

Water _____ Egg trays_____ Electricity_____

Birds_____

**Section K: Extension services**

41. What kind of extension workers provide services to you?

| No | Villagers | County | Ngo's | Private |
|---|---|---|---|---|
| | | | | |

42. How effective are service provided by extension workers?

| Poor | Fair | Good | Excellent |
|---|---|---|---|
| | | | |

**Appendix VI: Checklist for group discussions with service providers, traders and key informants**

1. Who are the dominant actors in poultry value chain?
_____-

2. What are the major constraints faced most in your poultry production and marketing?
_____

3. Do you face any challenges as extension workers if any suggest how to address the problem? _____

4. What are the numbers of private extension providers in your area?
_____

5. Do you have any credit services (specify)? _____

6. What number of the farmers who have received credit for poultry farming?
_____

7. What are the number of non- governmental organization (NGOs) and projects in your area dealing with poultry production (specify)?
_____

8. What are the proportion of farmers adopting various technologies (TIMPS) in poultry farming?

9. What are the number of markets for indigenous poultry products?
_____

10. What are the number of farmer producer organizations/Community based organizations (CBOs) in your area? _____

11. What are the potential local feed resources for indigenous chicken in your area?
_____ .