PHENOTYPIC CHARACTERISTICS OF INDIGENOUS CHICKEN IN OYE, IKOLE AND EKITI EAST LOCAL GOVERNMENT AREAS OF EKITI STATE

By

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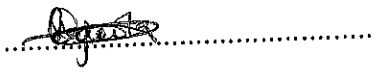
DECLARATION

I, **OYEBANJI ESTHER ADEOLA**, hereby declare that this project is my own original work done within the period of April to October and it has neither been submitted before nor being currently submitted in any other institution. All citations and sources of information have been clearly acknowledged by means of references.



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25/03/2019

Date

CERTIFICATION

This is to attest and certify this project under the topic "phenotypic characteristics of indigenous chicken in Ikole, Ekiti East and Oye local government areas of Ekiti state'' to have met the requirement of a final year student project and the Federal Government Institutional principles and regulations guiding the Award of Bachelor Of Agriculture (B. Agric) degree in Federal University Oye-Ekiti and approved to have contributed to knowledge and has given relevant information as regard the topic in view.

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DEDICATION

This report is dedicated to the most glorious God, most blessed, helper, strengthener and author and finisher of knowledge for granting me grace to finish this project.

I would also like to dedicate this report to my parents Mr and Mrs Oyebanji and my siblings (Damilare, Timileyin and Ikeoluwa Oyebanji) for their love, support and encouragement during the course of this project.

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ABSTRACT

The phenotypic characteristics of local chickens were studied in three local government areas of ekiti state, Nigeria (Ikole, Ekiti East and Oye local government). One hundred and eighty (180) captive adult birds (normal feathering female and male, frizzled local chicken were scored and measured for phenotypic characteristics (variation in plumage and shank colour, and eye colour, shank length, body length, body weight, beak length, comb height, comb type, clutch size, chest length, comb length and sex.

Seven plumage colour types (brown, white, white/black/brown, black, white\black, brown/black and white/brown) were observed. The predominant plumage colour across the three local government areas is white/black/brown (20%, 26.7%, 28.3%). The least dominant plumage colour across the three local government is white/brown. Four eye colour were observed orange, yellow, red and brown. The orange eye colour is the most common eye colour across the three local government areas (46.67%, 60%, 55%). The single and the rose comb type were observed across the study area. The commonest comb type was single. The normal feather type is more dominant across the three local government areas (80%, 78.33%, 86.44%). Whereas, the frizzled feather chicken is less dominant across the study areas. Four shank colour were observed in the three study areas (cream, yellow, brown and black). Across the study areas the yellow colour shank is most dominant (54.24%, 65%, 61.67%) whereas the brown colour is less dominant. There were no significant differences ($P > 0.05$) across the local governments for body weight, shank length, comb length, chest length and comb height. The beak length and the body length were significant ($P < 0.001$). The body weight ranged from 1.06 – 1.08 kg. Oye and Ekiti east local government had the highest ($P > 0.05$) similar value 1.08 kg while Ikole local government had the least value (1.07 kg). The shank length varied from 13.69 – 13.71 cm). The comb length

ranged from 4.56 – 5.15 cm. Ikole local government had the highest similar value ($P > 0.05$) 5.15 cm. The beak length ranged from 2.36 – 2.67 cm. The body length varied from 38.55- 43.50 cm. The chest length varied from 13.63 – 14.14 cm. The comb height ranged from 2.14- 2.51 cm. The magnitude of the value of the parameters between shank length and comb height, between shank length and comb height, between shank length and body length, between comb height and comb length and between comb height and body length were positive and significant ($P < 0.001$). There was also positive and significant relationship between comb height and body weight and between clutch size and body weight ($r = 0.34292, 0.36718$). Between shank length and beak length, between shank length and body weight, between comb height and beak length and between beak length and body weight there was positive and significant ($P<0.05$). The correlation between shank colour and clutch size, between comb length and clutch size and between beak length were negative.

Keywords : phenotypic characteristics, chickens, plumage colour, body weight, body length, shank length, beak length, comb height,correlation.

Word count : 480

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

The local or indigenous chicken strains are a general term given to animals or birds kept in the wide-ranging or scavenging in the free-range. They are multipurpose unimproved birds with no identified description (Mengesha, 2012). Farmers in Africa gave these chicken names like; family chickens, bush chickens or African hen (Gueye, 2009). Local chickens are mostly in each household and every culture owned them. Besbes *et al.* (2012) reported that family chickens are produced by families to get food, income and employment. Local chickens contribute significantly to the livelihood of the rural farmers by providing them with high-quality animal protein in the form of eggs and meat for family consumption (Molla, 2010), ease poverty and provide their owners with income and nutritional benefits (Reta, 2009).

Most farmers keep local chickens including the poor, women, and children. They require little care and adapt well to rural conditions than exotic chickens (Gueye,2010). Unlike pigs, local chickens have few taboos attached to them (MeyerRochow, 2009), and occasionally they have kept importance in religious and cultural rights (Isidahomen *et al.,* 2012). Consumers prefer local chicken meat because of their better texture and strong flavour than those of commercial chickens (Sow and Gronget 2010).

The Nigerian local chicken otherwise called the native or village chicken are widely distributed in the rural areas of the country where they are kept by the natives principally as a source of protein and income. These native chickens play major roles not only in rural economies but also contribute substantially to the gross national income (Momoh *et al.,* 2007). They appear to be generally heterogeneous with no specific colour pattern and non–descriptive both in phenotype and genotype. The native chickens constitute about 80 percent of the 120 million poultry birds.

They are known for their adaptation superiority in terms of their resistance to endemic diseases and other high environmental conditions (Nwakpu *et al.,* 2009). One way of overcoming challenges posed by past strategies in improving sustainable productivity is through genetic selection and development of sustainable indigenous parent stock (Nwakpu *et al.,* 2009). Among the major genes of interest that can be considered for this purpose is the naked neck.

The naked neck gene is incompletely dominant with Na/na birds showing an isolated tuft of feathers on the ventral side of the neck above the crop, while Na/Na birds either lack this tuft or it is reduced to just a few pin feathers or small feathers. The resulting bare skin becomes reddish, particularly in males as they approach sexual maturity (Somes, 1990). The reduction in feather coverage in naked neck birds permits convectional heat loss from the animal surface, thereby leading to improved thermo-regulation under the prevailing conditions. Mohammed *et al.* (2005) reported the superiority of bare-necked indigenous chickens over two other Sudanese local fowls in terms of live weight. Similarly, Merat (1990) reported that in high temperatures near 30°C or higher, naked neck birds had a better laying rate, mean egg weight, egg shell strength and carcass yield than normal feathered birds. In many developing countries, the local gene pool still provides the basis sector.

The genetic resource base of the indigenous chickens could form the basis for genetic improvement and diversification to produce breeds adapted to local conditions. However, there is paucity of information about existing or potential levels of productivity and production characteristics of indigenous chickens managed under extensive systems (Hoffman, 2005). In Nigeria, previous characterization attempts on indigenous chickens with major genes have been concentrated on on-station performance at the expense of on-farm testing. In Nigeria, indigenous chickens were characterized along genetic lines of feathers and plumage colour (such as normal

or frizzed feathered), body structure (such as naked neck, dwarf types and colour variants (such as black, white, brown, mottled etc).

1.2 Problem statement

The indigenous breed represents a huge reservoir of chicken genome. Their continued use in low input small scale village production serves as cheap in-situ conservation techniques that need to be encouraged and supported (Olori, 2009). Several studies reported that local chickens contribute significantly to food security and poverty alleviation. However, such studies also found the cost of producing these chickens to be low, because they feed by scavenging (Okeno *et al.*, 2012). Other studies show that local chickens need little space for rearing (Gueye, 2009). Furthermore, most social groups including landless families keep local chickens (Deshingkar *et al.*, 2008). The frizzling and the naked genes in particular had been described as adaptability gesnes acting as sex maker and disease resistant factor (Islam and Nishibori, 2009). In Ekiti state however, there is lack of information on local chicken production, production performances and breeds that produce more eggs and meat hence the study.

1.3 Statement of the research (Justification)

The indigenous breeds represents a huge reservoir of chicken genome. Their continued use in low input small scale village production serves as cheap in-situ conservation techniques that need to be encouraged and supported(Olori,2009).

The frizzling and the naked genes in particular have been described as adaptability genes acting as sex maker and disease resistant factor (Islam and Nishibori, 2009)

Indigenous chicken needs to be maintained for the purpose of conserving the wide gene pool they represent into the future.

1.4 Research questions

What are the phenotypic characteristics, productivity, and contribution of local chickens to household and breeding in Ekiti state (Ikole, Omuo and Oye local government areas)?

1.5 Hypothesis

The hypothesis tested:

i) The management methods do not influence the productivity of the local chickens and their contribution to household in Ekiti state.

ii) There are no different phenotypic characteristics on local chickens and their productivity of identified phenotypic characteristics in Ekiti state.

1.7 Aims and objectives

The study aimed at determining the phenotypic characteristics, productivity, and contribution of local chickens to households in three local government areas of Ekiti state.

1.7.1 Objectives of the study include;

i) to identify the physical characteristics of local chickens and determine the productivity of identified phenotypic characteristics in Ekiti state;

ii) to aid the selection and genetic improvement of indigenous chicken in Ekiti state.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 History and Distribution of Indigenous chickens

The domestic chicken (*Gallus gallus,* 2n = 78) is believed to have descended from the wild Indian and Southeast Asian red jungle fowl. The evolutionary history of the domestic fowl can be divided into three phases. The first phase started with the evolution of the genus *Gallus*, followed by the emergence of the domestic fowl from its progenitors and lastly the appearance of the large number of the current breeds, varieties, strains and lines. The domestication of fowl in the region of the Indus valley is believed to have occurred by 2000 BC.

History and spread of chickens across the African continent is a subject of debate and speculation among researchers (Hassaballah *et al.* 2015). Several authors in developing countries documented the origin of domestic chickens but their introduction into the African is unknown (Dueppen, 2011). However, Mwacharo *et al.*(2011) reported that terrestrial and maritime introduction likely brought chickens to Africa. According to Mtileni *et al.* (2011) chickens in Africa existed since thousands of years ago. Further, keeping chickens as domestic animals in South Africa probably came from traders on the way to India and European settlers in the early 15^{th} and 16^{th} centuries.

Local chickens varied especially in morphological characteristics (Dana *et al.* 2010). The Nigerian local chicken is perhaps the most diversified of all the species of indigenous livestock in Nigeria. Their body size, plumage color, feather characteristics and distribution are not uniform but highly variable with small body sized being largely unimproved (Dana *et al.* 2010). According to Eshiett (1990) evidence from earlier studies by Hill (1954) showed that many varieties of indigenous fowls are located within the humid tropical environment with some

unique characteristics. However the various types have not been adequately identified and characterized to highlight their peculiarities and potentials (Odubote, 1994).

Indigenous chickens are major poultry species used in the rural areas and their population vary from one country to another. Their distributions outnumber that of other livestock specie (Gueye, 2010). Kanginakuduru *et al.* (2008) reported that local chickens represented about 98 % of the total number of poultry kept in Africa despite most rural farmers keep chickens. Sonaiya (2009) reported that rural farmers often regard local chickens as secondary to other livestock and crop farming. Fisseha *et al.* (2010) found an average flock size of 13 chickens per household in Bure district, north-west Ethiopia. Samson and Endalew (2010) reported that central highlands of Ethiopia and in the south coast of Kenya sixteen birds per household. They further stressed that majority of farmers keep chickens when there is plenty of feeds and few predators. Results of the study done by the same authors further revealed that flock sizes per household varied between seasons mainly because of, diseases, and predators.

2.2 Characteristics of indigenous chickens

The most important characteristic of local chickens is their potential to produce meat and eggs (dual-purpose) for human consumption. Most indigenous(local) chickens are in rural areas, have good maternal qualities, high survival rate and hardier than exotic breeds (Kingori *et al.* 2010). Although they grow slowly, they have the potential to grow fast if farmers select chickens with such characteristic for breeding (Mengesha, 2012b). Lyimo *et al.* (2014) identified that variation in the growth and productivity of local chickens may be due to variation in gene possession. However, Apuno *et al.* (2011) reported that some differences in appearance of local chickens may be due to the major gene marker, which increased adaptability of these breeds to tropical environments. They further explained that, large comb allows efficient heat control, while frizzled and naked necked allow better heat dissipation.

According to Okeno *et al.* (2012) local chickens need little care and adapt well to rural condition. It is these reasons that farmers with little or no income can also keep local chickens because they feed by scavenging from the surrounding. The method of producing local chickens is still primitive and suffers setback such as poor housing, poor feeds and feeding systems, disease outbreaks and predators (Blackie, 2014). Dorji *et al.* (2011) stressed that production performances of local chickens is low because of inadequate feeding and the harsh environmental conditions in which they exist. However, Olwande *et al.* (2010) reported that local chickens are broody, able to take care of their young ones.

Findings of Faruque *et al.* (2010) showed that variations in local chicken appearance exist in features like; plumage colour, comb types, shank colour and feathers on shanks. According to Yakubu (2009) one chicken can have multi-coloured plumage and shank feathers at the same time. The complexity in nature of the local chickens, have made it difficult for several researchers to describe them (Faruque *et al.* 2010). However, Egahi *et al.* (2010) reported that local chickens' gene possession is responsible for the differences in appearances.

2.3 Importance of local chickens

Finding from literatures and other presentations gave enough evidence to support the impact of local chickens in the livelihood of rural communities in nutrition, health status, income and socio-cultural. Gabanokgosi *et al.* (2013) and Melesse, (2010) described local chickens as valuable in rural areas because they fulfil major roles and benefits in the livelihood of rural families. Okeno *et al.* (2012) described local chickens as an investment to the welfare of women and children in the tropics. However, Conan *et al.* (2012) reported that the main objectives of keeping poultry are production of eggs for hatching, sale, home consumption, and sacrifice for healing ceremonies.

Kingori *et al.* (2010) described local chickens as efficient converters of leftover grains as well as insects into valuable protein, for example meat and eggs. Since the local chickens scavenge in crop fields, Gueye (2009) suggested that farmers might use local chickens to control weeds and insects. Moreki, (2012b) suggested that farmers might also use local chicken faeces as fertilizer for vegetable gardens and crop fields.

Chowdhury *et al.* (2013) reported that consumers prefer local chicken meat because of their texture and strong flavour. Aila *et al.* (2012) also reported that local chicken meat contains low fats than commercial chickens, because their diet consist of kitchen leftovers, worms, insects, green leaves and other plant materials. Local chicken meat contains lower fat and muscle weight than commercial chickens because they use energy to find food (Sow and Grongnet, 2010). Dyubele *et al.* (2010) contended that despite commercial chickens have high muscle weight, their meat contains high fats, which can be a risk for diseases like heart diseases and diabetes in humans.

Moreki *et al.*(2010), reported that consumers also recognised the low price, the typically convenient portions and the lack of religious limits for the consumption of local chickens. Sanka

and Mbaga, (2014) also reported that local chicken is superior to exotic chickens in protein content and high in water retention but low in fat content. They also assumed that meat from local chickens has some unique features and have more advantages over commercial chickens, especially when determined for niche market-serving consumers who prefer chewy, low-fat meat. Sow and Grongnet, (2010) pointed out that poultry meat and eggs accounted for more than 30% of the animal protein consumed throughout the world, and the rate is increasingly steadily.

Local chickens play major role in various religious and socio-cultural of many African people. Sonaiya (2009) reported the use of red cocks to seek for rain and good harvest, white cocks for thanksgiving and black cocks to keep away bad luck, diseases, war, and quarrel. Similarly, Yakubu (2009) reported the use of frizzled and naked neck for rituals and sacrifices in Nigeria. Meisert *et al.* (2011) reported the use of chickens as banquets, the use of cocks as alarm clocks, and the use of cocks as offerings to deities.

2.4 Productivity of local chickens

Local chickens have small body size, late maturing, small egg sizes, and clutch sizes Fisseha *et al.* (2010). Addisu *et al.* (2013) reported that local chickens grow slowly and reach sexual maturity late and this influences production performance. Magothe *et al.* (2012) showed that a hen would lay 36 eggs a year in 3 cycles of 12 to 13 eggs. Each cycle lasted for about 16 days. They further explained that hens spend 21 days brooding on eggs, 84 days rearing their young and 18 days recovering before another production cycle sets in. Thus each reproductive cycle would last 139 days, of which only about 16-days spent on laying eggs. The authors concluded from their findings that egg incubation and rearing of young is a load hampering production potentials of local hens.

Furthermore, Kgwatalala *et al.* (2013) reported that hatchability of 80 percent from natural incubation is normal, while 75 to 80 % is satisfactory. It is for this reasons, authors throughout the world described local chicken production performances as below standard than exotic breeds (Kingori *et al.* 2010).

According to Moreki (2014) hatchability by definition means percentages of eggs hatched, reported as several fertile eggs hatched or percentage of chicks hatched from all incubation. Dzoma, (2010) listed egg weight, humidity, shell strength, and gene make up as reasons that influence hatchability. Alabi *et al.* (2012) reported 1.02 kg body weight in male and 1.00 kg females at five months of age. Findings from Mengesha, (2012b) showed that local chickens produce small eggs, with thick shell and a deep yellow yolk. Fisseha *et al.* (2010) stressed that productivity of local chickens are related to poor feeding and poor housing. Wilson (2010) reported an average annual egg production of about thirty–four eggs per hen, with an average egg weight of 38 grams in Ethiopia. When comparing local chickens to exotic breeds they lay few numbers of eggs, which weighed about 43 grams (Kingori *et al.* 2010). Findings of Isidahomen *et al.* (2013) found that commercial poultry breeds can produce up to 300 eggs per year with an average weight of 63 to 65 grams. Table 2.1 below shows variations in egg production by local chickens in some African countries.

Isidahomen *et al.* (2013) reported that local chickens produce four clutches per hen per year with up to ten eggs per clutch. Blackie (2014) reported that poor feeding, diseases and lack of proper housing as causes of few eggs production by local chickens. Farmers mostly use all the eggs for incubation and eat a few (Lambio *et al.* 2010). Studies from Olwande *et al.* (2010) showed that predators (dogs eating eggs) and parasites are some of the reasons for poor hatching in most rural areas. Similarly, Addisu *et al.* (2013) and Kingori *et al.* (2010) stressed that lack of housing subjects newly hatched chickens to the unfavourable results of weather (torrential rain)

and predators. Ajuyah (2013) reported that about 40 to 60 % of young chickens die during the first 8 weeks of age, mainly because of disease and predator attack.

Table 2.1: Number of eggs local chickens produce in some African countries

Country	Number of eggs per hen per year	Source
Ethiopia	Less than 80	Fisseha *et al.* (2010)
Nigeria	30 to 128	Yakubu (2009)
Mali	20 to 100	Gueye (2009)
Botswana	30 to 150	Kgwatalala *et al.*(2013)

2.5 Chicken ownership and management

A study carried out by Mlambo *et al.* (2011) revealed that among poultry species, chickens are the most common species in many rural areas. Kingori *et al.* (2010) reported that women and children in some African countries owned 80 % of local chickens in rural areas. However, Abubakar *et al.* (2007) noted that in Nigeria the whole family own chickens, with women owning majority of chickens, followed by the children and men last. They further stressed that in Borno state of Nigeria men own majority of chickens, followed by women and children. Olwande *et al.* (2010) reported that feeding, cleaning of chicken houses and treatment of sick chickens is the duty of women, while building chicken houses is a duty of men.

2.6 Rearing methods for local chickens

Mlambo *et al.* (2011) reported that in developing countries the most common rearing methods for local chicken are free-range and backyard. Magothe *et al.* (2012) stressed that chickens in free-range are not in confinement, but scavenges for food over a wide area. In addition, chickens sleep in simple houses within the house of the farmer but may roost on trees and nest in bushes. Kingori *et al.* (2010) reported that in backyard rearing method, chickens sleep in houses at night and scavenges during the day. However, they may get grains in the morning and evening to add extra feeds to scavenging. According to Mlambo *et al.* (2011), full confinement rearing method is not common in rural area; however, in urban and villages close to cities most farmers use it in rearing specialised breeds. A study carried out by Fentie *et al.* (2013) and Yakubu (2009) described local chickens as able to survive in a rural environment, scavenge-able feeds are difficult to find. Ajuyah, (2013) pointed out that in free-range local chickens spend most of the daytime scratching the ground in a search for food.

2.7 Feeds and feeding

The major feed sources of local chickens are earthworms, insects, seeds, green leaves and other plant materials in the household yard. Gunaratne, (2013) pointed out that scavenge-able feed does not contain enough nutrients needed by local chickens. Scavenge-able feed contain little protein and vitamins Hailemariam *et al.* (2009). Also, lack of protein and vitamins make chickens weak and vulnerable to predators. However, Olwande *et al.* (2010) reported that chickens become vulnerable to predators and susceptible to diseases because of feed shortage and a lack of proper nutrition. According to Ravindran (2013), nutrients that local chickens obtained from scavenge-able feeds are depending on foraging habits, which varied with chicken breeds. Furthermore, foraging habits of young chickens varied with that of old chickens, because they cannot compete with old and aggressive chickens for feed available from scavenging.

However, according to Mutayoba *et al.* (2011) in developing countries scavenge-able feeds varies with seasons and districts. In addition, in dry season, local chickens do not get enough protein because of a lack of freshly leaves and stems in the range

Chowdhury (2013) reported that scavenge-able feed mainly consists of household leftover, green materials, insects, earthworms, crop residues, grass shoots, and fruits. Momoh *et al.* (2010) reported that household leftover form a major part of the total diet of local chickens. In addition, household leftover ranged from 69 % in the rainy season to 90 % in the dry season. Goromela *et al.* (2008) however, reported that only a small part of 10 % to 31 % of the diet in dry season and rainy season come from scavenging in the environment. Hailemariam *et al.* (2009) reported that more than 70 % of local chickens' feed intake was household leftovers.

Ajuyah (2013) reported that, generally feed intake for local chickens consists of cooked rice (27 %), coconut leftovers (30 %), broken rice (8 %), and other scraps (36 %). The rest was from the environment (13 % grass shoots, 8 % small animals and 7 % rice kernels). However,

Mutayoba *et al.* (2011) pointed out that scavenge able feed contained 8.8 g of crude protein and 2864 calories of energy. Furthermore, they stated that 8.8 g is below the estimated 11 g of protein needed by each chicken each day to meet maintenance needs in the tropics. Study carried out by Hailemariam, *et al.* (2009) showed that scavenged feed for each household flock per day was 550 g of dry weight.

Mutayoba *et al.* (2011) reported that seasons, breeds, social habits and life cycle of insects and other invertebrates influences the quality and quantity of scavenge-able feeds and highlighted the importance of supplementary feeds in seasons where scavenge-able feeds are hard to find. According to Ravindran (2013), chickens hardly get extra feeds in developing countries. In addition, if they do, it is small amounts of grains thrown on the ground. Similarly, Mapiye *et al.* (2008) reported that rural farmers offer extra feeds in the form of kitchen leftovers and small amounts of grains. Mostly in Nigeria other extra feeds are small amounts of cereals, which include millets, sorghum and maize (Kyule *et al.*, 2014). According to Gunaratne (2013) some farmers give, extra feeds to their chickens in the morning or in the afternoon and others give two times a day.

2.8 Diseases in local chickens

Disease is a condition that hinders normal body roles (Permin and Bisgaard, 2013). Diseases do result from a combination of indirect and direct causes. Indirect causes are those conditions that influence resistance and direct causes are those that produce diseases (Mesert *et al.*, 2011). Reports from Adebayo *et al.* (2013) showed that disease outbreak is one of the constraints to poultry production in developing countries. According to Simainga *et al.* (2010), the impact of disease on poultry industry has both monetary and gene fault losses. Furthermore, they explained that monetary losses are direct result of deaths, medicine costs, veterinary service costs, and low production. At village level, contacts between flocks of different households,

exchange of chickens as gifts or even entrusting sales and buying are the main sources of disease transmission (Alders and Pym, 2009).

Njagi *et al.* (2010) noted that local chickens have low resistance to diseases such as Newcastle, fowl pox and coccidiosis. Permin and Bisgaard (2013) pointed out that coccidiosis is caused by parasites which live on the ground. Coccidiosis occurs mainly in winter while good management can prevent coccidiosis. A study by Adebayo *et al.* (2013) revealed that local chickens are susceptible to diseases such as infectious bursal disease than commercial chickens. According to the author, infectious bursal disease is a contagious disease of young chickens, causing deaths at 3 to 6 weeks of age. Other diseases reported include Newcastle, typhoid, diarrhoea, and coryza (Alders and Pym, 2009). Simainga *et al.* (2010), described Newcastle as contagious. They further explained that, Newcastle would infect all chickens in a flock within three to four days.

Bell (2009) reported that when Newcastle appears it would often kill almost all the flock sat ones. According to Permin and Bisgaard (2013) a virus that causes Newcastle is disastrous than other disease causing organisms. Newcastle disease is disastrous in chickens than other avian species. Mapiye *et al.* (2008) reported that Newcastle disease do spread by direct contact (between healthy and infected chickens) and by contaminated shoes, clothing, and syringes. It is, further explained that the course of the disease varies according to the virulence of the strain involved, age of chicken and immune status as well as the general well-being of a particular chicken.

According to Simainga *et al.* (2010) mortality caused by Newcastle disease ranged from 50 to 100 % in some African countries. Newcastle disease has no treatment; however, vaccination and hygiene can prevent the disease (Njagi *et al.* 2010). Simainga *et al.* (2010), identified greenish diarrhea, sudden death, nervous signs such as tremors, convulsions, and

paralysis of legs and wings as clinical signs for Newcastle disease. However, Permin and Bisgaard (2013) identified wet nasal, coughing, swollen heads, sneezing, decline in feed and water intake, nervous signs and diarrhea as signs of Newcastle disease.

Duangjinda *et al.* (2012) reported that avian influenza is a noticeable disease caused by a viral infection. According to Molla *et al.* (2015) the disease depends on the age of chickens, poultry species, characteristics of the viral strains involved and environmental conditions. Adebayo et al. (2013) reported that the most common symptoms include noisy breathing, coughing, watery eyes, swollen head, sharp cough, sneezing, and gasping. The authors further explained that rural areas regard sneezing and gasping as infectious bronchitis and bloody diarrhoea as coccidiosis.

2.9 Disease control

Moreki, (2013) reported that absence of disease control in many rural areas contribute to high mortality among local chickens. Vaccination with standard vaccines is not common in rural areas because many chicken farmers do not have income to buy such vaccines. As a result, most farmers in the rural areas use herbs.

The Table 2.2 listed herbs rural farmers use to treat sick chickens in different countries in Africa. According to SriBalaji and Chakravarthi (2010) the limited use of modern or conventional vaccines in local chickens is a result of reasons like cost, dose format, and lack of thermo-stability. The dose format is difficult because of flock sizes, scattered, multi-aged and under slight condition, are expensive and produced in large dose units suitable only for large commercial flocks (Moreki, 2012a).

Moreki *et al.* (2010) reported that 95 % of the medical recipes used to treat infected chickens in the villages are from plants origin. Similarly, Lagu and Kayanja (2010) reported

many plant products that rural farmers believe to cure chicken diseases in developing countries. Simainga *et al.* (2011) referred to herbs used to cure disease as Ethno-veterinary medicine. Furthermore, Moreki (2013) defined Ethno-veterinary medicine as the use of local knowledge and methods for caring, healing, and managing livestock. Ethnoveterinary medicine, come from the guide of older people, which they pass on from one generation to another.

Masimba *et al.* (2011) reported that rural farmers in many developing countries regard Ethno-veterinary medicine suitable for preventing and curing various diseases of chickens. Yirga et al. (2012) reported that farmers use more than one plant products in preparing Ethno-veterinary medicines. Farmers do not measure the quantity of herbs, making it difficult to measure the impact of Ethnoveterinary medicine in preventing and curing diseases.

Table 2.2: Lists of herbs rural farmers use to treat sick chickens

Disease	Herbs	Application	Country and Sources
Eye infection	Leaves and roots	Fluid(Used as eye drops)	Botswana, Moreki, (2013)
	Leaves	Mashed and used as eye drops to open gummed up eye of young chicken	Zimbabwe, Masimba *et al.* (2011)
Sore eyes	Bulbs	Fluid(Use as eye drops)	Zimbabwe, Masimba *et al.* (2011)
Cough	Fruits	Soaked in drinking Water	Nigeria, Adebayo *et al.* (2013)

2.10 Mortality rates

According to Nathi *et al.* (2012) predators (fox, hawks, cats, and dogs), limited feed supply, low-level of management and diseases are the causes of mortality among local chickens. Fentie *et al.* (2013) reported that 55 % of mortality rate noted in their study was among young chickens. They further identified predators, diseases, external parasites, rains, and accidents as the main causes of deaths among chicks. Molla, (2010) reported high mortality of chicks in their early weeks of age. Kebede *et al.* (2012) observed that chicken mortality was a result of poor management, predators, and accidents. The 12 % of chicken losses noted in their study may be due to accidental stepping, crushed under objects, children beating and drowning.

Mapiye *et al.* (2008) reported that hawks, crows, dogs, rats, squirrels, eagles, and thieves as the main causes of chicken losses in rural areas. However, Ndathi *et al.* (2012) reported that heat stress are the main cause of chicken deaths in rural areas. He therefore, implore farmers to provide chickens with water regularly to prevent heat stress. Mutibvu *et al.* (2012) reported contacts between flocks, exchange of chickens as gifts, purchasing live chickens as sources of infection transmission.

Gunaratne, (2013) reported that lack of protein and vitamins weakened young chickens and made them vulnerable to diseases and predators that in turn led to high mortality rates. Mekonnen *et al.* (2010) observed a shortage of protein in scavenge-able feeds during short rain and dry season and identified lack of protein and vitamins as the main causes of chicken deaths in rural areas. Mekuria (2010) reported parasites as the main causes of free-range chicken deaths. The most common parasites noted in their study was lice, fleas and mites (feather and legs).

2.11 Housing for local chickens

Good housing is a precondition for any sustainable poultry project (Holt *et al.* 2011). In rural areas, housing occupied a low priority in managing poultry including chickens under free-range. According to Kingori *et al.* (2010) in modern poultry enterprises farmers built and design housing in consideration of chickens' welfare and efficiency of production. Although, there is little information on the monetary efficiency of traditional housing in Africa, reports by Mutibvu *et al.* (2012), revealed that farmers at rural level do not provide houses for chickens. Holt *et al.* (2011) identified three types of traditional poultry houses in Africa, namely saddle roofed, round thatched huts, boxes, and basket types.

However, chickens sometimes roost in family house, kitchen or on tree branches. According to Kebede *et al.* (2012) reported reasons for lack of housing in rural areas to include income of farmers, importance of housing to farmers and the purpose of production. Nathi *et al.* (2012) reported that where farmers provided housing to local chickens, they use local materials such as sugar cane stems, wood, mud bricks, cereal residues, and bamboo because they are readily available. However, according to Holt *et al.* (2011) proper housing must not only protect chickens from heat and cold but must provide enough ventilation for chickens to feed and sleep in comfort and security.

2.12 Marketing of local chickens

Marketing is not important to subsistence farmers because chicken keeping is a tradition. However, Dadheech and Vyas (2014) reported that farmers only sell chickens when they need money or barter their free-range chickens for food and household items. Molla (2010) reported that the greatest reason farmers sell their chickens is for income generation. Furthermore, farmers sell chickens at households within the villages, on roadsides, during entertainment

ceremonies and local and city markets. Yitbarek (2013) described the marketing channel for selling chickens as informal and poorly developed. Meanwhile, Mesert *et al.* (2011) reported that major channels through which farmers sell their chickens in the markets are direct selling to hawkers.

However, Kyule *et al.* (2014) pointed out that farmers have little knowledge on how marketing works and why price rise or falls and have almost no information on marketing conditions. Thus, most farmers sell chickens within the vicinity. According to Molla (2010), reasons for selling chickens in vicinity include; small number of chickens, long-distance to urban markets, and occasional selling of chickens (based on prevalent pressing needs of the family).

Yitbarek (2013) reported that consumer preference, high consumption during holy holidays, festivals, and disease outbreak as reasons for chicken prices falling dramatically because of high supply than demand. According to Aila *et al.* (2012) traders mostly use public transport (buses and minibuses) to transport chickens to urban markets. During transportation, farmers keep chickens with bags, and or binding their legs together can result in losses because of stressful conditions.

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 General Description of The Study Location

This survey was carried out at three local government areas of Ekiti State viz: Ikole local government, Oye local government and Ekiti East local government. Ekiti State is located at South Western part of Nigeria with coordinates 7^0 N and 5^015^0E. It was established in 1996 with its headquarters at Ado Ekiti

3.1.2 Brief Description of each Location

Ikole local government is one of the local government area in Ekiti state of Nigeria with its headquarters in Ikole town, it comprises of towns and villages. It is located between latitudes $7^047'0"$ N and longitudes $5^031'0"$ E with 321 km^2. Oye local government area has its headquarters in Oye Ekiti. It has an area of 507 km^2.It was carved out of Ekiti north local government in 1989. It lies between latitudes $7^053'21"$ N and longitudes $5^020'41"$E. Ekiti East local government area has its headquarters in Omuo Ekiti. It has an area of 1072 km^2. It is situated at $7^076'$ N and longitudes 5^072^0E.

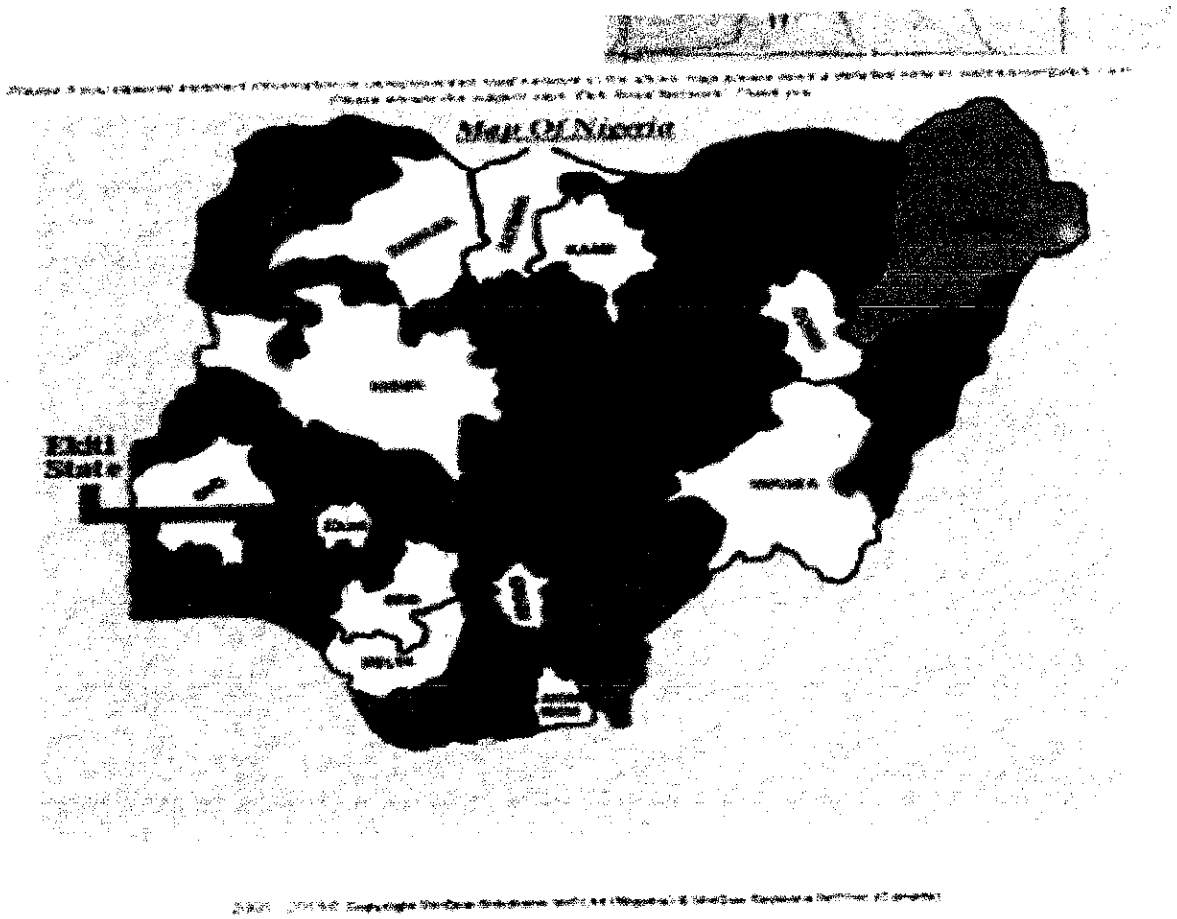

Fig 1: MAP OF NIGERIA

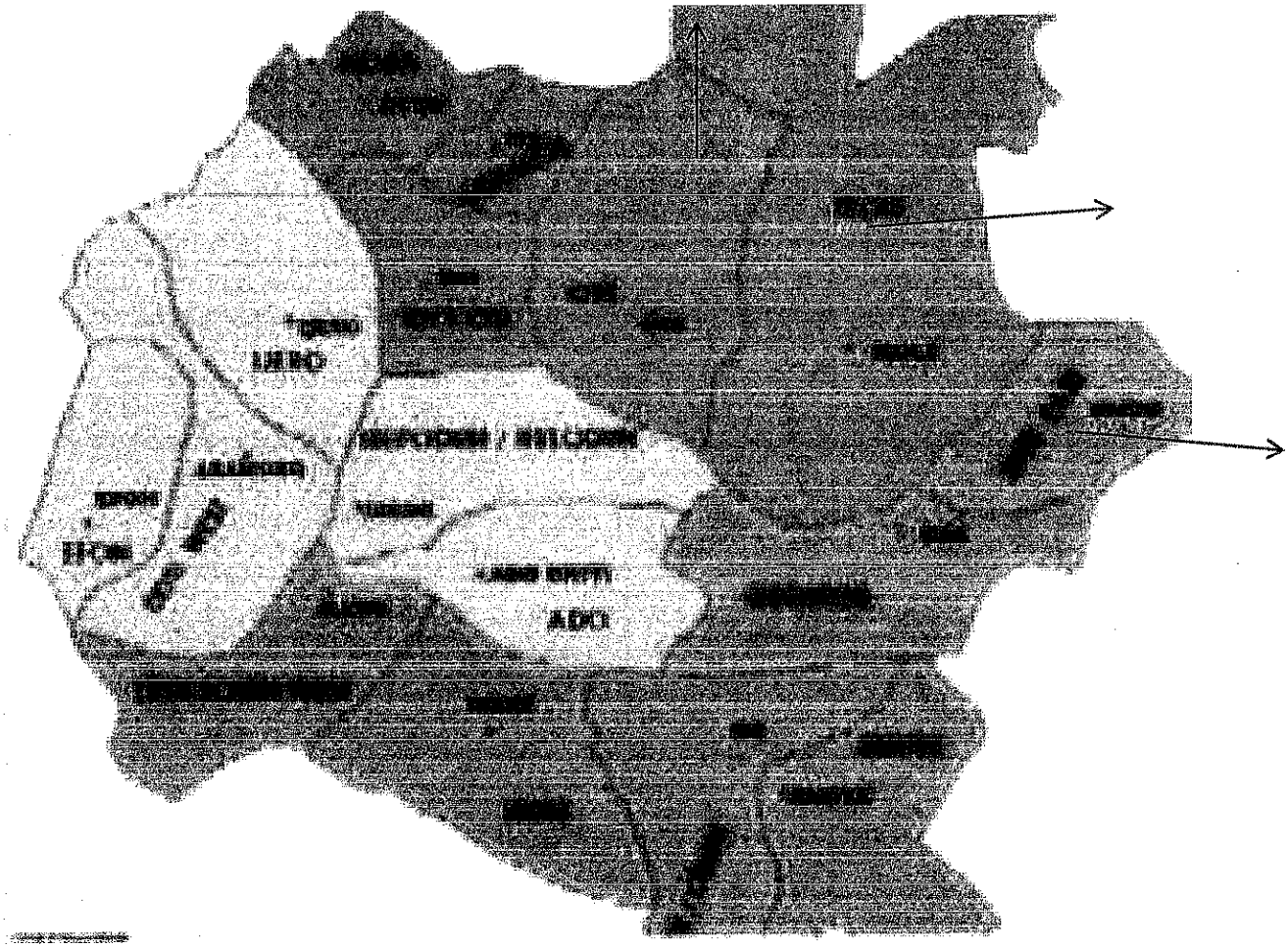

Fig 2: MAP OF EKITI STATE INDICATING THE LOCAL GOVERNMENT

3.2 ORIGIN OF THE STUDY ANIMALS

The indigenous chickens examined in the study areas were those brought by the village producers or middlemen and resell them in the markets. The markets were chosen because of the availability of high populations of local chickens at the place.

One hundred and eighty (180) indigenous chickens, comprising of 90 males and 90 females were randomly sampled from the study area. Animals were reared under extensive and semi intensive system fed with majorly kitchen waste with little feed supplementation from the owners and was partly sheltered in the night.

3.3 DATA COLLECTION

Data were obtained for body parameters such as plumage colour, eye colour, comb type, shank length, shank colour, body weight, body length, chest length, beak length, comb length, comb height and sex

The data were collected using dial spring weighing scale, tape rule, camera, ruler and GPS. Dial spring weighing balance was used to measure the live body weight of the chickens while simple tape rule and ruler was used to take body linear measurements.

- Data on qualitative traits (plumage colour, eye colour, shank colour) were taken by observation.
- The body weight was measured in kilograms on a top loading weighing scale (dial spring weighing scale).
- The body length was taking as the distance from the tip of the beak over the neck, through the body trunk to the tail.
- The body length, shank length, comb height, beak length, comb length and chest length were measured in centimeters using flexible measuring tape and ruler.

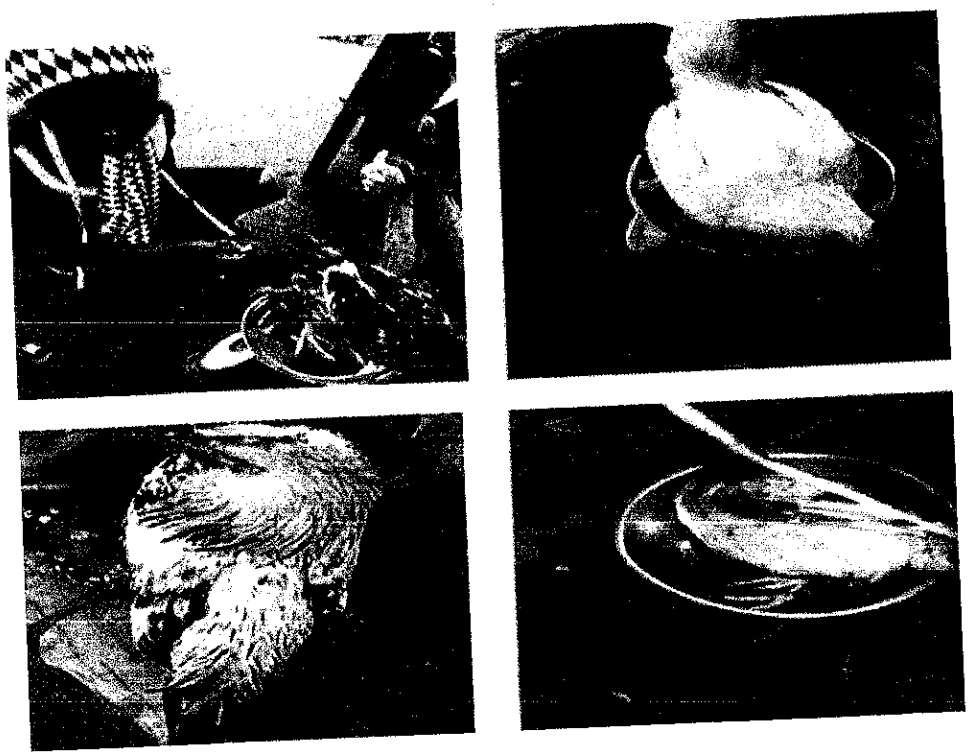

PLATE 1: Taking body measurements using a dial spring weighing scale.

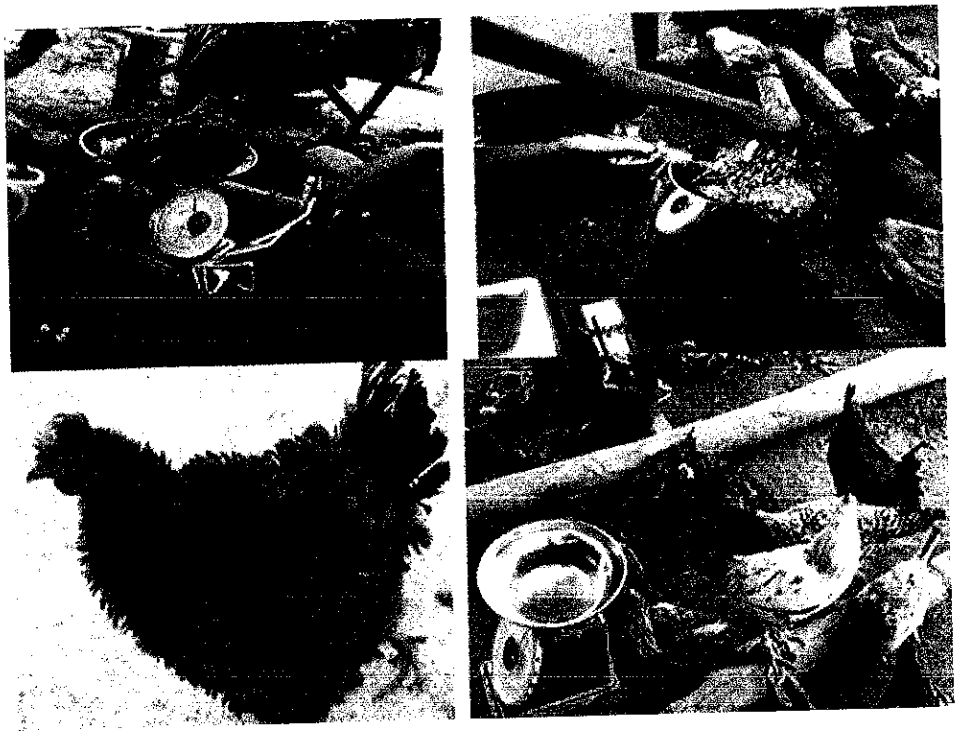

Plate 2: Top: Taking measurement from the dial spring weighing scale.

Below :Observing the qualitative traits of the birds

3.4 STATISTICAL ANALYSES

Data collected were subjected to simple descriptive analysis and subsequently analyzed using the Analysis of variance technique of SAS (2012). Differences in means were separated using Tukey's honestly significant test. Significance was declared at $P<0.05$.

CHAPTER FOUR

4.0 RESULTS

The variation of plumage colour is shown in Table 4.1. The predominant plumage colour across the three local government areas is white/black/brown (20%, 26.7%, 28.3%). Other colour variation include black (16.7%, 13.3%, 15%), brown (8.3%, 10%, 11.7%), brown/black (18%, 10%,10%), white (15%, 18.3%, 15%), white/black(16.7%, 10%, 8.3%), and white/brown(5%, 11.7%, 11.7%). The least dominant plumage colour across the three local governments is white/brown. Seven plumage colour types (brown, white, white/black/brown, black, white\black, brown/black and white/brown) were observed in the indigenous chicken population in the study area.

Table 4.2. Shows the variation of the head region characteristics (eye colour, and comb type). Four eye colour were observed orange, yellow, red and brown. The orange eye colour is the most common eye colour across the three local government areas (46.67%, 60%, 55%). Other eye colour include red (16.7%, 15%, 15%), yellow (45%, 20%, 25%) and the brown colour which is least dominant in the three areas (0%, 5%, 5%).

Across the three local government the most dominant comb type is single (90%, 78.3%, 76.7%) and is least common comb type is the rose with (10%, 21.7%, 23.3%).

The single and the rose comb type were observed across the study area. The normal feather type is more dominant across the three local government areas (80%, 78.33%, 86.44%). This indicates that most farmers in the study areas (Oye, Ikole, Ekiti east local government) keep the normal feathered type of chicken. Whereas, the frizzled feather chickens are less dominant across the study areas.

There were no significant differences ($P > 0.05$) across the local governments for body weight, shank length, comb length, chest length and comb height. The beak length and the body length were significant ($P < 0.001$).

Table 4.5 shows the mean phenotypic variants of quantitative body measurements across oye,ikole and ekiti east local government (mean ± SE). The mean of the beak length and the mean of the body length were significant at 1%. The body weight across the three local governments ranges from 1.06- 1.11 kg. There were no significant differences between the mean of body weight, shank length, comb length, body length, chest length and comb height.

Table 4.6 shows the correlation coefficients between body parameters. The magnitude of the value of the parameters between shank length and comb height ($r = 0.560011$), between shank length and comb height ($r = 0.034473$), between shank length and body length ($r = 0.40305$), between comb height and comb length ($r = 0.61522$) and between comb height and body length ($r = 0.54062$) were positive and significant ($P < 0.001$).

Table 4.7 and 4.8 shows the mean comparison between the local government areas and the morphological traits and mean comparison between sex and the morphological traits respectively.

Table 4.1: Plumage colour characteristics of indigenous chicken population of the study Areas

Parameters	Local Government					
Plumage colour	**Oye**		**Ikole**		**Ekiti East**	
	Frequency	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**Percentage**
Brown	5	8.33	6	10	7	11.67
White	9	15.00	11	18.33	9	15.00
White/blk/br	12	20.00	16	26.67	18	30.00
Black	10	16.67	8	13.33	8	13.33
White/black	10	16.67	6	10.00	5	8.33
Brown/black	11	18.33	6	10.00	6	10.00
White/brown	3	5.s00	7	11.67	7	11.67
Chi square Probability:	0.498					

blk: black, br: brown

Table 4.2: Morphological characteristics of eye colour and comb type of indigenous chicken population in the study area

Parameters	Local Government					
Eye colour	**Oye**		**Ikole**		**Ekiti East**	
	Frequency	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**Percentage**
Yellow	22	36.67	12	20.00	15	25.00
Orange	28	46.67	36	60.00	33	55.00
Red	10	16.67	9	15.00	9	15.00
Brown	0	0.00	3	5.00	3	5.00
Comb type						
Single	54	90.00	47	78.33	46	76.67
Rose	6	10.00	13	21.67	14	23.33

Chi square Probability for eye colour: 0.19

Chi square probability for comb type: 0.081

Table 4.3: Morphological characteristics of the sex and feather type of indigenous chicken population of the study area

Parameters	Local Government					
Sex	**Oye**		**Ikole**		**Ekiti East**	
	Frequency	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**Percentage**
Male	30	50.00	30	50.00	30	50.00
Female	30	50.00	30	50.00	30	50.00
Feather type						
Normal	48	80.00	47	78.33	51	86.44
Freezled	12	20.00	13	21.67	14	13.56

Chi square Probability for sex : 1.00

Chi square Probability for feather type : 0.163

Table 4.4: Morphological characteristics of shank colour of indigenous chicken population of the study area

Parameters	Local Government					
Shank colour	Oye		Ikole		Ekiti East	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Cream	14	27.73	0	0.00	3	5.00
Yellow	32	54.24	39	65.00	37	61.67
Brown	1	1.69	0	0.00	0	0.00
Black	12	20.00	21	35.00	20	33.00
Chi square Probability<0.001						

Table 4.5. Mean Phenotypic variants of quantitative body measurements across Oye,Ikole and Ekiti East local government (mean ± SE).

Parameters (cm)	Local Government			
	Oye	Ikole	Ekiti East	Pr(Value)
Body Weight (kg)	1.08 ± 0.03	1.06 ± 0.02	1.08 ± 0.03	0.922
Shank length	13.71 ± 0.17	13.86 ± 0.19	13.69 ± 0.19	0.773
Comb Length	4.56 ± 0.30	5.15 ± 0.27	5.12 ± 0.26	0.241
Beak length	2.36 ± 0.06^{b}	2.66 ± 0.04^{a}	2.67 ± 0.04^{a}	< 0.001
Body length	38.35 ± 0.49^{b}	43.50 ± 0.65^{b}	43.23 ± 0.64^{a}	< 0.001
Chest Length	13.63 ± 0.22	14.14 ± 0.24	14.03 ± 0.25	0.279
Comb Height	2.14 ± 0.17	2.49 ± 0.17	2.51 ± 0.16	0.212

Means bearing different superscript in a row differ significantly (P<0.05)

Table 4.6 : Correlations between body and egg parameters

Parameters	**Shanklength**	combheight	comblength	beaklength	bodylength	body_wgt
Shanklength	1.00000^{ns}					
combheight	0.56011***					
	<.0001					
Comblength	0.34473***	0.61522***				
	<.0001	<.0001				
beak_length	0.22615*	0.18936*	0.31107***			
	0.0023	0.0109	<.0001			
body length	0.40305***	0.54062***	0.44062***	0.08524^{ns}		
	<.0001	<.0001	<.0001			
Bodywgt	0.22251*	0.27727***	0.34292***	0.17206*	0.27016*	1.00000^{ns}
	0.0027	<.0001	<.0001	0.0209	0.0002	

***= correlation is significant @ 0.001 probability level

* = correlation is significant @ 0.05 probability level

ns = not significant

Table 4.7 : Mean Comparison between the Local Government Areas and the Different Morphological Traits

Local govt	Shank length	Comb height	Comb length	Beak length	Body length	Body weight	Chest length
Oye	13.67[a]	2.15[a]	4.52[a]	2.36[b]	38.23[b]	1.08[a]	13.62[a]
Ikole	13.86[a]	2.50[a]	5.15[a]	2.66[a]	43.50[a]	1.06[a]	14.14[a]
Ekiti east	13.66[a]	2.50[a]	5.10[a]	2.67[a]	43.11[a]	1.08[a]	14.06[a]

Means with the same letter are not significantly different ($P < 0.05$).

Table 4.8 : Mean Comparison between Sex and morphorlogical Traits

Sex	Shank length	Comb height	Comb length	Beak length	Body length	Body weight	Chest length
Male	14.335^{b}	2.937^{a}	5.875^{a}	2.532^{a}	43.147a	1.144^{a}	13.840^{a}
Female	13.140^{a}	1.842^{b}	3.990^{b}	2.490^{b}	40.177^{b}	0.993^{b}	14.038^{a}

Means with the same letter are not significantly different ($P < 0.05$).

CHAPTER FIVE

5.0 DISCUSSION

This result in Table 4.1 is in agreement with other authors (Odubote 1994; Ozoje *et* al., 1999; Adebambo *et al.*, 1999 and Duguma, 2006). Duguma (2006) reported very diverse plumage colouration in indigenous chickens of Ethiopia and he concluded that diversity in plumage colour is a feature for camouflaging, adaptability and survival. Odubote (1994) reported similar observation in Nigerian indigenous chickens that diverse plumage colour is an adaptability and survival feature. However, Nwosu, (1979) had earlier reported that wide variation in colouration is as a result of lack of conscious selection breeding programmes targeted at choice of colour in Nigeria native chickens. However, plumage colour heterogeneity is among the traits that characterize Nigeria native chickens and thus regarded as reservoir of gene pool for conscious selection and breeding programme for a desired trait.

In the current study, very diverse plumage colouration was observed among the local chickens of Oye, Ikole and Ekiti east local government area of Ekiti state . Nwosu *et al.* (1985) attributed this to the lack of selection of breeding programme directed towards choice of plumage colour.

Eye colour to a large extent depends on the pigmentation (carotenoid pigments and blood supply) of a number of structures within the eye (Crawford, 1990). Mancha (2004) and Guni and Katule (2013) reported orange eye colour as most common among the indigenous chickens of Nigeria and Tanzania, respectively. Similar findings were also reported by Ssewannyana et al. (2008) for Ugandan local chickens.

The commonest comb type was single. This observation agrees with the findings of Smith (2001) and Ikeobi *et al.* (2001) who reported that among the rose, walnut and pea, single is the most common comb type in Nigeria.

These differences are probably the usual differences observed between and within free ranging local chickens in different geographical locations (Msoffe *et al.*, 2002).Similarly, the fact that single combed chickens were predominant followed by those possessing rose and pea combs tallies with the reports of Oluyemi and Roberts (1979), Mbap and Zakar (2000), Ikeobi *et al.* (2001), Mancha (2004) on indigenous chickens of Nigeria. Similar results were also obtained in other African countries; Badubi *et al.* (2006) reported that the indigenous chickens of Tanzania were mostly single combed as was also observed by Bhuiyan *et al.* (2006) in Asia among the indigenous chickens of Bangladesh. The higher values observed for the single comb type which was also the largest in size (Oluyemi and Roberts, 1979) suggests a selection advantage and greater adaptability. Combs are important avenue for heat loss in birds (Van Kampen, 1974) and since the tropical climate is characterized by high temperature (Ibe, 1993), large combs would provide an efficient means for heat dissipation

The high variation in plumage and shank colour and comb type reported in this study is consistent with the findings of McAinsh *et al*, (2004) .who stated that variation in phenotype is exactly what characterizes local chickens. They further stated that this is probably an expression of high variability at genotype level. Equal numbers of male and female chicken were studied from the indigenous chicken population.

The frizzle gene has favourable effects on production traits such as egg number, egg weight, egg mass, body weight and productivity index but less pronounced than the naked neck gene (Somes, 1988; Mathur, 2003).

Four shank colour were observed in the three study areas(cream, yellow, brown and black). Across the study areas the yellow colour shank is most dominant (54.24%, 65%, 61.67%) whereas the brown colour is less dominant in the three study areas. Dana *et al.* (2010) in Ethiopia

and Daikwo *et al.* (2011) in Dekina, Nigeria, who observed predominantly yellow shanks among indigenous chickens. The shank colour is significant across the three local government.

The body weight ranged from 1.06 – 1.08 kg. Oye and Ekiti west local government had the highest ($P > 0.05$) similar value 1.08 kg while Ikole local government had the least value (1.07 kg).

The mean body weight for both sexes combined falls within the range of 1.06-1.08 kg reported by Williamson and Payne (1982). The bodyweight obtained in this study also showed that the local chickens in the study area are of the light ecotype class, as described by Atteh (1990). The study further revealed that the local chickens of Oye, Ikole, Ekiti east local government areas of Ekiti state have not undergone appreciable gene mixing with the exotic breeds, otherwise their body weight could have been high. Aganga *et al.* (2000) and Badubi *et al.* (2006) attributed low live weight in indigenous chicken to poor management, while Mwalusanya *et al.* (2001) reported genetic, nutrition and parasitic problems as possible reasons.

The shank length varied from 13.69 – 13.71 cm. Ikole local government had the highest value 13.86 cm ($P > 0.05$) followed by Oye local government with 13.71cm whereas Ekiti west has the least value (13.69 cm). The comb length ranged from 4.56 – 5.15 cm. Ikole local government had the highest similar value ($P > 0.05$) 5.15 cm, followed by Ekiti east local government with 5.12 cm while Oye local government has the lowest value of 4.56 cm.

The beak length ranged from 2.36 – 2.67 cm. Ekiti east had the highest value ($P < 0.001$) 2.67cm, Ikole had the value of 2.66 cm whereas Oye local government had the least value of 2.36. The body length varied from 38.55 – 43.50 cm. Ikole local government had the highest value ($P < 0.001$) 43.50 cm, Ekiti east had the value of 43.23 cm while Oye local government had the least value of 38.35 cm.

The chest length varied from 13.63 – 14.14 cm. Ikole local government had the highest value ($P > 0.05$) 14.14 cm whereas Oye local government had the lowest value of 13.63 cm and Ekiti east had the value of 14.03 cm. The comb height ranged from 2.14 – 2.51 cm. Ekiti east had the highest value ($P > 0.05$) 2.51 cm followed by Ikole local government which had 2.49 cm while Oye local government had the least value of 2.14 cm.

Correlation coefficients between body and egg parameters are shown in **Table 4.6.** The magnitude of the value of the parameters between shank length and comb height (r =0.560011), between shank length and comb height (r =0.034473), between shank length and body length (r =0.40305), between comb height and comb length (r =0.61522) and between comb height and body length (r =0.54062) were positive and significant ($P < 0.001$). There was also positive and significant relationship between comb height and body weight and between clutch size and body weight (r =0.34292, 0.36718). Between shank length and beak length, between shank length and body weight, between comb height and beak length and between beak length and body weight there was positive and significant ($P<0.05$) the correlation coefficients (r=0.22615, r=0.22251, r=0.17206) respectively.

The parameter between shank length and clutch size, between comb height and clutch size and between comb length and clutch size had a negative and significant ($P < 0.001$) with correlation coefficients (r=-0.42005, r=-0.43807, r= -0.33335) respectively. However, the correlation between beak length and clutch size was negative (r=-0.33335) and still significant ($P<0.05$).
Similarly, the positive correlation between body length and shank length is also an indication that they could be used complimentarily in selection (Falconer, 1989). If the positive phenotypic correlations translate into positive genetic correlations thus, selection for one will improve the other as a correlated response (Muhiuddin, 1993). The results of this study are similar to reports by Mancha (2004) and Sudik (2007) in Plateau state. However the negative correlations between

clutch size and shank length, and between clutch size and shank length are indications that shank length may not be suitable for improving both egg weight and clutch size. However, Sudik (2007) observed non-significant correlations between clutch size and other body/egg characteristics.

Hens in the three local government area have larger chest length than the male (cock) ($P<0.05$). It is evident that the body measurements of the hens are generally smaller than that of the male (cock). This can be attributed to the fact that the body built of males in general, is suited for muscle building. On the other hand, the body of hens (cock) is built for reproduction.

The mean body weight recorded for males and females in this study is in agreement with the range of 0.9-1.8 kg reported by Williamson and Payne (1982). The live body weight obtained in this study also showed that the local chickens in the study area are of the light ecotype class, as described by Atteh (1990).

Sexual dimorphism with respect to body weight was also expected due to differential growth rates of the males and females. The sexual dimorphism is explained by the differences in level of male sex hormones which is responsible for greater muscle development in males than in females. The table 4.9 showed the mean body length (cm) for males and females. In the results, males are found to be 43.147 cm while females are found to be 40.177 cm. The result was higher than the reported values obtained by Badubi, *et al*, (2006), who recorded 18.00 cm and 20.00 cm as average body length for male and female local chickens in Botswana. The effect of environment and area was highly significant ($P <0.05$) for body length and beak length.

CHAPTER SIX

6.0 CONCLUSIONS AND RECOMMENDATION

6.1 CONCLUSIONS

The study showed wide variations among the traits considered among the indigenous chickens in the study area. The study reveals phenotypic variability which is affected by both genetic and environmental factors. The low frequencies of some characteristics may indicate their vulnerability or threat of extinction. Considering the hardy nature and productive performance of these chickens they have vast potential for subsequent breeding works. The performance of the local chickens can be enhanced greatly with improvement in basic management systems.

6.2 RECOMMENDATION

It would also be interesting to study the genetic diversity to inform future breeding program. It is highly recommended to carry out in-situ conservation and improvement of the indigenous chickens to enhance their sustainable utilisation. Any genetic improvement program should consider full participation of women as they have been found to be involved in all stages of chicken values chain. Detailed information will help to develop appropriate interventions in areas such as disease prevention and control, genetic improvement and marketing of poultry products, which can strengthen low-input chicken farming in developing countries.

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APPENDIX

CORRELATION BETWEEN SEX, LOCAL GOVERNMENT AND BODY TRAITS

	Local government	Shank length	Sex (Male)	Sex (Female)	Comb height	beak length
Sex	0.114	0.086	1.000	0.016	0.099	0.333
(Male)	0.282	0.418		0.884	0.349	0.013
Sex	-0.089	0.057	0.016	1.000	0.076	0.059
(Female)	0.399	0.594	0.884		0.476	0.578

ANOVA Table for the effects between sex and local government on different traits

Source	Df	Plumage colour	Eye colour	Shank length	Comb type	Comb height	Comb length	Beak length	Body length	Feather type	Shank colour	Body weight	Clutch size	Chest length
Rep	29	3.730	0.740	2.040	0.186	1.310	2.730	0.200	18.300	0.148	1.910	0.072	3.134	4.133
LGA	2	0.730	1.020	0.650	0.326	2.270	7.250	1.777	507.890	0.109	4.609	0.008	0.902	4.252
Sex	1	8.750	1.070	63.120	0.006	54.150	157.780	0.833	389.970	0.345	0.951	0.980	2510.033	1.276
LGA*Sex	2	4.220	0.280	0.250	0.043	2.540	6.040	0.244	14.900	0.004	0.213	0.031	7.871	9.485
Error	143	3.140	0.530	1.540	0.145	1.390	3.910	3.910	19.600	0.149	0.829	0.033	3.223	3.234