INTESTINAL HELMINTHS OF GALLUS GALLUS DOMESTICUS AND NUMIDA MELEAGRIS SLAUGHTERED AT KAURA NAMODA MARKET KAURA NAMODA ZAMFARA STATE NIGERIA

BY

MUSTAPHA AMINU MAGAJI
1410308051

NOVEMBER 2018

INTESTINAL HELMINTHS OF *GALLUS GALLUS DOMESTICUS* AND *NUMIDA MELEAGRIS* SALAUGHTERED AT KAURA NAMODA MARKET, KAURA NAMODA, ZAMFARA STATE, NIGERIA

BY

MUSTAPHA AMINU MAGAJI
1410303015

A PROJECT
SUBMITTED TO THE

DEPARTMENT OF BIOLOGICAL SCIENCES
FEDERAL UIVERSITY GUSAU

In partial fulfillment of the requirements
For the award of the Degree of

BACHELOR OF SCIENCE
ZOOLOGY

NOVEMBER, 2018

DECLARATION

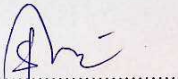
I hereby declare that this project is written by me and it has not been presented before in any institution for a Bachelor of Degree except for quotations and summaries which have been duly acknowledged.

.....
Mustapha Aminu Magaji

26/11/2018
.....
Date

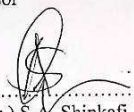
CERTIFICATION

This Project entitled "Intestinal helminthes of *Gallus gallus domesticus* and *Numida meleagris* slaughtered at Kaura Namoda market, Kaura Namoda, Zamfara State, Nigeria" meets the regulation governing the award of Bachelor of Science of the Federal University Gusau and is approved for its contribution to knowledge and literary presentation.



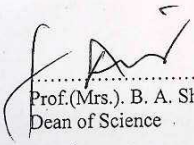
Mal. S. I. Moyi
Supervisor

26/11/2018.
Date



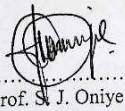
Dr. (Mrs.) S.A. Shinkafi
Head of Department

26/11/2018
Date



Prof.(Mrs.). B. A. Shinkafi
Dean of Science

26/11/18
Date



Prof. S. J. Oniye
External Examiner

26/11/2018
Date

DEDICATION

I dedicated this project research to Allah almighty, the sustainer of the globe and the family of late Alhaji Ahmad Magaji Kwashabawa.

AKNOWLEDGEMENTS

All thanks firstly goes to almighty ALLAH whose mercy and grace brought me to this stage.

I wish to show my sincere gratitude to my supervisor Mal. S. I. Moyi for laudable assistance, academic inspiration, advice and guidelines, also for critical reading and corrections which made the project what it is today. I will like to express my appreciation to Mr. Bruno I. Aguh, Dr. Ibrahim I. Magami and all lecturers and staff in the Department of Biologial Sciences not mentioned here, that have contributed greatly torwards the success of my study in this University.

I also recognised the effort of my beloved parents being the key figure for making my dreams a reality, your contributon would never be forgotten and also my beloved brothers. I, also want to express my gratitude to my uncles for their advice and my friends in person of Kamilu Aliyu, Isma'il Yusha'u, Adamu salihu, Mukhtar Mustapha and Hafiz Muhammad and all my course mates.

TABLE OF CONTENTS

CHAPTER TWO

CHAPTER THREE

LIST TABLES

Table **Page**

LIST OF APPENDICES

ABSTRACT

The study was conducted to determine the prevalence of intestinal parasite of local chickens and guinea fowl in Kaura Namoda of Zamfara state, Nigeria. A total of 100 samples were purchased from Kaura market and other slaughtering locations and transported to the Zoology Laboratory of Federal University Gusau and examined for the presence of helminths parasites. Almost all the samples were found to be infected with intestinal helminths. This study will help in understanding the menace caused by the helminths parasite in guinea fowl and local chickens production, and also by coming out with the ways of reducing this menace, there by achieving the full potentials of guinea fowl and local chicken production in Nigeria. Out of the 100 samples of intestines of *Numida meleagris* and *Gallus gallus domesticus* examined, 75 were found to be positive for intestinal helminths representing 75% prevalence which *N.meleagris* has the highest prevalence of 97.5% (35/40) while *G. domesticus* had the least prevalence of 63.33% (40/60) Among the local chicken and guinea fowl, male of guinea fowl had higher prevalence of (100%) than male of local chicken (56.7%) and female of local chicken also had the least prevalence of 70% and female guinea fowl (95%).This findings clearly shows that guinea fowl had high parasites infections than local chickens. In both local chickens and guinea fowls those with weight of 0.00-1.0kg had the highest prevalence of (67.5%), (100%) and those with 1.1-2.0kg weight had the least prevalence of (55%) and (90%) respectively. Nematodes found in both local chickens and guinea fowl comprise of *Ascaridia galli, Heterakis gallinarum, Strongyloide* sp and *Capillaria avium* and Cestode include *Raillietina tetragona, R. cesticulus, R. echinobothridia and Daevinea proglotina.* Nematode had the highest prevalence in particular A. galli in both local chickens and guinea fowl.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

A parasite is an organism that lives in or on another organism (referred to as the host) and gains an advantage at the expense of that organism. The two types of internal parasites that affect poultry are helminths (worms) and protozoans. Usually in poultry, low levels of infestation do not cause a problem and can be left untreated. Clinical signs of a parasite infestation include un-thriftiness, poor growth and feed conversion, decreased egg production, and, in severe cases, death. Also, parasites can make a flock more susceptible to diseases or worsen a current disease condition (Jacquie, 2015).

The two main types of intestinal parasites are helminths and protozoans that reside in the intestine (not all helminths and protozoans are intestinal parasites). Intestinal parasites can damage or sicken its host via an infection which is called helminthiasis in the case of helminths (Loukopoulos, 2007).

The major hindrances in the production of guinea fowl are helminth parasites and insect pests. These helminth parasites cause various problems ranging from gastroenteritis, anorexia, abdominal distension, diarrhoea and emaciation, all

result in serious economic losses (Kiran and Afaf, 2014). Gastrointestinal parasites cause loss of protein in intestinal tracts in the guinea fowl in turn which results in poor development and delaying in egg laying (Kiran and Afaf, 2014).

Poultry are reared for consumption and commercial production systems in many areas of the world. It is one of the most important sources of protein and farm manure for man (Ajayi, 2010). Factors which hinder the development of poultry to its fullest capacity include Poor management systems and diseases (Kolawole, 2013).

Political instability, economic crises, war, food insecurity or hunger, poverty, diseases, pestilence and religious and socio-cultural crises are problems confronting and militating against African development. The role of local or indigenous or rural/scavenging chicken in food security, alleviating poverty, disease mitigation and meeting the socio-cultural fulfillment towards ensuring political, economic and socio cultural stability in Africa is hereby reviewed. The Local or indigenous chicken of any country are better adapted to local conditions as they are hardy, can thrive under minimal supply of feed, more resistant to local pests, parasites and diseases than the exotic breeds or hybrids (Kolawole, 2013). Poultry is a collective name for all domesticated animals for example birds such as chickens, pigeon, turkey, duck, goose and guinea fowl and other birds for purpose of domestic economy, this study is largely based on domestic chicken

production. The diet of chicken and guinea fowl consists of grains, seeds, larvae and adult stages of various arthropods, earthworms and snails (Kolawole, 2013). Most of the developing countries are found in the tropics which are currently experiencing high increase in human population, dramatic urbanization and monetarization of economies. The dominant issues to address therefore relate to reducing under nutrition, enhancing food security, combating rural poverty and achieving rates and patterns of agricultural growth that would contribute to overall economic development and environmental protection. Contribution from sustainable increase in livestock production would therefore be desirable in order to meet the demands of the human population on livestock populations and their products. The World Bank has estimated that it will be necessary to increase meat production by about 80 percent between 2000 and 2030 (FAO, 2014). Poultry production plays a significant role in the economic and social-life of the resource-poor households, contributing to cheap source of animal proteins and cash income (Magothe *et al.*, 2012; Yakubu *et al.*, 2013). When agroecological issues and the demographics of the human population are considered, village poultry often rank highly in terms of being an existing resource whose productivity can be increased with only a modest input. In sub-Saharan Africa, there are several species of poultry (Yakubu *et al.*, 2013) mainly represented by domestic indigenous chicken (*Gallus gallus domesticus*), guinea fowl (*Numida meleagris*), duck (*Cairina* sp.) and turkey (*Meleagris gallopavo*); their distribution varies from one region to the other depending on both the physical and social environment.

Food Security/nutritional value, the contribution of local or indigenous chicken and guinea fowl production to household food security is indicated by the quantity and quality of poultry products, mainly meat and eggs emanating from this type of poultry that is consumed. Meat and egg of local chicken are sources of protein in village diets and have been described as "cheap and valuable protein in convenient, readily harvestable and manageable quantities" (Kolawole, 2013). Meat from native or local chicken is popular among local people for making delicious soup. The average protein content of poultry meat is about 20 % and it also contains relatively little fat (7 %), especially under the skin. In all places there is usually a strong preference for the meat of local chicken breeds. This has improved the nutritional status of rural dwellers and checked malnutrition. Village chicken products are often the only source of animal protein for resource-poor households (Kolawole, 2013).

Domestic birds such as chicken, guinea fowl, duck and goose serve as food directly to man. Their meat and eggs are in high nutritional value and form part of many nation diet. Another significance is the ability of these birds to devour insect such as locust, which are harmful to man and some others eat rodents that could destroy grains (Ajayi, 2010). The big boom facet of animal breeding is in the area of economic integration (Sarkar, 2012).

In Nigeria, guinea fowl ranks second in the poultry sector, and compares favorably with domestic chicken for meat and egg production (Nwagu and Alawa,

1997). Despite the ubiquitous distribution of guinea fowl species throughout Africa (Crawford, 1990). Little is known about the biology of wild or feral stocks. Chicken originated in Southeast Asia and were introduced to the east of the world by sailors and traders. Nowadays, indigenous village chicken are the result of centuries of cross breeding and random breeding with the flock (Ajayi,2010). There is no comprehensive list of the breeds and varieties of chicken used by rural small holders, but there is considerable information on some indigenous populations from various regions. Most of this is based on feather color and other easily measured (genetic trait) but more detail data are becoming available (Ajayi, 2010).

In India, guinea fowl are raised in part of the Pundab (Fatihu *et al*, 1992). Domesticated guinea fowl are of three principal breeds, Pearl, White, and Lavender. The pearl is by far the most common. It has published grey feathers regularly dotted with white. The white guinea fowl has pure white feather while the lavender has light grew feathers dotted with white (Fatihu *et al*, 1992).

1.2 Statements of the research Problem

Local chickens are omnivores that are generally reared by people for their eggs, meat etc. Meat and egg serve man with great nutritional value (protein, vitamin). However despite their importance to man, intestinal helminths are there infecting them and decreases poultry production.This study will therefore provide preliminary information on the subject in the area.

1.3 Justification

Poultry production can play an important role in poverty alleviation and require less land and financial investment, thus there is need to conduct a research that will focus on the best way to promote local poultry production. It is therefore necessary to survey and identify species of helminths parasite of local chicken and guinea fowl commonly occurring in this area (Kaura Namoda), because information on the common helminths of local chickens, pigeon and guinea fowl in the area is scanty or unavailable. This study will therefore provide preliminary information on the subject in the area.

1.4 Aim of the study

The aim of this study is to determine and compare between the intestinal parasite of local chickens and guinea fowl slaughtered at Kaura Namoda market, Kaura Namoda, Zamfara State.

1.5 Objectives of the study

The objectives of the study are as follows;

- To determine the presence and prevalence of intestinal helminths of *Gallus gallus domesticus* and *Numida meleagris* with respect to weight and gender slaughtere at Kaura Namoda market.
- To identify species composition of intestinal helminths found in both *Gallus gallus domesticus* and *Numida meleagris*

1.6 Hypotheses

- The intestinal parasites of *Gallus gallus domesticus* and *Numida meleagris* does not vary with respect to weight and gender.
- The species composition of both *Gallus gallus domesticus* and *Numida meleagris* does not vary.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

These are game birds comprising of domestic fowls, guinea fowls, peacocks and turkey as well as Malay region jungle fowl from which all domestic chickens are descended of the order galliformes. They are largely ground-living birds with relatively short wings and therefore can fly only short distance. The beak is short and stout thereby feeding primarily on grains. The heavy feet with strong claws are adapted for running and scratching the ground (Ademola, 2013).

Guinea fowl (sometimes called guinea hen) are a family of birds in galliforms order, although some authorities (for example the ornithologist union) include the guinea fowl as a sub family *numidae*, of the sub family *phasmidae*, the guinea fowl are native to Africa but the helmented guinea fowl has been domesticated and both the feral and wild types birds have been introduced elsewhere (Wikipedia, 2014).

Guinea fowls are carinate birds (capable of flight), but are terrestrial and most likely to run rather than fly when startled (Ayorinde, 2004). They are however very agile flyers. They belong to the family phasmidae, subfamily Numidae and order Galliformes. Other agriculturally important birds in the order includes turkey, chickens and pheasants. Guinea fowl are native to West Africa but are

now kept in many part of the world. Generally, male guinea fowl (cock) and female (hen) are not distinctly sexual dimorphic until they are about months of age (Moreki, 2009).

2.2 Diversity and Distribution of Guinea Fowl and Local Chickens

These breeds commonly possess valuable traits such as adaptation to harsh condition, including tolerance of parasitic and infectious diseases, drought and poor quality food. They are being replaced in both developed and developing countries by a few high production breed which to be successful, require high inputs, skilled management and comparatively benign environment (Amita, 2013).

2.2.1 Diversity and Distribution of Guinea Fowl

The guinea fowl comprises four genera, Viz, *Agelastes*, *Numida, Guttera* and *Acryllium* (Ayorinde, 2004).The *Agelastes* consists of the white breasted guinea fowl (*meleagrides*) and the black guinea fowl *(niger*), Whilst the Numida consists of the helmented type (*meleagris*). On the other hand, the *Guttera* consists of the plumed (*plumifera*) and the crested (*pucherani*) types, with the vulturine type (*vulturinum*) being found under the last genera *Acryllium* (ayorinde, 2004). The white-breasted guinea fowl, *Agelastes meleagrides* is a medium-sized terrestrial bird, up to 45 cm long with black plumage, a small featherless red head, white breast, long black tail, greenish brown beak and grayish feet (Bird Life International, 2013). It is distributed in the subtropical West African forests of

Cote d' Ivore, Ghana, Liberia and Sierra Leon. The white-breasted guinea fowl however, has been identified by the International Union for Conservation of Nature and Natural Resources (IUCN) as Vulnerable. This type of guinea fowl is heavily poached whilst its habitat is rapidly declining owing to logging, forest clearance for agriculture and human settlement (Bird Life International, 2013). Black guinea fowls, *Agelastes Niger* are 40 cm to 43 cm in length, and have a featherless head; short crests of black down feathers and black plumage (Bird Life International, 2013). These birds are usually found in the humid forests of Central Africa. They possess large toes to enable them grasp the ground, but tiny feet to aid in flight (Bird Life International, 2013).

The vulturine guinea fowl, *Acrylliumvulturinum* is the largest (16-71cm in length) and most ornate, with a long, glossy-blue cape, white hackles extending from the neck and cobalt blue breast, with looks similar to the vulture, it has black body plumage finely spangled white spots, with short rounded wings, and a tail longer than those of other members in the family *Numididae* (Bird Life International, 2013).

The crested guinea fowl, *Guttera pucherani* is found in open forest, woodland and forest-savannah medley in sub-saharan Africa with a body length of approximately 50 cm, and blackish plumage with dense white spots, it has a noticeable black crest on top of its head, which varies from small curly feathers depending on the subspecies (Bird Life International, 2013).

The plumed guinea fowl, *Guttera plumifer* have a naked head and neck with a small fold of skin at the back of its head, wattles, long straight black crest and black plumage with white spots (Bird Life International, 2013). They are 45cm to 51cm in length and can be found in the humid primary forest of Central Africa (Bird Life International, 2013).

The helmeted guinea fowl, *Numida meleagris* is naturally distributed in West Africa along with the other species except the vulturine type (Awotwi and Ikani, 2004). In spite of its African origin, it is able to thrive in various climatic conditions and is reared commercially in Europe, America and Asia (Moreki, 2009). Helmeted guinea fowls are 53cm to 63cm in length and are characterized by a bonny helmet, naked grey neck and wattles on either side of the beak. The helmeted type is the common guinea fowl with varieties including the white, pearl, royal, purple, lavender, coral blue and dundotte (Moreki, 2009). There are nine subspecies of the helmeted guinea fowl. This type of guinea fowl is the most wide spread and though it can still be found in the wild, it has been domesticated and can even be kept as pets in certain areas. The preferred habitat for the helmeted guinea fowl is the savannah, where they thrive best. In Ghana, the northern Savannah zone is the niche that accommodates the largest population of helmeted guinea fowls. In Northern Ghana, helmeted guinea fowls have a high cultural value and make up about 25% of the poultry population in the zone. In

Nigeria, 25% of the entire poultry population is made up helmeted guinea fowl (Ikani and Dafwang, 2004).

2.2.2 Diversity and Distribution of Local Chickens

Poultry, particularly chickens are the most widely kept livestock species in the world and also the most numerous (Perry *et al.*, 2002). Therefore, there is a growing interest in using poultry as a tool in poverty alleviation in villages throughout the world. FAO, (2000), estimated the total meat production to be 245 million tones and about 30% there off was poultry mainly from chickens produced in the developing countries (Sonaiya *et al.*, 1992).

The chicken (*Gallus gallus domesticus*) is a type of domesticated fowl, a subspecies of the red jungle fowl. It is one of the most common and widespread domestic animals, with a total population of more than 19 billion as of 2011.

The domestic chicken is descended primarily from the red jungle fowl (Gallus gallus) and is scientifically classified as the same species (Wong*et al.*, 2004). As such, it can and does freely interbreed with populations of red jungle fowl (Wong*et al.*, 2004). Recent genetic analysis has revealed that at least the gene for yellow skin was incorporated into domestic birds through hybridization with the grey jungle fowl (Eriksson*et al.*, 2008).

The traditional view is that chickens were first domesticated for cockfighting in Asia, Africa, and Europe. In the last decade, there have been a number of genetic

studies to clarify the origins. According to one early study, a single domestication event which took place in what now is the country of Thailand gave rise to the modern chicken with minor transitions separating the modern breeds (Fumihito, 1994).

However, that study was later found to be based on incomplete data, and recent studies point to multiple maternal origins, with the clade found in the Americas, Europe, Middle East, and Africa, originating from the Indian subcontinent, where a large number of unique haplo types occur.(Liu, 2006). It is postulated that the red jungle fowl, known as the bamboo fowl in many Southeast Asian languages, is a special bird well-adapted to take advantage of the large amounts of fruits that are produced during the end of the 50-yearbamboo seeding cycle, to boost its own reproduction (King, 2009).

2.3 Local Chickens and Guinea Fowl Management Systems

Poultry management systems in Africa are differentiated on the basis of flock size and input-output relationships. These include extensive, semi-intensive and intensive management systems (Kitalyi, 1998).

In the extensive management system, different species of poultry that include guinea fowls, chickens, ducks and turkeys are kept. In general, poultry production by small holder farmers in rural area is mainly extensive (Gueye and Kitalyi, 1998). But backyard poultry production in urban areas is either intensive or semi-intensive. Under the extensive management system, no standard poultry

management practices are followed. The system is characterized by minimum inputs, with birds scavenging, no investment beyond the foundation stock, a handful of grain each day and simple night enclosures.

The semi-intensive poultry management system refers to the provision of permanent housing with access provided to a yard or the surrounding environment.

Under this system of management, the birds are given supplementary feed and water within the houses and the stocking density is up to 500 birds per acre (Kitalyi, 1998). Diseases are also controlled to enhance productivity. Thus the semi-intensive management system allow birds to get as much as they can from the environment. The farmer complements these inputs by supplementary feeding, and protecting the birds from the vagaries of nature through housing and disease control. The intensive system of guinea fowl production is based on specialized breeds of guinea fowls (broilers, breeders and layers).

2.4 Meat Status of Local Chickens and Guinea Fowl

The local chicken and guinea fowl are harder than the exotic breeds of broiler and the taste, flavor and juiciness are almost similar to the exotic cockerel stocks. Excessive abdominal fat particularly in broiler lead to consumer rejection and adds to processing difficulties (Crawford, 1990). Advocate the suitability of local chickens from exotic strains for preparation of chicken delicacies due to its desirable flavor, less abdominal fat and juiciness. Local chickens contains 56%

water and 320 calories, 100g of meat energy, where as 71% water and 151 calories for exotic broiler (Singh, 1990).

2.5 Helminthiasis in Local Chickens and Guinea Fowl

The word "helminths" is derived from the word helminths (worm). They are division of eukaryotic parasites that live and feed off living host, receiving nourishments and protection while disrupting their host's nutrients absorption, causing weakness and disease, those that live inside the digestive tract are called intestinal parasite (Urquhart *et al*., 1987).

2.5.1 Nematodes

Nematodes are un-segmented worms that are cylindrical and elongated in shape with tapering at the extreme end. They possess an alimentary canal with few exceptions the sexes are separate and life cycle may be direct or indirect (Soulsby, 1982). The body of nematodes is covered with a colorless somewhat translucent layer, called cuticula. This is often marked by transverse groove. The digestive system is tubular, the mouth of many nematodes is a simple opening at the anterior end of the body, which may be surrounded by two or three lips and leads directly to the esophagus. The esophagus continues with the anal or cloaca opening in the posterior end of the body (Soulsby, 1982).

The most common parasitic infection reported in guinea fowl has been *Heterakis gallinarum* (Nwagu and Alawa, 1995). This nematode, which is relatively non-pathogenic in chickens, has been shown to cause granulomas in caeca of guinea

fowls in Pakistan. *H.gallinarumas* having the highest incidence and affecting 100% of all guinea fowls infected with helminths. Outbreaks and occurrences of Ascaridiosis have been reported as well (Nwagu and Alawa, 1995).

The species *Ascaridia numida* has been associated with intestinal obstruction and Mucoid enteritis leading to emaciation and in some cases death of young guinea fowls. However, other papers reported the ascarid in guinea fowl as *Ascaridia galli,* as the main ascarid of chickens (Nwagu and Alawi, 1995).

General life cycle of Nematode

Nematode have either direct or indirect life cycle, nematodes normally pass through four developmental stages before reaching fifth (final) stage, successive stages are proceeded by shedding of the cuticle (molting), in some nematodes the cuticle is retained for a short period of time as a protective covering, in others it is shed at once (Soulsby, 1982).

Eggs are deposited reach the outside in the droppings, regardless of the location of the adult worms, some eggs are embryonated in the host but others require suitable environmental conditions outside the host to become infected and to reach new hos or intermediate host, but few hatch in the environment and release free leaving larvae, the time require for the eggs to develop in to embryo depends upon the specie of the parasite, since under similar environmental conditions, the eggs of some nematodes require only a few days to complete embryonation while others require several weeks (Soulsby, 1982). For nematodes with direct life

cycle, the final host becomes infected by eating embryonated eggs containing second stage larvae or free larvae, the final host become infected either by eating the infected intermediate host or by infection of the larvae by a blood feeding arthropod (Soulsby, 1982).

Mode of infection

Eggs laid by mature worm in infected birds are passed out in faeces. Once outside the body, the egg undergo development either within an invertebrate host or not. In case of direct life cycle bird become infected by eating embryonated egg or the free larvae. For those within an indirect life cycle, the intermediate host ingests the embryonated eggs or free larvae. Birds become infected when they consume the host that contains the infected larvae. The length of life cycle of various species can last from day to month (Hodasi, 1969).

2.5.2 Intestinal Nematode Affecting Poultry

Ascaridia galli

Ascaridia is a genus of parasitic roundworms belonging to the ascarids that infects chickens, turkeys, ducks, geese, grouse, quails, pheasants, guinea fowls and other domestic and wild birds. They occur worldwide and are very common in chicken. Several studies report incidences of up to 90% in various countries. It is much more abundant in traditional farming with outdoor run than in industrial production facilities. The disease caused by *Ascaridia* worms is called ascaridiasis (Junquera, 2017).

The lifecycle of *A. galli*

The lifecycle of *A. galli* is direct in a single host, involving two principal populations, namely the sexually mature parasite in the gastrointestinal tract and the infective stage (L2). The eggs are oval in shape and have thick, albuminous shells that are highly resistant to desiccation and persist for a long time in the environment (Junquera, 2017).

Larvae do not hatch, but moult inside the eggs until they reach the L2 stage. This can take about two weeks, but the period depends on other factors such as the weather condition. The lifecycle is completed when the infective eggs are ingested by new hosts through contaminated water or feed. The eggs containing the L2-larvae-passive are mechanically transported to the duodenum, where they molt and become larvae stage 3 and then larvae stage 4. The infective eggs are ingested by a chicken; when it reaches the proventriculus, it hatches (Junquera, 2017). Temperature, carbon dioxide levels, and pH are thought to be triggering factors that signal the larva to hatch from its egg. The larva then burrows into the mucosal lining of the small intestine, where it undergoes two additional molts. In this phase of their lifecycle, these worms cause the most damage to their hosts. They then re-enter the small intestine and develop into adults, where they live their lives out feeding on gut content and making a vast number of eggs that would then be excreted by a host and free to continue their lifecycle (Junquera, 2017). If the animal is able to mount an immune response to the larvae, i.e. from

pre-exposure, the larvae do not develop into adults, but hide in the mucosa of the small intestine. This is common for infection of older birds. Transport hosts such asearthworms are thought to play a role in transmission of *A. galli*, hence free range birds tend to have a higher risk of infection (Junquera, 2017).

Pathogenicity

The nematode infects fowl of all ages, but the greatest degree of damage is often found in birds under 12 weeks of age. Heavy infection is the major cause of weight depression and reduced egg production in poultry husbandry. In severe infections, intestinal blockage can occur (Junquera, 2017). Unthriftiness, drooping of the wings, bleaching of the head, andemaciation are seen. Infection also causes loss of blood , reduced blood sugar content, increased urates, shrunken thymus glands , retarded growth, and greatly increasedmortality . In heavy infections, adult worms may move up the oviduct and be found in hens' eggs, and sometimes they are also found in the birds' feces (Junquera, 2017).

Treatment

Piperazine is the drug of choice. Continuous medication in feed with hygromycin B is also widely employed. Piperazine may be administered to chickens in the feed (0.2-0.4%) or water (0.1-0.2%), or as a single treatment (50–100 mg/bird). However, piperazine is quite ineffective for young chickens, while tetramisole is 89-100% effective for chicken of different ages. More recent drugs such asalbendazole and levamisole are also highly effective. (Junquera, 2017).

Fenbendazole is also very effective, 99.2-100% and 69.0-89.6% effective at administration doses of 60.6 ppm and 30.3 ppm. Ivermectin was also demonstrated to be 90 and 95% effective against immature and adult worms, respectively (Junquera, 2017).

Prevention and Control of Ascaridia Infections

To prevent or at least reduce Ascaridia infections it is recommended to keep the birds' bedding as dry as possible and to frequently change it, because development of the worm's eggs needs humidity. Strict hygiene of feeders and drinkers are a must to avoid or reduce their contamination with eggs. Pasture rotation is also recommended. All these measures are particularly important for young birds. For birds kept outdoors it is advisable to restrict their access to humid environments where earthworms are usually more abundant (Junquera, 2017).

Heterakis gallinarum

Heterakis gallinarum is a small whitenworm of approximately 7-17mm. Under favourable temperatures and moisture condition, the egg take between 12 and 15 days to reach the infected stage. Upon ingestion by chicken and guinea fowl second stage larvae hatch within 1-2 hours, within 24 hours the larvae are found in the cecal of infested bird (Junquera, 2017). The worm reach maturity in 24 days and egg are shed in faeces between 24 and 30 days after infection. Earth worm may ingest the eggs although no development take place within the earth worm, they may concentrate egg population and transport eggs to non infected ground.

H. gallinarum is midly pathogenic and when present in large number can cause thickening of the caecal wall (Junquera, 2017).

Strongyloides spp

Strongyloides worms, also called threadworms (in the US) or pinworms (in the UK) represent a genus of parasitic roundworms that affects many domestic and wild vertebrates, including chicken and gujnea fowl. They are found worldwide in regions with a warm and humid climate, mainly in rural areas with poor sanitation standards. There are several species of veterinary importance for livestock: Strongyloides avium. Found worldwide in poultry (chicken, ducks, turkey etc.) (Junquera, 2017).

Symptoms and diagnosis

In all livestock larvae can also substantially harm the gut's wall, causing serious inflammations (enteritis) and diarrhoea (sometimes hemorrhagic), loss of appetite, strong weight losses and even death after massive infections. Anaemia can also occur. Larvae migrating through the skin can produce strong dermatitis, with strong itching, especially in the legs in other animals

Strongyloides avium is also particularly harmful for young birds. It affects mainly birds kept outdoors. Severe infections cause weakness, weight loss and diarrhoea (mucous or hemorrhagic), (Junquera, 2017).

Diagnosis is confirmed through detection of small embryonated eggs in the feces. Small larvae (about 600 micrometers long) may be found in elder faeces. In poultry adult worms can be found in scrappings of the mucosa of the caecum after necropsy (Junquera, 2017).

Prevention and control of Strongyloides infections

These worms that are quite abundant in warm regions are particularly harmful for young stock. Consequently preventative measures must focus on protecting young stock, which includes protecting pregnant and lactating stock as well, because it can directly infect its offspring (Junquera, 2017).

Strict hygiene and manure removal (in stables, boxes, pens, etc.) is a must, and the facilities should be kept as dry as possible, which diminishes the risk of infection through the skin, since larvae need humidity to survive and reach their hosts. Grazing on dry pastures reduces survival of infective larvae and hinders infection through the skin (Junquera, 2017).

Gongylonema ingluvicola

Clinical signs and lesions

This nematode parasite creates convoluted tracts in the crop wall. It causes a mild chronic inflammatory reaction with flattening, compression and cornification of the epithelium.

Diagnosis

Definitive diagnosis can be arrived at during post mortem. The parasite has cuticular thickenings, which are oval to round on the anterior aspect. The tail of the male worm has a number of papillae and spicules. The left spicule is slender and longer than the right one.

Treatment

Piperazine is the drug of choice. Continuous medication in feed with hygromycin B is also widely employed. Piperazine may be administered to chickens in the feed (0.2-0.4%) or water (0.1-0.2%), or as a single treatment (50–100 mg/bird). However, piperazine is quite ineffective for young chickens, while tetramisole is 89-100% effective for chicken of different ages. More recent drugs such asalbendazole and levamisole are also highly effective. (Junquera, 2017).

2.5.2 Cestodes

The cestodes form a group of worms, which with a few exceptions exhibit two striking morphological features; they possess an elongated tape-like body and lack an alimentary canal. Adult tapeworms occur only in tubular habitat, usually the alimentary canal, but occasionally in the bile or pancreatic ducts (Hanan, 2003). Members of class cestoda (cestodes) or tapeworm are always endoparasitic and almost all of them are gut parasite of vertebrates (Ademola, 2013).

2.5.2.1 Intestinal Cestodes Affecting Poultry

Raillietina tetragona

R. tetragona (synonym Taenia tetragona Molin) is a parasitic tapeworm belonging to the class Cestoda . It is a cosmopolitan helminth of the small intestine of pigeon, chicken and guinea fowl , and is found throughout the world.

It is a very typical of cestode with striking resemblance to other species of *Raillietina* . Its identifying features are, therefore, mainly on the neck and scolex structures. In addition, it is relatively large, and requires ant as intermediate host to complete its life cycle (Junquera, 2017).

Life cycle

The tapeworm completes its life cycle in two different hosts, the definitive host being birds, and the intermediate hosts are ant, particularly the species of Tetramorium, and housefly of the species Pheidole and Musca, in which the cysticerdoids develop. In Sudan the intermediate host is exclusively of the ant*Pachycondyla sennaarensis*. Ant species of *Leptothorax* are also known to harbour the juvenile stages. The sequence of development in the intermediate host comprises 5 stages, namely (1) oncosphere stage, (2) lacuna stage, (3) cystic cavity stage, (4) scolex formation stage and (5) cysticercoid stage. In birds, the gravid proglottids containing a large number of egg capsules are passed out to the exterior with the feces. The eggs grow on soil into larvae called onchospheres, which are ingested by ants, and enters the alimentary canal, from where they migrates into the abdominal cavity of the host (Junquera, 2017).

Pathogenicity and pathology

The adult parasite infects the small intestine of fowl, from where it obtains nutrition from the digested food of the host. Even though there are rumours of heavy infections leading to death, there are no factual scientific reports. Generally the parasite is quite harmless, and does not cause serious lesions under natural conditions. However, instances of reduced weight loss and decreased production of eggs are observed in experimental infections. Pathological symptoms include reduced glycogen in the liver and intestinal mucosa, enteritis, hemoglobin depression, lymphocyte and macrophage infiltration, reduced total white blood cells (Junquera, 2017).

Diagnosis and treatment

Infection is diagnosed by identifying proglottids in the faeces. Dibutyltin dilaurate is one of the earliest drugs found to be effective. Commercially, praziquantel is the drug of choice. It is 100% effective at 10mg/kg and is well tolerated by chickens, and treated birds showed no clinical complications at various doses tested. Oxfendazole and niclosamide are equally effective and safe. The most effective control measure is disruption of the habitat of intermediate hosts near poultry farms (Junquera, 2017).

***Hymenolepis* spp**

This genus contains *H. carioca, H. cantaniana, H. lanceleolata* and *H. nyrocae.* These tapeworms are threadlike and inhabit the small intestine.

Hymenolepis species have been reported in the chickens in Africa and the United States.

They have an indirect life cycle with dung beetles acting as the intermediate host, and are associated with catarrhal enteritis and diarrhoea in birds.

2.5.3 Trematodes

The trematodes are flattened, they have a blind alimentary canal. Two suckers for attachement. They are hermaphrodite (Soulsby, 1982). The digestive system consist of the mouth, pharynx, short esophagus and two intestinal ceca. The excretory system originate from the coolecting tubules and empties through an excretory pure near the posterior end of the parasite, the eggs of trematodes are passed in the feaces of the host and under suitable condition of moisture and warth, larvae (Miracidium) hatches out, the miracidium penetrate the intermediate host which is snail, following penetration the ciliated coat of the miracidium is lost and it becomes a sporocyst. Terminal cells of sporocyst develops into radia. Redula develops into final stage cercaria (Soulsby, 1982).

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study Area

Kaura Namoda is a local government in northern Zamfara, Zamfara state, Nigeria. It headquarter is in Kaura town. It has an area of 868 km^2 and a population of 281,367 at the 2006 census and coordinates 12°36′0 N, 6°35′23E latitude. The majority ethnic group is Fulani besides hausa, average annual tempreture is 27.0°C. The average rainfall is 911mm from April to October, the hottest months are March and April, the cold season known as harmattan lasts from November to Febuary.

3.2 Sampling Procedure

A stratified random sample was used to collect the samples according to the age, gender and weight variables as.

3.3 Sample Collection

A total of hundred (100) samples were used. Fourty (40) guinea fowl (*Numida meleagris*) based on weight, gender and age and sixty (60) local chickens (*Gallus domesticus*) was bought in Kaura market at Kaura town in the month of october. The age was noted by asking the people selling them. Each sample was wrapped in a polythene bag and drop of10% formaline was dropped before tithing. The

samples were transported to the Zoology Laboratory of Federal University Gusau and examined for the presence of intestinal helminths parasites.

3.4 Materials and Reagents

i. Forceps

ii. Dissecting tray

iii. Hand lens

iv. Scissors

v. Petri dish

vi. Light microscope

vii. Glass slide

viii. Masking Tape

ix. Pipette

x. 10% formalin

xi. Lugols Iodine

xii. Normal saline

3.5 Identification of Parasite

The samples were being slaughtered, dissected in Zoology laboratory of Federal University Gusau. Each intestinal tract was spread on a dissecting tray and separated into its different sections (small and large intestine). The lumen of each section was opened longitudinally and the contents scrapped into a petridish containing normal saline, as described by Fatihu (1992). The contents of each section were then observed under a light microscope using 10 objectives for parasites. Parasite from each section were isolated, counted and preserved in labelled vials containing 10% formalin. The parasites were examined and identified microscopically as described by Cheng (1973).

3.6 Data Analysis

The results obtained were analyzed using simple percentage and Chi square and 5% level of significance to compare and to establish the prevalence of helminths parasites between different samples.

CHAPTER FOUR

RESULTS

4.1: Prevalence of intestinal helmiths in *Numida meleagris* and *Gallus gallus domesticus*

Out of the 100 samples of intestines of *Numida meleagris* and *Gallus gallus domesticus* examined, 75 were found to be positive for intestinal helminths representing 75% prevalence and *N.meleagris* has the highest prevalence of 97.5% (35/40) while *G. domesticus* had the least prevalence of 63.33% (40/60), (Table 1).

Table 4.1: Prevalence of intestinal helmiths in *Numida meleagris* and *Gallus gallus domesticus*

Birds type	NE	NP	P (%)
G.domesticus	60	38	63.33
N. meleagris	40	39	97.5
Total	**100**	**75**	**75**

NE=Number of fowl examined; NP= Number of Positive; P= Prevalence

4.2: Weight specific prevalence of Intestinal parasites of *G. domesticus* and *N. meleagris*

Weight specific prevalence showed that out 60 sample of intestine of *G. domesticus* examined, those with weight range of 0-1.0kg has the highest prevalence of 67.5% (27/40) followed by those with 1.1-2.0 kg weight range had the least prevalence 55.0% (11/20). There was no significant difference (χ^2=3.84; df=1; P> 0.05) (Table 4.2).

Out of the 40 sample of intestine of *Numida meleagris* examined with respect to weight, guinea fowl with weight range from 0.0-1.0kg had the highest prevalence of 100% (30/30) and those with weight range of 1.1-2.0kg had the least prevalence of 90% (9/10), (Table 4.2). There was no significant difference in the result (χ^2=3.84; df= 1; P>0.05).

Table 4.2: Weight specific prevalence of Intestinal parasites of *G. domesticus* and *N. meleagris*

Bird type	GF			LC		
Weight (Kg)	NE	NP	P (%)	NE	NP	P(%)
0.0-1.0Kg	30	30	100	40	27	67.5
1.1-2.0Kg	10	9	90	20	11	55.00
Total	**40**	**39**	**97.5**	**60**	**38**	**63.33**

(χ^2=3.84; df=1; P> 0.05)
Keys: GF=Giunea fowl; LC=Local chikens; NE=Number of fowl examined; NP= Number of Positive; P= Prevalence

4.3: Gender specific prevalence of Intestinal Parasite of *G. domesticus* and *N. meleagris*

Gender specific prevalence showed that out of the 60 intestine of *G. domesticus* examined female had the highest prevalence of 70% (21/30) while the male had the least prevalence of 56.7% (17/30), (Table 4). There was no significant difference in the result obtained (χ^2=6.38; df=1; P>0.05).

Out of the 40 sample of intestine of *Numida meleagris* examined male guinea fowl has the highest prevalence of 100% (20/20), while the female has the least prevalence of 95% (19/20), (Figure IV and Table 4). There was significant difference in the result obtained (χ^2=3.84; df= 1; P>0.05)

Table 4.3:Gender specific prevalence of Intestinal Parasite of *Gallus. domesticus* and *N. meleagris*

Bird type	GF			LC		
Gender	**NE**	**NP**	**P (%)**	**NE**	**NP**	**P (%)**
M	20	20	100	30	17	56.7
F	20	19	95.0	30	21	70.0
Total	**40**	**39**	**97.5**	**60**	**38**	**63.33**

(χ^2=6.38; df=1; P>0.05).
Keys: GF=Giunea fowl; LC=Local chikens; NE=Number of fowl examined; NP= Number of Positive; P= Prevalence

Table 4.4: Species of helminths encountered in *N. meleagris* and *G. domesticus*

Birds	**GF**		**LC**	
Names of helminthes	**Positive**	**Negative**	**Positive**	**Negative**
A. galli	+		+	
Strongyloides sp.	+		+	
Subulurabrumti	+		+	
H. gallinarum	+			
R. cesticulus	+		+	
R. echinobothridia	+		+	
D. proglotina	+		+	
R. tetragona	+		+	
Capillaria sp.	+		-	
Gongylonema sp.	-		+	

Keys: GF=Giunea fowl; LC=Local chikens; += Positive; - = Negative.

CHAPTER FIVE

DISUSSION CONCLUSION AND RECOMMENDATIONS

5.1 Discussion

The present study revealed that *G. domesticus* and *N. meleagris* of Kaura Namoda are infected by many types of parasites species, exclusively comprising cestodes and nematodes species. A prominent feature of this study is the complete absence of trematodes species, this observation is in conformity with findings of Fabiyi, (1972), Fatihu*et al.* (1992) and Yoriyo *et al*, (2008), who also found that no trematodes infection among bird examined in the northern part of Nigeria. The absence of these parasite was previously linked to their complex life cycle requiring at least an intermediate host which is mostly aquatic, this help to break the life cycle where water is not available and probably reducing the spread of the parasites among the two birds examined.

Among the local chicken and guinea fowl, male of guinea fowl has higher prevalence of 100% than male of local chicken 56.7% and female of local chicken also has the least prevalence of 70% and female guinea fowl with 95%.This findings clearly shows that guinea fowl has high parasites infections than local chickens.The differences observed in prevalence of helminths among the birds (*G. domesticus* and *N.* meleagris) in this study could be due to the differences in the incidence of the infective stages and intermediate host of the parasites in places

where these birds feed. There was higher prevalence of nematodes among birds observed in this present study which is inconsistent with the findings of Oniye *et al,* (2005), Yoriyo *et al,*(2005), similarly their intermediate hosts like ants and beetles are available and abundant in Kaura Namoda and may form an important diet of birds, from this study it can be assumed that the birds might have acquired the helminths infection from their diets.

In both local chickens and guinea fowls those with weight of 0.00-1.0 has the highest prevalence of 67.5%, 100% and those with 1.1-2.0 weight has the least prevalence of 55% and 90% respectively.This could be attributed to the habitat of local chicken and guinea fowl as they feed on indiscriminately wide range of diets under poor husbandry.

Nematodes found in both local chickens and guinea fowl comprise of *Ascaridia galli, Heterakis gallinarum, Strongyloide* sp and *Capillaria avium* and cestode include *Raillietina tetragona, R. cesticulus, R. echinobothridia* and *Daevinea proglotina*

Ascaridia species has the highest prevalence rate in both local and guinea fowl. Similar reports have been documented from other parts of Nigeria; (Luka & Adams, 2007), conduted in Zaria, Kaduna state. (Pam *et al*., 2006) and Nsukka in Enugu State (Nnadi & George, 2010), Jos in Plateau State. In other climes, especially Africa, several studies have strongly suggested that *Ascaridia galli* is

the commonest and most important helminths of poultry (Eshetu *et al.*, 2001; Kaingu *et al.*, 2010).

5.2 Conclusion

The present study has indeed proved that helminthiasis is prevalent in local chickens and guinea fowl, this could be traced with warm environmental condition which create and support the eggs and early stage of development and hence increase survival and transmission of these parasites. The entire samples examined were almost positive with different classes of helminths such as nematodes and cestodes implicated. This study clearly showed that there is presence and high prevalence of intestinal helminths in both *Gallus gallus domesticus* and *Numida meleagris* with respect to weight and gender Both *G. domesticus* and *N. meleagris* composed of almost similar intestinal helminths found. This work strongly suggests that free range poultry is susceptible to high risk of helminths infection and therefore have high economic impact in the poultry production.

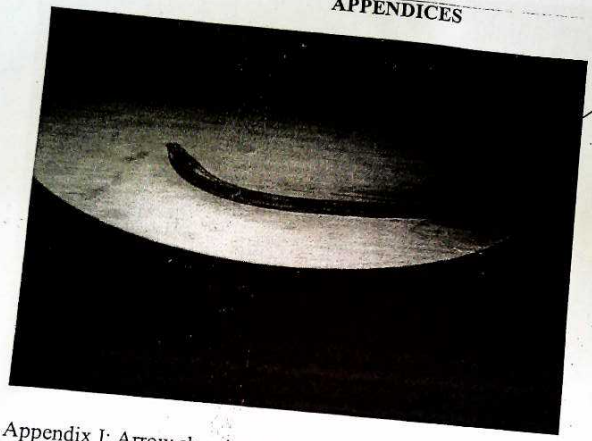
5.3 Recommendations

It is recommended that:

- general measures of sanitation design to prevent development of the parasite eggs and the subsequent ingestion by intermediate hosts should be adopted in order to achieve effective control of helminths and protozoan parasites.

- appropriate deworming and treatment of infected birds be carried out regularly, particularly at the grower stage by a Veterinarian. In addition, proper and adequate nutrition would also minimize the incidence rate of helminthiasis of domestic birds in the Area Council.
- Further research should be carried out on domestic birds in Kaura Namoda

APPENDICES



Appendix I: Arrow showing microscopic view of *Heterakis galliarum*

Appendix II Arrow showing microscopic view of *Gongylonema spp.*

Appendix IV: Arrow showing microscopic view of *R. tetragona*

References

Aboki, E., A.A.U. Jongur and Onu, J.I. (2013). *Nigerian Journal of Agriculture and Sustainability*.**4** (1). Pp 52-66.

Awotwi, E. K and Ikani, K. (2004).*Some Aspects of the Reproductive Physiology of the Male and Female Guinea Fowl.* (Thesis).University press Legon Ghana.Pp 59

Ademola, O. (2013). *Tropical zoology*. (third edittin). Published by Universitypress Plc, 3 ccrown building, Jericho, Ibadan, Nigeria. P374

Amita, S. (2012). *Animal Breeding* (first edition). Publishing House Private Limited. 4383/4B, Ansari road, New Delhi India. P 98.

Amita, S. (2013). *Domestic Animal Diversity* (first edition). Publishing House Private Limited. 4383/4B, Ansari road, New Delhi India. P 2.

Ajayi, F.O. (2010). Nigerian Indigenous chicken. *Asian Journal of Poultry Science* **4**. Pp 164-172.

Ayorinde, K. L. (2004). Growing and laying indigenous guinea fowls for optimum growth in Kenya. *Worlds Poultry Science Journal*.**5**. Pp 121-123.

BirdLife International (2013). *Globally Threatened Birds*. The official RedList Authority for Birds for IUN.

Crawford, R. D. (1990). *Poultry Breeding and Genetics*. Elsevier Amsterdam press Oxford, New York.

Cheng I., (1973). *Parasites of man and animals diagonostic method*.Bailliere printing press, Tindale, London. Pp 222 – 301

Erikson, M., Phiri, I. and Idiki, I. K. (2008). Grastrointestinal helminths of Domestic Chickens and Ducks slaughtered at Gombe main market, Gombe state, Nigeria. *Asian Journal of Poultry Science*. **2** (1): P32.

Eshetu, Y., Mulualem, E, Ibrahim, H, Berhanu, A and Aberra, K (2001). Study of gastro- intertinal helminths of scavenging chickens in four rural districts of Amhara region, Ethiopia. Revision Science Techniques *Office International Epizootic*, 20(3): 791-796.

Food and Agriultural Organization, (2014) .Small Scale Poultry Production in Nigeria.Pp 48
http://www.fao.org/../y5169e07

Fatihu, M. T., Ogbengu, V.C, Njoku, C.O. and Sarror, D.I. (1992). Observation on lesions associated with some gastrointestinal nematodes chickens in Zaria. *Bulletin of animal health production for Africa*.**40**. Pp 15-18.

Fabiyi, J.P. (1972). Incidence of helminths parasitesof the domestic fowl.Vom area press Plateau state, Nigeria. Pp 229-234.

Fumihito, A., Miyake, T., Sum, S., Takada. M. and Kondo, N. (1994). One subspcies of the red jungle fowl suffices as the matriahis ancestors of all domestic breeds. *National Academy of Sciene of the United States of America*. Pp 1250-1259.

Gueye E. F and Kitalyi,A. j., (1998). The role of network in information dissemination to family poltry farmers. *Worlds Poultry Science Journal*.65. Pp 112-123.

Hanan, D.(2003). *Establishement studies of the life cycle of cestodes*.University of Khartoum press.Pp35-45

Ikani A., and Dafwang, P. (2004). *Guinea fowl production in Nigeria*. 207, Poultry Series No.8. National Agricultural Extension and Research Liaison Services, Ahmadu Bello University Press, Zaria, Nigeria. Pp. 32.

Jacquie, J., (2015). *Internal Parasites of Poultry Small and Backyard* Flocks. University of Kentucky press. Pp 101- 120.

Junquera, P. (2017). *Parasitic worms of poultry*. Biology. Prevention and control.Mississippi State University Extension Services press. Pp350-353

Kiran, S. and Afaf, M, (2014). Survey on Intestinal helminths of guinea fowl in western Nigeria*World Journal of Environmental Biosciences*.

Usmanu Danfodiyo University Press, Sokoto, PMB 2346, Nigeria.Pp **5** (2) 35-36.

Kitalyi, A. J., (1998). Village chicken production systems in rural Africa. *World poultry journal*.143-153

Kaingu, F, Kibor A, Shivairo R, Kutima H, Okeno T, Wayhenya R and Kahi AK (2010). Prevalence of gastrointestinal helminths and coccidian in indigenous chicken from different agro-climatic zones in Kenya. *African Journal Agricultural Research*. **5**(6): 458-462.

Kolawole, A.(2013). Principle of parasitology. Published by University press Plc, 3 crown building, Jericho, Ibadan, Nigeria.Pp 309 – 331.

Loukopoulos, P.(2007). *Lethal Ozolaimusmegatyphlon infection in guinea fowl*. Journal of zoo and wildlife medicine. **38** *(1)*.Pp 131-134

Luka, S.A. and Ndam, I.S. (2007) Grastrointestinal Parasites of Domestic Chickens, *Gallus domestic* (Linnaeaus 1758)in Samaru, Zaria, Nigeria. *Science World Journal*, **2**: 27-29.

Liu. J. (2006). Gastro intestinal parasites of domestic fowl from ijebu North, South western Nigeria.*Basic Research journal of Agricultural sciences*. **3:** (7): Pp60 – 64.

Magothe, T. M.; Muhuyi. W., and Kahi A. K.,(2012).Indigenous chicken production in Kenya. *Worlds Poultry Science journal*.**68**: Pp119 – 132.

Maggothe, I., Norris, D. and Alabi, O. J. (2012). Helminths in Scavenging chicken of seleted district of western *Nigeria. African Journal of Agricultural Research*. P32.

Moreki, (2009). Moreki J C, Thutwa M, Ntesang K, Koloka O and Ipatleng T (2010).Utilization of the guinea fowl and Tswana chicken packages of the Livestock Management and Infrastructure Development Support Scheme, Botswana. *Livestock Research for Rural Development* 22: http://www.lrrd.org/lrrd22/11/more22210.htm .

Minga, U., Msoffe, P., and Gwakisa P. (2004). *Biodiversity in disease resistance and in pathogens withing rural chickens*. Proceeding of the 22nd Worlds Poultry Congress Istanbul.Pp 12-13.

Meridale, N.Y. (2018). *Poultry Protozoan Diseases*.The definitive website on Chickens & Other Fowl.7:31 PM, Thursday, July 5th, 2018, Eastern Standard Time.

Nnadi, P.A. and George, S.O. (2010) A Cross-Sectional Survey on Parasites of Chickens in Selected Villages in theSubhumid Zones of South-Eastern Nigeria. *Journal of Parasitological Research*, 2010, Article ID: 141824.

Nwagu, B. I., and Alawa, T., (1995). Factors Affecting Fertility and Hatchability of Guinea Fowl Eggs in Nigeria. *World Poultry Science journal*. **53**: pp 279-285.

Oniye, S. J., Adang, K. L., and Abdu, P. A. (2005). Gastrointestinal helminths of domestic birds. *Proceeding of Notional workshop on disease of livestock and pultry held at National Researh Institute*.**24**: P 41.

Pam VA, Daniel LN, Brengshak S, Wai MS, Omalu CJ & Ashi RD (2006).The survey of intestinal parasites of local and exotic chickens slaughtered at Yankari market, Jos, Plateau State. *Journal of Medical and Pharmaceutical Science*, **2**:(3):27-30.

Perry, B. D., Randolph. T. F., McDermoft. J. J., Sones K. R. and Thronton P. K. (2002). Diversity of domesti fowls of cCentanc distrit, South Afria. *African Journal of Agricultural Researh*. **6:** (9). Pp 23.

Singh, J. (1990). Estimation of heterosis in body weight of F1 ross between the local chicken and broiler Ile-Ife, Nigeria. *Agricultural Experimental Station Bulletin*. **5** (4): Pp12-13

Sonaiya,Ologun, E. A.; Daniyan, O.C. and Olori, V.E.(1992). *Health and husbandry aspects of village extensive poutry production in south western Nigeria*.**2:** (3).P 5.

Soulsby, E. J. L (1982). *Helminths, Arthropods and Protozoans of Domesticated Animals*. 7th edition. Bailliere printing press, Tindale, London. Pp 222 – 301

Urquhart GM, Armour J, Duncon JL, Dunn AM & Jennings FW (1987). *Veterinary Parasitology*. Longman Group UK Ltd., England. Pp. 19, 276-277.

Wong, M. C., Siu, K. L. and Jin, D. Y. (2004).Red jungle fowl diversity in Lasani town Pakistan. *World Poultry Journal*. **10** (6): Pp 21-22. Aniset press, 308 Lasani town Sargodha road Pakistan.

Yakubu A., Musa A., Akinsola, O. M., Abimuku, H. K., (2013). *Livestock Research for Rural Development*.Retrieved, from http://www.1rrd.org/1rrd25/1/yaku25018.htm.

Yoriyo, K. P., Fabiyi J. P., Adamu S. and Panda M. S. (2005).Prevalence of gastrointestinal helminths of free range chickens and guinea fowl in Bauchi and environs. *Nigeria Science World Journal*.**2**: Pp 135-139.

Yoriyo, K. P., Adang KL., Adamu S., Panda M.,(2008).*Prevalence of gastrointestinal helminths of free range chickens and guinea fowl in Bauchi*.Bulleting of pure and applied science. **27:** (1): 1-6.