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Collage of Graduate Studies

Prevalence of Gastrointestinal Worms Infections of Poultry in Atbara Locality River Nile State - Sudan

نسبة انتشار الديدان المعوية المعدية في الدواجن بمحليه عطبرة ولاية نهر النيل - السودان

A thesis Submitted to the College of Graduate Studies in partial fulfilLment of requirments for the degree of master in preventive veterinary medicine (M.P.V.M).

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2019

بسم الله الرحمن الرحيم

﴿ ويسألونك عن الروح قل الروح من أمر ربي وما أوتيتم من العلم إلا قليلاً ﴾

صدق الله العظيم

سورة الإسراء الآية (85)

Dedication

To my parents, daughter, brothers and sister.

To my husband with great and deep respect.

Acknowledgements

I thank God for giving me grace to endure until the end .I have been blessed with the presence of many people who have assisted me with this research.

I would like to express my heartfelt gratitude to the professor; Mohammed Abdel Salam, my supervisor for his invaluable guidance, support and advice. I would like to thank staff in the Atbara laboratory for their help and provide all services for my work, including Dr. Khadeeja abdelmajid.

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Abstract

This study was carried out from October 2018 to September 2019, to identify and estimate the prevalence of gastrointestinal worms of poultry in Atbara in River Nile state, Sudan.

A total of 322 faecal samples are collected from 19 poultry farms in Atbara locality. Flotation and sedimentation tests are used for identification of gastrointestinal worms .Out of 78 positive cases,(23,2%)were found positive for nematodes (24%), includes *Ascaridia galli.*

A.galli was the most common gastrointestinal worm was recorded .other worms were *Strongylides avium(5%), capillaria spp*(4%). *heterakis gallinarum* (2.2%) ,whereas were one species of cestodes and this *Raillietina spp* (0.9%) .

الخلاصة:

اجريت الدراسة من أكتوبر 2018 وحتى سبتمبر 2019 لتحديد وتقدير مدى انتشار الديدان المعدية المعوية في الدواجن بمحليه عطبرة بولاية نهر النيل .

اخذت 322 عينه من البراز جمعت من19 مزرعة دواجن بمحلية عطبرة وجدت (78) (24%)منها ايجابيه للديدان المعدية المعوية وقد تم اختبارها بطريقة التعويم والترسيب للتعرف علي الديدان المعدية المعوية. من بين(78) عينه ايجابيه تم العثور على (75) ايجابيه بالديدان الأسطوانية وتشمل (39) مصابه بديدان *Ascaridia galli*.

سجلت *Ascaridia galli* أعلي انتشار(24%) وتليها ديدان *Strongylides avium* وجدت بمعدل انتشار (5%) وتليها ديدان *Capillaria spp* بمعدل انتشار (4%) وتليها ديدان *Heterakis gallinarum* بمعدل انتشار(2.2%).

بينما وجد نوع واحد فقط من الديدان الشريطية *Raillietina* spp بمعدل انتشار(0.9%).

Introduction

Poultry are kept in backyards or commercial systems in most areas of the world, compared to a number of other livestock species, fewer social and religious taboos are related to the production, marketing and consumption of poultry products and one of the most important protein source for man throughout the world. (FAO,2004).In developing countries poultry production offers an opportunity to feed the fast growing human population and provide income resource for pour farmer. Moreover, poultry in many parts of the modern world is considered as the chief source of not only cheaper protein of animal origin but also high quality human food (CSA, 2009).

Various infectious diseases and parasitic infections have been played an important role causing hidden economic losses in the production of poultry meat and eggs with deleterious and debilitating effects on infected birds especially young birds causing decreased feed conversion, retarded growth, interfering development and making them susceptible to secondary infections(B.Anupama , 2016).

Prevalence of gastrointestinal parasites in Desi fowl has been reported by various workers from different parts of the world (Permin *et al*., 2002; Ashenafi and Eshetu 2004; Pinckney et al., 2008; Yehualashet 2011; Percy *et al*., 2012).

Reid (1984 and 1995) reported that over 1400 species of 193 genera belonging to 17 families have been identified from birds. As many as 45species of tapeworms ,belonging to 10 genera have been reported to parasitize domestic fowl (Elowni ,1977) .An invetigation into helminthes infection of domestic fowl in Meghalaya ,India based on autopsy of 532 chickens revealed 90.9% prevalence of infection(yadav *et al*., 1992). Ten

species of helminthes were encountered of which *capillaria contorta* was recorded for the first time from fowls in India: *Ascaradia galli* was the most prevalent species followed by *Raillietina* spp and *heterakis gallinae*. Other helminthes found were *C .annulata*, *Echinolepis carioca*, *Echinostoma* spp and *Strongloids* spp.

Trematodes infections appeared to be very rare helminthes of fowls in this climatic area (affected the presence of their intermediate hosts). (Yadav *et al*., 1992).

Epidemiological studies in other parts of country in view of the changing dynamics of parasitic infections and to follow appropriate control measures (Msoffe *et.al*., 2010).

Objectives of the study:

(1)The aim of this study is to provide on the gastrointestinal worms found in chickens in Atbara, River Nile state.

(2) Prevalence of gastrointestinal worms in Atbara.

Chapter One

Review of literature

1.1Background of gastrointestinal parasites:

Per definition, parasitism is defined as, an intimate and obligatory relationship between to heterospecific organisms during which the parasite, usually the smaller of the two paranters is metabolically depend on the host. According to this definition, for now without further restrictions, all parasites are important as these so called (metabolic dependencies). Lower the performance of the host in different ways and thus, economic losses occur to define which parasites are of major importance in poultry production, their prevalence should be the first criteria according to several studies the most prevalent infections are with the nematodes *Ascaridia galli*, *Heterakis gallinarum* and *Capillaria obsignata* (Permin and Hansen, 1998).

Worms are classified as nematodes (round worm) or Cestodes (tape worms), some worms require an intermediate host and consequently preventing contact with these invertebrates is an obivious step in control and prevention (Leeson and Summer, 2009).Nematodes are the most common and most important helminth species in poultry .More than 50 species have been described in poultry of these majority causes pathological damage to the host (Permin and Hansen, 1998).

[Table 1]: Gastrointestinal helminthes and preferred sites of infection in poultry:

Parasite species	Preferred site (s) of infection
Cestodes	
Choanotaenia infundibulum	Small intestine
Raillietina tetragona	Small ,large intestine
Raillietina cesticillus	Small intestine
Raillietina echinobothrida	Small ,large intestine
Davainea proglottina	Small intestine
Nematodes	
Ascaridia galli	Large ,small intestine
Heterakis gallinarum	Caecum
Capillaria caudinflata	Caecum
Strongyloides avium	Small intestine
Trichostrongloides tenius	Small intestine
Subulura brumpti	Small intestine

Source: (Ohaeri and Okwum ;2013)

1.2 characteristic of Nematodes and Cestodes:

1.2.1 Nematodes:

Nematodes belong to phylum: Nemathelminthes, Class: Nematoda the nematodes of poultry are parasitic, unsegmented worms. The shape is usually cylindrical and elongated, but the cuticle may have circular annulations, smooth, longitudinal striations or ornamentations in the form of cuticular, plagues or spines. All worms have alimentary tract and have separated sexes.

The nematodes or roundworms are the most common internal parasites of chickens. These include *Ascaridia galli* (intestine),

Heterakis gallinarum (ceca) and various *capillaria* species (crop-intestine)These are found through digestive tract as group, The nematodes are characterized by being long spindle shape worms varying in colour from off-white to creamy yellow (leeson and Summer ,2009).

Capillaria contorta and the *capillaria obsignata* are parasites of the crop and intestine respectively. *A .galli* occurs in the jejunum and *Heterakis gallinarum* in the cecum (Simon and Emeritus, 2005).

Ascaridia galli it is a parasitic round worm belonging to the phylum Nematoda and is the most prevalent and pathogenic species, especially in domestic fowl .It causes Ascaridiasis a disease of poultry due to heavy worm infection, particularly in chicken and turkeys. It inhabits the small intestine and can be occasionally seen in commercial eggs.

It is the largest nematode in birds, the body is semi-transparent, creamy white and cylindrical. The anterior end is characterized by a prominent mouth, which is surrounded by three large tri-lobed lips. The edges of the lips bear teeth-like denticles .The body is entirely covered with a thick proteiaceous structure called cuticle ,The cuticle is striated transversely throughout the length of the body and cuticular alae are poorly developed .Two conspicuous papillae are situated on the dorsal lip and one on each of the sub ventral lips (lalchhandana *et al*, 2009) .

These papillae are the sensory organs of nematode. *Ascaridia galli* is diecious with distinct sexual dimorphism .Females are considerably longer and more robust, with vulva opening at middle portion (approximately midway from anterior and posterior ends). The anus at

the posterior end of the body and tail end of females is characteristically blunt and straight.

Males are relatively shorter and smaller with a distinct pointed and curved tail (Ramadan, 1992).

There are also ten pairs of caudal papillae towards the tail region of the body, and they are arranged linearly in well-defined groups such as pre cloacal (3pairs), cloacal (1 pair), post cloacal (1 pair) and sub-terminal (3 pairs) papillae.

The eggs are elliptical with thick shell and are not empryonated at the time of deposition. The length (73-92 x 45-57) μm. (Ruff, 1991)**.**

Heterakis gallinarum*:* is a small, white caecal worm having 3 small equal sized lips on the mouth and has 2 lateral membranes extending almost the entire length of its body. The worm has a distinct oesophagus ending in a well-developed bulb containing a vulvar apparatus. The male is 7-13 mm long, having a well-developed preanal sucker and long alae with 12 pairs of papillae. The spicules are not equal, with the right spicule being slender and 2 mm long and the left being broad and measuring 0.37-1.9 mm long. The female is 10-15 mm long. Its vulva is prominent and is positioned slightly to the middle of the body. It has a long and narrow tail with eggs that are thick-shelled, ellipsoid and unsegmented when deposited. They measure approximately 63-75 x 36-50 μm (Permin and Hansen, 1998).

Capillaria species: are six commonly found in poultry: (*C. annulata*, *C. contorta*, *C. caudinflata*, *C. bursata*, *C. obsignata* (Synonym, *C. columbae)* and *C. anatis)*. All six species have been reported to occur in domesticated and wild birds. Furthermore, all species are cosmopolitan in

their distribution (Soulsby, 1982). *The Capillaria* species are located throughout the intestinal tract. *C. annulata* and *C. contorta* are found in the crop and in the oesophagus. *C. caudinflata*, *C. bursata* and *C. obsignata* parasitizes the small intestine, whereas *C. anatis* occurs in the caeca. The worms of this genus are small and hair like and difficult to detect in the intestinal content. The *C. annulata* males are 15 - 25 mm long and the females are 37 - 80 mm long. The characteristic eggs have bipolar plugs and measured 60 x 25 gm. *C. contorta* males are equal in size to the males of *C. annulata*, but the females are shorter only measuring 27 - 38.mm. The eggs of *C. contorta* are app. 60 x 25gm. *C. caudinflata*, *C. bursata*, *C. obsignata* and *C. anatis* are all smaller only measuring 6 – 35 mm. The eggs measured 45 x 25 μm (Permin and Hansen, 1998).

Subulura brumpti*:* is very common in chickens, turkeys, guineafowls, ducks, pheasants, grouse and quails in North and South America, Africa and Asia (Soulsby, 1982). The adult worms occur in the lumen of the caeca.

The males are 7 - 10 mm long and the females measure 9- 18 mm. The eggs are spherical and thin-shelled (52-64 x 41-49μm).

The adult worms are quite similar in shape and size to *Heterakis* spp. and can be differentiated by microscopical examination of the oesophagus and the spicules.

1.2.2 Cestodes:

Tapeworms belong to the phylum Platyhelminthes, class Cestoda. The tapeworms of poultry are all endoparasitic, hermaphroditic worms with flat, long

Segmented body without an alimentary tract or body cavity. Poultry tapeworm may reach a length of 30-50cm.

They have a scolex (the head) followed by a neck. The rest of the body is called strobila consisting of a number of proglottids (segments) developing from the neck. Each segment contains asset of reproductive organs. The number of segments differs between species. The segments furthest away from the neck mature and detached from the body.

These gravid segments

Contain numerous eggs which are released to the environment with the faeces (Permin and Hansen, 1998).

The most commonly known species: *Davainea proglottina* – (4 mm) and located in the duodenum.

Choanotaenia infundibulum – measured (25 cm) and located in the distal duodenum and jejunum.

Raillietina tetragona- (25 cm) Cestode located in the distal jejunum and *Raillietina echinobothridia* (30 cm) Cestode of the jejunum resulting in nodular granulomas and catarrhal enteritis.

Raillietina tetragona was the only recorded grossly as typical tapeworm structure, it is composed of a series of ribbon-like body segments, gradually enlarging from the anterior end towards the posterior. It is whitish in colour, highly elongated, dorso-ventrally flat, and entirely covered with a tegument. The entire body is divided into 3 parts, namely the head region called scolex, followed by an

unsegmented neck or growth region, and then by highly segmented body proper called strobila. The scolex is a bulbous knob-like structure bearing suckers and a rostellum, which are the organs of attachment to the host. A defining structure from those of other tapeworms is a single prominent rostellum surrounded by four suckers individual segments in the strobila are called 'proglottids' and are entirely covered with hair-like microtriches(Radha.,2006). These microtriches are the absorptive structures for feeding, and there are no Digestive organs. As all other cestodes, they are hermaphrodite. A set of both male and female reproductive systems is present in each proglottid (Baker. 2008).

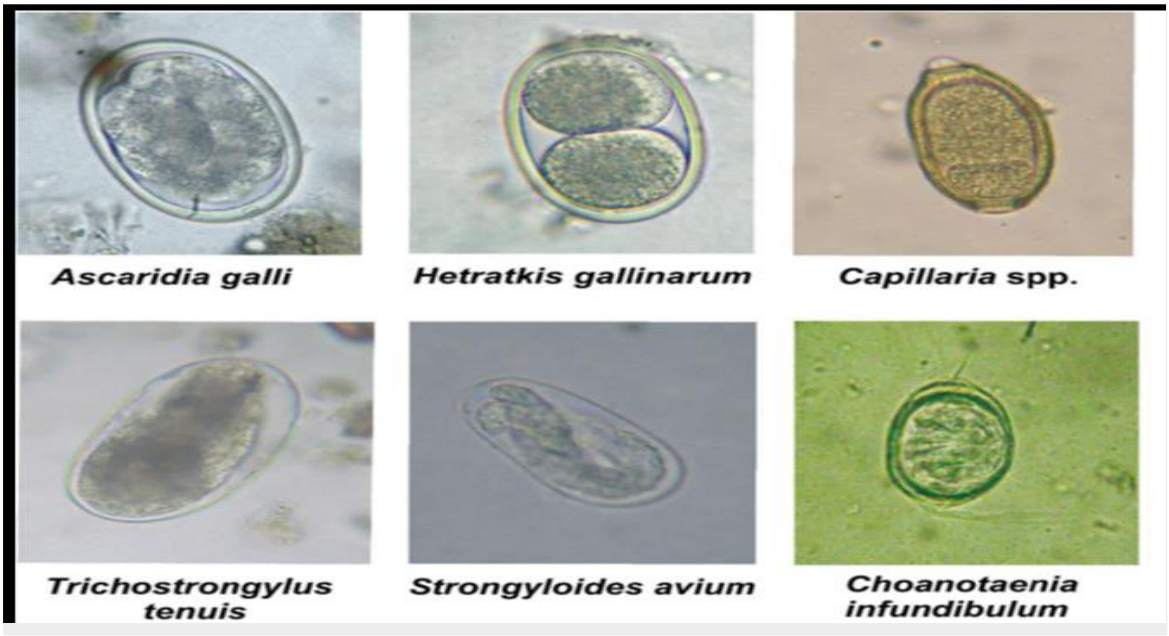

Figure 1: Eggs of some gastrointestinal worms. (Saroj Kumar *et al*., 2013)

1.3General life cycle of Nematodes and Cestodes:

1.3.1Nematodes:

Eggs pass from the definitive host in the caecal droppings .They are contained embryos infective the beetles and cockroaches which are the reported intermediate hosts. The larvae hatch in 4-5 hours, penetrate the intestinal wall, and enter the body cavity where further

development occurs .The first larvae moult on the 4^{th} or 5^{th} day after infection, and by the 7^{th} or 8^{th} day the larvae encapsulate on the intestinal wall and the moult to the second stage occurs between the 13^{th} and 15^{th} days after ingestion. Shortly thereafter the larvae contract in length and coil in shape with the capsule, becoming the third or infective stage, when the definitive host swallows an infected intermediate host, the larvae migrates to the caeca and proceeds to develop to the fourth stage within about 2 weeks. The final moult takes place on about the 18^{th} day after infection. The young adults continue to grow develop and eggs appear in the faeces about 6 week after infection (Somia. 2008).

Ascaridia galli, *Heterakis gallinarum* and *capillaria obsignata* have a direct life cycle (no intermediate host is needed to complete their life cycle which, to some extent, explains the high prevalence rates).

The infection starts with the ingestion of embryonated egg, containing an infective l3-larvae this similar for all of three mentioned nematodes species.

In the case of *A. galli* the larvae hatch a round 24 hours either in the proventriculus o the duodenum of the host, where it lives freely in the lumen for around nine days and then penetrates the mucosa for the tissue phase (histotropic phase).

This tissue phase lasts for 7 to50 days depending on the infection and is causing inflammatory reactions and injures host intestinal cells (Ramadan and Abou zanada., 1991).

After several moltings, *A.galli* reaches maturity and female worms start producing eggs (prepatent period) at an age of 5to 8weeks

depending on hosts, immune status, age and length of histotropic phase (B.Anupama., 2016).

Favourable predilection site is the upper part of the intestine around the liberkuhns glands were this nematode feeds on digesta. Average lengths of the adults vary between 5 to 8cm in male between 6 to12cm in female worms (Ramadan and Abou znada., 1992) making A.*galli* the largest nematode parasite described in poultry.

The life cycle of ***Ascaridia galli*** can be a representative and directly occurred in a single host, involving two principal populations, namely the sexually mature parasite in the gastro intestinal tract and the infective stage (l3). Larvae don't hatch but moult inside the eggs until they reach the l3 stage this can take about two weeks but the period depends on other factors such as the weather condition the life cycle is completed when the infective eggs are ingested by new hosts through contaminated water or feed. The eggs containing the l3_larvae are mechanically transported to the duodenum. The infective eggs are ingested by a chicken where it reaches the proventriculus and hatches (Anderson., 2000). Temperature, carbon dioxide levels and PH are thought to be triggered 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 moults. It is this phase of their life cycle where these worms cause the most damage to their host. They then re-enter the small intestine and develop into adults where they live and feeding on gut content and making a vast amount of eggs that would then be excreted by a host and free to continue their life cycle .If the 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. Transmission to the host can be by earthworms are thought to play a role in transmission.

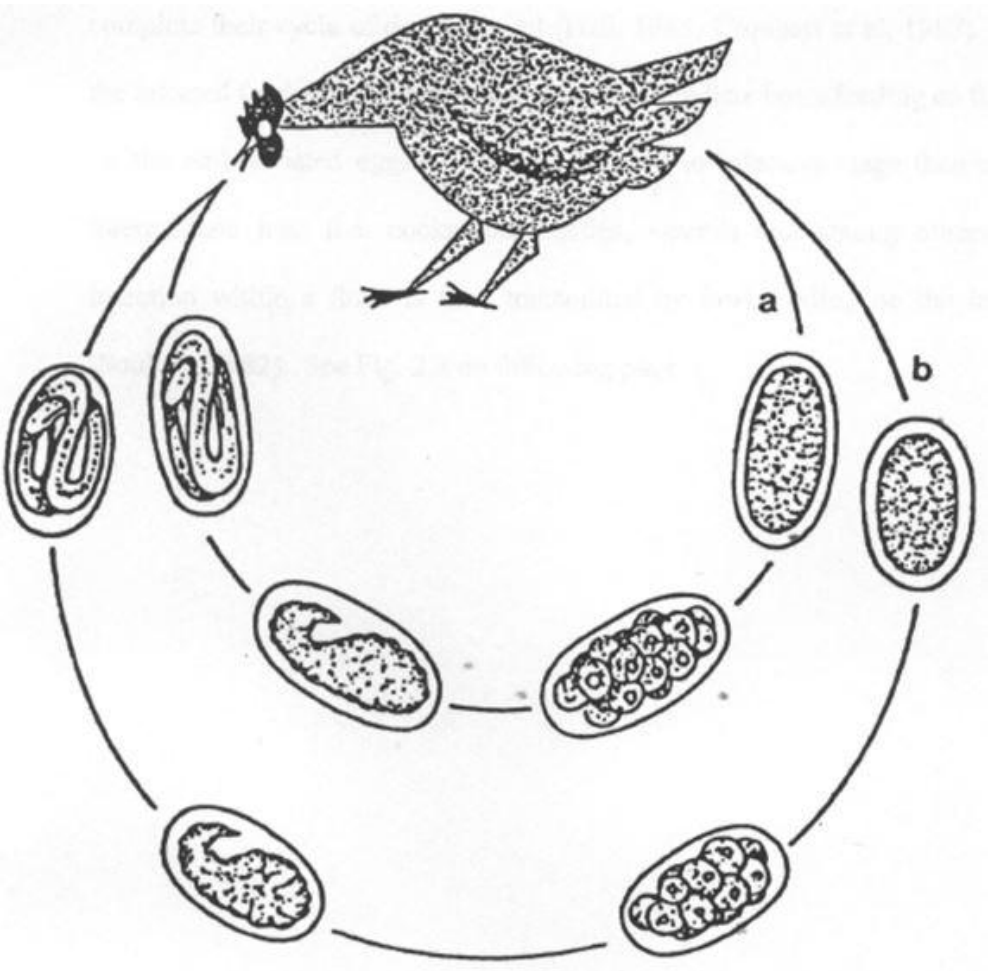

Figure 2: Direct life cycle of nematodes.

The life cycle of *A. galli* (a) and *H.gallinarum* (b). Eggs are passed with the faeces and embryonation of the eggs takes place in the environment. Susceptible host then ingests infective eggs (with L3 larvae). Occasionally earth worms can act as transport hosts (Permin and Hansen, 1998).

Heterakis gallinarum laravae hatches in the upper intestine and within the following 24 hours they reach the caeca representing the final predilection. It is not fully known, if the life cycle of *H. gallinarum* includes a tissue phase.

Some authors described a histotrpic phase, whereas others state just a rare occurrence of tissue phase (Norton and Ruff, 2003) if at all (Bauer, 2006). However, the fact that larval stages are closely associated and occasionally embedded in cecal tissue (Norton and Ruff, 2003), It may lead to misinterpretation and confusion surrounding this phenomenon. Prepatent period of *H. gallinarum* varies between 21 to34 days (Bauer, 2006).Average lengths of the adults vary between 7 to13mm in male and between 10 to 15 mm in female worms (Norton and Ruff, 2003).

Similar lengths and time frame for prepatent period are described for the 'hair like' Capillaria obsignata (Norton and Ruff, 2003).As one may assume by the nick name, a specific characteristic of the Capillaria- species is their width ranging between 33 to 53 μm.

The nematode parasites of poultry that exhibit an indirect life cycle require an intermediate host to complete their life cycle of development; an example here is ***Subulura brumpti*** with

Cockroaches and beetles as intermediate hosts (Ruff, 1991).

After the eggs have passed with the faeces they develop in the

Intermediate hosts finally encapsulating in the intestinal wall after 7-8

days. After another 7 days in the intermediate host the infective L3 larvae have developed. The final host becomes infected when ingesting the infected beetles or cockroaches.

The larvae migrate to the caeca and develop into adults in 6 weeks.

Therefore, in an indirect life cycle when the infected fowl pass their

Droppings, the intermediate hosts feeding on the droppings pick up the embryonated eggs. The development to infective stage then occurs inside the intermediate host (i.e. cockroach, beetles, weevils, and among others, grasshoppers). Infection within a flock is then transmitted by fowl feeding on the intermediate hosts.

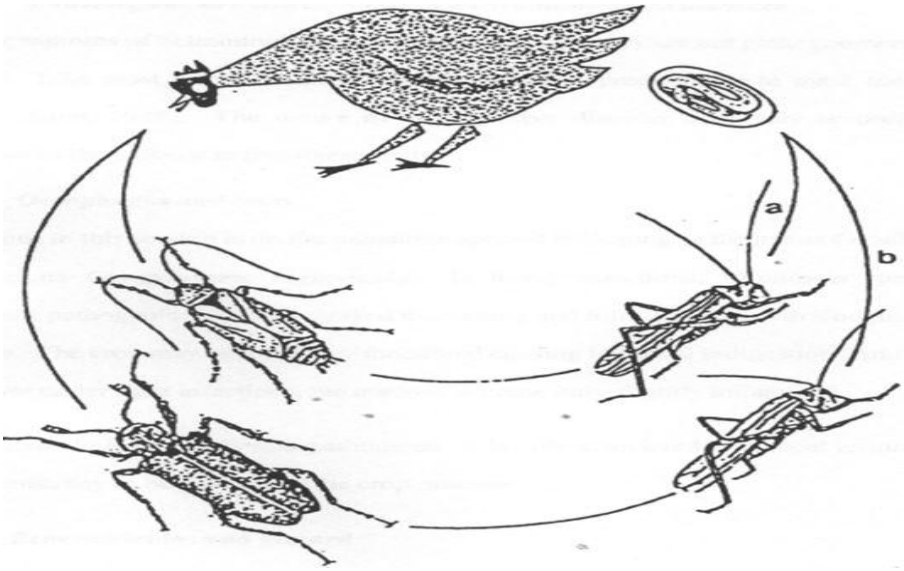

Figure 3: Indirect life cycle of nematodes.

The life cycle of *Tetrameres Americana* (a) and *Subulura brumpti* (b), with embryonated eggs passed in the faeces. The eggs are ingested by the intermediate host such as cockroach, beetles, weevils among others and within which the larvae undergoes development to the infective stage (L3). When the final host ingests the intermediate hosts, the adult worms develop in the proventriculus of the host (Ziela, 1999).

1.3.2 Tapeworms:

Life cycle of poultry tape worms require intermediate hosts. (Reid, 1984) The intermediate host may be swallowed by the host after being attracted by odour or movement.

The eggs hatch in digestive tract and the larvae penetrate the intestinal wall, and enter the body cavity.

The hexacanth embryo develops into a white, bladder- like spherical body known as cysticercoids in the several weeks.

The cysticercoids usually remain alive in the invertebrates intermediate host and become infective to the bird host for many months, for example *Raillietina cesticillus* retains its infectivity for five and half months. Mechanical or chemical actions within the gut of the definitive host free the cysticercoids.

The scolex evagenates, and attaches to the intestinal wall. The cyst wall degenerates and is lost, while strobila proliferates from the neck region to form a new tapeworm.

Most tapeworms require 2-3 weeks prepatent period in the bird to mature and release the first proglottids in the faeces (Reid ,1984).

Life cycle of ***Raillietina species***: The gravid proglottids are passed with the faeces and eggs may survive for a considerable time (years) (Urquart *et al*., 1996). Intermediate hosts such as ants (*Pheidole* and*Tetramorium*), beetles (*Calathus*, *Amara*) and others become infected by ingesting individual eggs. The embryo (larva) hatches from the egg in the intestine of the intermediate host. The larva changes into a cysticercoid and remains in the body cavity of the intermediate host until eaten by the final host. Activated by the bile in the final host, the cysticercoid attaches to the mucosa in the small intestine. Development of proglottids starts immediately. The prepatent period varies between 2 to 3 weeks (Soulsby, 1982).

Life cycle of ***D. proglottina***: That is gravid proglottids are passed out with the faeces. The eggs hatch after being swallowed by various species of gastropod molluscs such as *limax*, Cepaea ,*Agriolimax* and *Arion*.

Cysticercoids develop after 3 weeks and develop into adult tapeworms in 2 weeks upon ingestion by the final hosts (Ruff.1991).

Life cycle of *Choanotaenia infundibulum* that After the eggs have been deposited with the faeces, they hatched in the gut of the intermediate hosts following ingestion .The intermediate hosts are among other beetles of the genera *Tribolium*, *Geotrupes*, *Aphodius* or *Calathus* and the house fly, *Musca domestica*. After development in the intermediate host the cysticercoids are infective for the final host .After ingestion of an intermediate host gravid segments are released with the faeces of the host within 2 weeks. (Soulsby, 1982; Urquart *et al*., 1996).

1.4 pathogenicity and clinical signs of nematodes and Cestodes:

1.4.1 Nematodes:

Ascaridia galli infects fowl of all ages, but the greatest degree of damage is often found in young 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. It results in unthrifitness, drooping of the wing, bleaching of the head and emaciation. It also causes loss of blood, reduced blood sugar content, increased urates ,shrunken thymus glands , retarded growth and greatly increased mortality.

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 faeces (Jacobs .*et al*., 2003).

Extensive *A. galli* infection may reduce egg production in floor housed breeders and commercial layers. Death may occur due to intestinal obstruction in birds which are immune suppressed or are affected by an inter current debilitating condition (Simon and Emeritus, 2005).

The presence of *Heterakis gallinarum* also poses the danger of enhanced transmission of *Histomonas meleagridis* to both susceptible turkeys and other poultry through shedding of the eggs in the environment (Nnadi and George, 2010). Infections with *Capillaria* species can be highly pathogenic for birds kept in deep litter systems or in free-range systems where big numbers of infective eggs may build up in the litter or in the soil. Light infections with *C. contorta* and *C. annulata* produce inflammation and thickening of the crop and oesophagus. Heavy infections produce marked thickening of the oesophagus and crop wall with catarrhal and croupous inflammation. When infections occur in the small intestine or in the caeca (*C. caudinflata, C. bursata, C. obsignata or C. anatis).* The animals become emaciated, weak and anaemic. Bloody diarrhea with hemorrhagic enteritis is seen in heavy infections.

C. obsignata infections are very pathogenic in pigeons and may cause high mortality rates. Clinical signs due to *Subulura brumpti* are rarely seen, but the worm is important as a differential diagnosis to *Heterakis* spp (Permin and Hansen, 1998) .

1.4.2 Cestodes:

More than 1400 tapeworm species have been described in domesticated poultry and wild birds. The pathogenicity of the majority of these tapeworms is unknown. A great number are harmless or have a mild pathogenicity. Few species cause server reactions in the host (Premin and Hansen, 1998).

Chronic infections due to *Raillietina* species are characterized by reduced growth, emaciation and weakness. Of the three species *R. echinobothrida* is the most pathogenic. Nodules and hyperplastic enteritis may develop at the site of attachment. This phenomenon is named "Nodular tapeworm disease" and may occur in heavy infections. Cestodiasis results in emaciation in mature flocks, especially if severe infestation is exacerbated by malnutrition or immunosuppression (Simon and Emeritus, 2005). *Davainea proglottina*, is the most pathogenic of the poultry Cestodes , the doubly armed scolex penetrating deeply between the duodenal villi. Heavy infections may cause haemorrhagic enteritis, and light infections retarded growth and weakness (Urquhart *et al*., 1996).

D. proglottina is, despite of the small size, one of the more pathogenic species, especially in young birds and particularly if it occurs in large numbers. Clinical signs include dull plumage, slow movements, reduced weight gain, emaciation, dyspnea (difficulties in breathing),leg paralysis and death. Microscopically thickened mucosal membrane with haemorrhagic, fetid mucus and necrosis are seen.

Davainea proglottina is worthly because of its association with haemorrhagic enteritis which could complicate anaemic of ectoparasite origin (Nnadi and George, 2010).

The adult *Choanotaenia infundibulum* tapeworms are moderately pathogenic causing weight loss.

1.5 General Epidemiology of Nematodes and Cestodes:

1.5.1 Nematodes:

In Ascaridae, adult birds are symptomless carriers, and the reservoir of infection is on the ground, either as free eggs or in earthworm transport hosts (Urquhart *et al.*, 1996). Few epidemiological studies have been

carried out to investigate the infection and transmission of *A. galli*. It is generally accepted that the establishment of worms in the intestine is influenced by many factors such as the age of the chicken, the size of the infective dose, the age of the infective eggs, the sex of the chickens , and the diet of the host (Permin and Hansen, 1998).

Heterakis gallinarum is widespread in most poultry flocks and is of little pathogenic significance in itself, but is of great importance in the epidemiology of *Histomonas meleagridis*(Urquhart et al., 1996).

1.5.2 Cestodes:

Poultry reared under free range conditions are likely to be infected with Cestodes (tapeworms). All tapeworms of poultry have indirect life cycles with intermediate hosts such as earthworms, beetles, flies, ants or grasshoppers.

The intermediate hosts are essential to perpetuate the life cycle and infections are therefore rare in indoor systems. *Davainea proglottina* that is found worldwide is quite common in traditional and free-ranging poultry (Premin and Hansen, 1998).

1.6 Diagnoses of Nematodes and Cestodes:

1.6.1 Nematodes:

In infections with adult *Ascaridia* worms, the eggs are found in faeces, but since it is difficult to distinguish these from *Heterakis* eggs ,confirmation must be made by post-mortem examination of a casualty when the large white worms are found In the prepatent period, larvae are found in the intestinal contents and in scrapings of the mucosa.

H. gallinarum infection is usually only diagnosed accidentally, by the finding of eggs in faeces or the presence of worm at necropsy *Heterakis isolonche* infection is diagnosed at necropsy by the finding of caecal nodules containing adult worms, and confirmed microscopically by examination of the spicules (Urquhart *et al*., 1996). Parasitism can be diagnosed by examination of mucosal scrapings and faecal flotation, which reveal characteristic of bi-operculated ova (Simon and Emeritus, 2005). When viewed under the microscope, nematodes have transverse grooves running across the body, but unlike the tapeworms they do not physically segment and so only the complete worms are found in the intestine or faeces. Female worms produce eggs which are deposited in the faeces (Leeson and Summer, 2009).

1.6.2Cestodes:

Numerous Cestode species may occur in the intestinal tract and can be diagnosed at post-mortem or by examination of faeces (Simon and Emeritus, 2005).

1.7 Treatment, Prevention, and Control of Nematodes and Cestodes:

When birds are reared on a free-range system and a ascaridiasis is a problem, the young birds should possible be segregated and reared on a ground previously unused by older poultry.

Since nematodes may be a problem in deep litter houses ,feeding and watering systems which will limit contamination of food and water by faeces should be used(Somia., 2008).

Worms may become a problem in conditions of overcrowding and inadequate nutrition, particularly a deficiency of vitamin A which will

make birds more susceptible. The best defence against worms is good management and good diet.

When worms are present the most efficient way to control them is to break the life cycle in some way and so prevent constant re-infestation. Since worm eggs are either ingested by birds directly or via an intermediate host infestation can be significantly reduce by preventing contact between birds and droppings for example keeping them on wire.

A rotational system of poultry runs will reduce the number of viable eggs in the soil, few will remain viable if the run is left vacant for 8 months.

Once a year, or after a heavy worm infestation, the birds should be removed from the run and the ground covered with quicklime at a rate of 0.5 kg per square meter. After three weeks the whole run should be dug over to ensure that the worm eggs are killed.

It is important to introduce young birds onto clean ground that has not been used recently by older birds .young birds have little resistance to worms and will quickly become infected with the worm eggs dropped by older birds.

In the shed and run make sure that there are no damp, dark patches that will provide an environment for worm eggs to survive and become infective. Areas around water troughs present a particular risk.

Wild birds may introduce worms into a previously clean pen and must be excluded if complete control of worms is to be achieved.

It may be difficult to prevent birds having contact with the intermediate hosts of tapeworms but removal of breeding places for house flies will help. Remember when spraying for flies, ants or termites that the

insecticides used may be taken in by the birds and cause poisoning or residue problems in eggs and meat (l. small .,1996).

For the treatment of *A.galli,* 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 in effective for young chicken, while tetramisole is 89-100% effective for chicken of different ages. More recent drugs such as albendazole and levamisole are also highly effective . 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 (Sharma *et al*., 1990).

Treatment for nematodes can be done with piperazine, fenbendazole in feed or levamisole or ivermectin (where permitted) in drinking water (Simon and Emeritus, 2005). When birds are reared on a free range system, and ascaridiasis is a problem; the young birds should, if possible, be segregated and reared on ground previously unused by poultry. Since the nematode may also be a problem in deep litter houses; feeding, and watering systems which will limit the contamination of food and water by faeces should be used. In either case treatment with piperazine salts, Levamisole or a Benzimidazole such as Flubendazole, can be administered either in the drinking water or the feed (Urquhart *et al*, 1996). The traditional worming compounds, used in the feed or water, have been Piperazine and Hygromycin. Hygromycin is usually used at around 750g/tone feed.

While Piperazine use is at 2-3kg/tone feed. Birds can also be treated individually if desired, with about 100mg Piperazine. The traditional wormers are narcotics that paralyze, but do not kill the worm. The worms lose their attachment, and are passed out with the faeces. At this stage, the eggs can still be infective, and so effective treatment must involve 2 or 3 dosages of the wormer, each some 7-10 days apart (Leeson and summer, 2009).

Control over infection simply relies upon breaking the reproductive cycle of the tapeworm, by eradicated the intermediary hosts. Slug and snail bait, usually containing metaldehyde, must therefore be applied around the perimeter of the house. Chemical treatment of infected birds is possible, but a number of these require 24 hours prior starvation of the bird, and so this naturally disrupts egg production in mature birds.

Products such as Praziquantel are effective against tapeworms, while most of the common chemical treatments used for roundworms are ineffective (Leeson and summer, 2009). Niclosamide in feed was recommended as treatment option (Simon and Emeritus, 2005). Control of *Davainea* and *Raillietina* depends on the treatment of infected birds with a suitable anthelmintic such as Niclosamide and butyrate and the destruction of slugs and snails when possible (Urquhart *et al.*, 1996).

Chapter Two:

Materials and methods

2.1: Study area

The study was conducted from October 2018 to September 2019 in and around Atbara locality which is located in the River Nile state in north eastern of Sudan.

The study area is located17.70 latitude and 33.99 longitude and it is situated at elevation 358 meter above sea level (Wikipedia).

2.2 Sample collection and Examination:

Total of 322faecal samples were collected from19 farms of exotic chickens per cloaca where possible or with spatula for freshly voided faeces in sterile sample bottles (screw capped), labeled appropriately and were immediately transported to the laboratory for examinations of the internal parasites using saturated flotation method and sedimentation methods. The flotation solution was prepared by adding salt to a boiled water until the salt could no longer dissolve in the water. The solution was decanted and stored in a sterile bottle for using when needing arises. The procedure was conducted by placing the faecal matter in universal bottle containing10 mls of floatation medium. The mixture was filtered through a double layer of gauze into glass tube, more media was added until a meniscus was formed. A cover slip was placed gently on the tube and allowed to stand on a level surface for at least 10 minutes. The coverslip was carefully removed and placed on a glass slide (Junaidu *et al*., 2014).

The slid was then placed on microscope under magnification powered 10X10 for examination of parasites ova.

3.3 Data analysis:

The obtained results were analyzed using descriptive statistics.

Chapter Three:

Results

3.1 Prevalence of gastrointestinal worms:

Table 2 showed the overall prevalence of gastrointestinal worms infections of poultry in Atbara, River Nile state. Among a total of 322 samples of poultry a number of 78 (24%) samples were found positive for worm infections. The high prevalence of poultry of nematodes in *Ascaridia galli* 39 (12.1%) followed by *Strongylides avium* 16 (5%), *Capillaria spp* 13 (4%) ,and *Heterakis gallinarum* 7 (2.2%), while only species of cestodes was found and this was *Raillietina* spp 3 samples positive (0.9%).

Table 2 : Overall prevalence of gastrointestinal worm infections of poultry in Atbara, River Nile state

Total sample collected	**Positive**	***Nematodes***				***Cestodes***
		Ascaridia Galli	***Strongylides avium***	***Heterakis gallinarum***	***Capillaria spp***	***Raillietina spp***
322	78	39	16	7	13	3
% positive from total samples	24.2	12.1	5.0	2.2	4.0	0.9

In table 3 the high infections of worms were found in farm no.2 (92.3%) and farm no.1 (76.9%). While the infection in farm no. 10 was found to be 54.5%, farm no. 12 (42.9%), farm no. 9 (50%), farm no. 4 (30%), farm no.6 (28.6%), farm no.17 (35%), farm no.19 (33.3%) and farm no. 18 (26.7%). The lowest infection was found in farm no.16 (7.7%). While there were many farms recorded no infections.

Table 3: Positivity of different samples collected from poultry {n=19} farm for gastrointestinal worms infections of poultry in Atbara, River Nile state

Farm no.	**Sample collected**	**No. positive**	**% positive**
Farm 1	13	10	76.9

Farm 2	13	12	92.3
Farm 3	13	0	0.0
Farm 4	10	3	30.0
Farm 5	5	0	0.0
Farm 6	7	2	28.6
Farm 7	20	0	0.0
Farm 8	20	2	10.0
Farm 9	20	10	50.0
Farm 10	22	12	54.5
Farm 11	13	0	0.0
Farm 12	14	6	42.9
Farm 13	11	0	0.0
Farm 14	32	0	0.0
Farm 15	31	0	0.0
Farm 16	13	1	7.7
Farm 17	20	7	35.0
Farm 18	30	8	26.7
Farm 19	15	5	33.3
Total	**322**	**78**	**24.2**

3.2 Nematodes recovered

3.2.1 *Ascaridia galli*

In table 4 the Prevalence of *Ascaridia galli* infection of poultry in Atbara was high in farm no. 2 (92.3%) followed by farm no. 1(76.9%). The lowest infection of *Ascaridia galli* was found in farm no. 16 (7.7%). But no infected with *Ascaridia galli* in the rest of the farms{12 farms}. The overall prevalence of *Ascaridia galli* was found to be 12.1%.

Table 4 : Prevalence of *Ascaridia galli* infections in poultry farms{n=19} in Atbara, River Nile state

Farm no.	Sample collected	*Ascaridia galli*	% Positive
Farm 1	13	10	76.9
Farm 2	13	12	92.3
Farm 3	13	0	0.0
Farm 4	10	3	30.0
Farm 5	5	0	0.0
Farm 6	7	0	0.0
Farm 7	20	0	0.0
Farm 8	20	2	10.0
Farm 9	20	7	35.0
Farm 10	22	0	0.0
Farm 11	13	0	0.0
Farm 12	14	0	0.0
Farm 13	11	0	0.0
Farm 14	32	0	0.0
Farm 15	31	0	0.0
Farm 16	13	1	7.7
Farm 17	20	0	0.0
Farm 18	30	4	13.3
Farm 19	15	0	0.0
Total	**322**	**39**	**12.1**

3.2.2 *Strongylides avium*

The high prevalence of *Strongylides avium* infection was recorded in farm no. 10 (45.5%) followed by farm no.12 (28.6%). The low prevalence of *Strongylides avium* infections was recorded in farm no. 6. However, the rest of the farms recorded no *Strongylides avium* infections as shown in table 5.

The overall prevalence of *Strongylides avium* was found to be 5.0%.

Table 5 : Prevalence of *Strongylides avium* infections in poultry farms {n=19} in Atbara, River Nile state

Farm no.	Sample collected	*Strongylides avium*	% Positive
Farm 1	13	0	0.0
Farm 2	13	0	0.0
Farm 3	13	0	0.0

Farm 4	10	0	0.0
Farm 5	5	0	0.0
Farm 6	7	2	5.0
Farm 7	20	0	0.0
Farm 8	20	0	0.0
Farm 9	20	0	0.0
Farm 10	22	10	45.5
Farm 11	13	0	0.0
Farm 12	14	4	28.6
Farm 13	11	0	0.0
Farm 14	32	0	0.0
Farm 15	31	0	0.0
Farm 16	13	0	0.0
Farm 17	20	0	0.0
Farm 18	30	0	0.0
Farm 19	15	0	0.0
Total	**322**	**16**	**5.0**

3.2.3 *Heterakis gallinarum*

The only infections by *Heterakis gallinarum* were found in farm no. 9 (15%), farm no. 12 (14.3%) and farm no. 10 (9.1%) as shown in table 6 and figure 8.The overall prevalence of *Heterakis gallinarum* was found to be 2.2%.

Table 6 : Prevalence of *Heterakis gallinarum* infections in poultry farms {n=19} in Atbara, River Nile state

Farm no.	**Sample collected**	***Heterakis gallinarum***	**% Positive**
Farm 1	13	0	0.0
Farm 2	13	0	0.0
Farm 3	13	0	0.0
Farm 4	10	0	0.0
Farm 5	5	0	0.0
Farm 6	7	0	0.0
Farm 7	20	0	0.0
Farm 8	20	0	0.0
Farm 9	20	3	15.0
Farm 10	22	2	9.1

Farm 11	13	0	0.0
Farm 12	14	2	14.3
Farm 13	11	0	0.0
Farm 14	32	0	0.0
Farm 15	31	0	0.0
Farm 16	13	0	0.0
Farm 17	20	0	0.0
Farm 18	30	0	0.0
Farm 19	15	0	0.0
Total	**322**	**7**	**2.2**

3.2.4 *Capillaria* spp

Table 7 revealed only two farms infected by *Capillaria spp*. The high prevalence of *Capillaria spp* was found in farm no. 17 (35%) followed by farm no.18 (10%). The overall prevalence of *Capillaria spp* was found to be 4.0%.

Table 7: Prevalence of *Capillaria spp* infections in poultry farms {n=19} in Atbara, River Nile state

Farm no.	Sample collected	*Capillaria spp*	% Positive
Farm 1	13	0	0
Farm 2	13	0	0
Farm 3	13	0	0
Farm 4	10	0	0
Farm 5	5	0	0
Farm 6	7	0	0
Farm 7	20	0	0
Farm 8	20	0	0
Farm 9	20	0	0
Farm 10	22	0	0
Farm 11	13	0	0
Farm 12	14	0	0
Farm 13	11	0	0
Farm 14	32	0	0
Farm 15	31	0	0
Farm 16	13	0	0

Farm 17	20	7	35
Farm 18	30	3	10
Farm 19	15	3	20
Total	**322**	**13**	**4.0**

3.3 Cestodes recovered:

3.3.1 *Raillietina* spp

Table 8 showed + v e only two farms were infected by cestodes and *Raillietina spp*. The prevalence of *Raillietina* in farm no.19 was found to be (13.3%) followed by farm no. 18 (3.3%). The overall prevalence of *Raillietina* was found to be 0.9%.

Table 8: Prevalence of *Raillietina* infections of poultry farms {n=19} in Atbara, River Nile state

Farm no.	**Sample collected**	***Raillietina spp***	**% Positive**
Farm 1	13	0	0.0
Farm 2	13	0	0.0
Farm 3	13	0	0.0
Farm 4	10	0	0.0
Farm 5	5	0	0.0
Farm 6	7	0	0.0
Farm 7	20	0	0.0
Farm 8	20	0	0.0
Farm 9	20	0	0.0
Farm 10	22	0	0.0
Farm 11	13	0	0.0
Farm 12	14	0	0.0
Farm 13	11	0	0.0
Farm 14	32	0	0.0
Farm 15	31	0	0.0
Farm 16	13	0	0.0
Farm 17	20	0	0.0
Farm 18	30	1	3.3
Farm 19	15	2	13.3
Total	**322**	**3**	0.9

Chapter Four:

4.1 Discussion

The study determined the prevalence rate of gastrointestinal worms of poultry farms in Atbara. The findings of the study indicated low prevalence of gastrointestinal worms in exotic chickens in poultry farms at Atbara locality.

This outcome might be indication of lower availability of infection stage of the worm in the study area and the inability of the infective stage of the worms to survive outside the host for a long time befor picked by the host due utilize disinfectant. Another reason for low prevalence could be due to the ability of owners to feed chicken with good nutrition which unexposed the chickens to feed on insects, mites, worms.

Out of 322 samples examined,78 samples were found to be infected which accounted for 24%.

Four species of nematodes were identified whereas only one species of cestodes were seen.

Trematodes were not observed in the study as snails and fish serve as intermediate hosts. Poultry are found in the chicken cage and rarely have access the aquatic condition, which are habitats of these intermediate hosts.

Most works on the prevalence of gastrointestinal worms in Sudan were done on local breeds of chicken. This observation had been made by many authors (Eisa *et al*,1976 and Ali.,1994) and investigated the parasite load of local breeds of chicken reared at backyard husbandry and study

revealed that chicken load regarding nematodes was[42.6%]in Khartoum state, and Cestodes was(67.3%).

Ali(1994) found that occurrence of nematodes and cestodes was similar (69.39%) and the type of nematodes reported in this study were *Ascaridia galli* and *Subulura brumpti* . This in agreement with (Eisa *et al.*,1976) and(Ali.,1994). However, (Eisa *et al*., 1976) found *Tetrameres Americana, congylonema ingulvicola* and *acuaria spiralis* ,which were not found in this study.

The prevalence of *Ascaridia galli* was 2% in Khartoum state , while Ali (1994) reported that it was(4.08%) . *A. galli* was found only in Bahery area in combination with *Choanotaenia infundibulum* which was agreement with(Eisa *et al*.,1976) and Ali (1994).

(Somia ;2008) investigated helminth and blood parasites of the local breeds of chicken in Khartoum state Sudan the results of study revealed that chicken regarding nematodes found *Subulura brumpti* (59%) and *Ascaridia galli* not recorded in Khartoum locality. While in Bahery locality *S.brumpti* recorded (43.2%) and *A. galli*(4%) .In Omdurman locality *S. brumpti* (20%) and *A. galli* not reported and cestodes found in Khartoum locality were highly infected by *Choanotaenia infundibulum* (66.1%) and lower prevalence of *Raillietina tetragona* (14%).

Similarly, Bahery locality was highly infected with *C.infundibulum* (52.3%) and had low prevalence of R. tetragona (4.5%).

Omdurman locality appeared to show similar result to Bahery and Khartoum and *C. infundibulum* (63.3%) and *R. Tetragona* (6.7%).

4.2 Conclusion and Recommendations

✓ Since most of gastrointestinal parasites have a subclinical occurrence ,studies in focus of these ideas should be conducted.

✓ It is therefore absolutely necessary that prevention and control measures with beter management system be introduced and public awareness scheme be introduced into communities.

✓ Institution of programmed control measure for improved harnessing of the potentials of poultry production in this state be put in place.

✓ Beter if experimental studies be conducted on the conjoint prevalence and economical effect of gastrointestinal .

✓ Proper education of poultry farmers on the risk factors appropriate stocking densities and the using of good and treated water help to reduce prevalence rate of these infection.

✓ Proper veterinary services to control parasites and their intermediate hosts of local and farm chickens in river Nile state for the purpose of increasing their productivity. Thus this is expected to increase the income of resource-poor families and commercial production.

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Approval Page

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.....prevalence of Gastrointestinal Worms infections of poultry in Athara Locality River nile State sudan.....

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