SURVEY OF INTERNAL PARASITES IN SHEEP AND GOATS IN THE WHITE NILE STATE – SUDAN (APRIL – MAY 2009)

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DEDICATION

TO

MY

PARENTS

I
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The present study was carried out in the White Nile State during the period of April – May 2009 to determine the prevalence rate of internal parasites in sheep and goats. A total of 409 animals were examined in four areas of which 51, 53 and 50 animals from each species in Al gazeera Aba, Rabak and Kosti areas, respectively. Besides, 51 sheep and 50 goats were examined in Omjar area. For detecting the ova and ooysts, fecal samples were collected directly from the rectum and examined using the floatation method and the modified McMaster egg counting technique for counting nematode eggs and coccidian oocysts. The sedimentation method was used for trematode eggs. The results indicated that gastrointestinal parasites are common in sheep and goats and that overall parasites egg counts were higher in the goats.

The overall prevalence of infection in sheep and goats was 79%, and about 36% – 57% of sheep and 41% – 44% of goats had single infections. The parasites detected were *Coccidia* (41.2% in sheep and 50.2% in goats), *Strongylids* (24.5% in sheep and 31.2% in goats), *Schistosoma* (23.0% in sheep and 26.8% in goats), *Monezia*(25.5% in sheep and 15.6% in goats), *Fasciola* (5.9% in sheep and 6.8% in goats), *Paramphistomum* (2.0% in sheep and 2.9% in goats), *Trichuris* (0.5% in sheep and 2.9% in goats), and *Strongyliodes* (0.97% in goats). In general, the prevalence of parasitic infections were higher in goats than in sheep (81.95% and 76.96% respectively) and that *Coccidia, Strongylids* and *Schistosoma* infection were the most obvious.
Data obtained from official records and from animal owners indicated that the owners are aware of the importance of internal parasites on the health and productivity of their animals. They treat their animals using anthelmintics, but they do not usually abide by treatment protocol. In general, sheep seem to be more attended than goats, and this may explain the higher prevalence of parasitic infection in goats.
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(2009 ...)
بسبب الانتشار المعتدل، يمكن القول إن الماء الأكبر في الطفيلة يتم تغذيته من الماء العذب.
INTRODUCTION

Sheep and goats are important livestock species in developing countries, because of their ability to convert forages, crops and household residues into meat, fiber, skins and milk (FAO, 1985). 96% of the milk and meat producing goats and sheep populations are found in developing countries, and 4% are found in developed countries. The total milk production for goats and sheep was 13.8 and 8.7 million tonnes respectively while meat quantity was 8.6 million tonnes for sheep and 4.9 million tonnes for goat worldwide (FAO, 2008).

Goats play an important socioeconomic role in rural areas especially for women who are among the most poor resource farmers in Africa. They are prolific and require low inputs for a moderate level of production, reach maturity early and are profitable to keep (Deyendrac and Burns, 1970).

Gastro-intestinal (GI) nematode and trematode (fluke) infections of ruminant livestock cause major problems in the developing world. These parasites are difficult to manage because in some cases they develop resistance to all available commercial dewormers and resistance to dewormers is now see worldwide (Zajac and Gipson, 2000; Kaplan, 2004).

Economic losses incurred by these parasites include reduced animal performance and weight gain, condemnation of whole carcass or affected organs at slaughter, cost of treatment, and mortality in severe cases (Over et al., 1992; Nari et al., 1997; Gatongi et al., 1997; Perry and Randolph, 1999; Perry et al., 2002). The main nematodes causing severe losses to the livestock industry, are *Trichostrongyles, Haemonchus*
contortus, Oesophagostomum spp, Cooperia spp and Trichostrongylus spp (Waller, 2006). Haemonchus contortus is a blood-sucking nematode of the abomasum in small ruminants, It is responsible for extensive losses and huge animal welfare problems globally and it is associated with clinical and pathological manifestations that include hemorrhagic anemia, hypoproteinemia, and parasitic gastroenteritis (Ahmed and Ansari, 1989; Albers et al., 1990).

Infections by liver flukes (Fasciola spp) also result in major economic losses in sheep and goats (Anonymous, 1994; Hansen and Perry, 1994; Urquhart et al., 1996). The construction of dams and the establishment of irrigation systems have further increased the distribution of these parasites by creating favorable environments for their snail intermediate hosts (Anonymous, 1994). Small liver flukes (Dicrocoelium spp) and rumen flukes (Paramphistomum spp) are less important parasites, but may cause sporadic losses in small ruminants (Anonymous, 1994; Urquhart et al., 1996).

Coccidiosis in small ruminants is mainly caused by the Eimeria species (Soulsby, 1982). Heavy infections will result in severe diarrhoea which sometimes contains blood and diagnosis can be done through faecal examination for oocyst identification (Urquhart et al., 1996).
Aims of the study
The present study is, therefore, aimed at surveying the parasitic infections of goats and sheep grazing together at the same pasture in the white Nile State of the Sudan during the dry season of the year in four areas.

Specific objectives:
- survey the internal parasite affecting sheep and goats grazing at same pasture.
- determine the load of the parasites.
- To compare the susceptibility of sheep and goats to parasite infection.
CHAPTER ONE

LITERATURE REVIEW

1.1. Helminthoses:
Helminth infections, or helminthoses, refer to a complex of conditions caused by the Nematod, Cestod and Trematod parasites. Although all grazing sheep and goats may be infected with the above-mentioned parasites, low worm burdens usually have little impact on animal health. But as the worm numbers increase, effects in the form of reduced weight gain and decreased appetite occur. With heavier worm burdens clinical signs such as weight loss, diarrhoea, anaemia, or sub-mandibular oedema (bottle jaw) may develop (Lughano and Dominic, 1996).

Parasitic helminths of small ruminants belong to the phyla Platyhelminthes (flatworms) and Nemathelminthes (roundworms) (Soulsby, 1982; Urquhart et al., 1996). The former phylum has two classes Cestode (tapeworms) and Trematode (flukes). The most important cestode parasites of ruminants, both in terms of public health and veterinary medicine, belong to the family Taeniidae. Adult cestode parasites of the genera Moniezia, Avitellina, Thysanosoma and Stilesia are common parasites of small ruminants in African countries (Urquhart et al., 1996).

All of the trematode species that are parasitic in small ruminants belong to the subclass Digenea. The most important of these species in Africa are the liver flukes, Fasciola hepatica, Fasciola gigantica and Dicrocoelium spp., and rumen flukes (Paramphistomes),
Paramphistomum spp (Soulsby, 1982; Anon, 1994; Hansen & Perry, 1994; Urquhart et al., 1996).

The causes of helminth parasitism in ruminant livestock are multiple and often interactive, the vast majority of cases are due to any of the following basic reasons.

(1) An increase in the number of infective stages on pasture
(2) An alteration in host susceptibility
(3) The introduction of susceptible stock into an infected environment
(4) The introduction of infections into an environment
(5) Ineffective parasite removal from the host animals due to the use of sub-standard anthelmintic doses and/or the development of anthelmintic resistance (Urquhart et al., 1996).

1.1.1. Nematode:

The Nemathelminthes (nematodes) include several superfamilies of veterinary importance. These are Trichostrongyloidea, Strongyloidea, Metastrongyloidea, Ancylostomatoidea, Rhabditoidea, Trichuroidea, Filarioidea, Oxyuroidea, Ascaridoidea and Spiruroidea. The Gastrointestinal nematodes of greatest importance in small ruminants are members of the order Strongylida, which contains the first four superfamilies, Trichostrongyloidea, Strongyloidea, Metastrongyloidea, Ancylostomatoidea, but most belong to the superfamily Trichostrongyloidea. All grazing sheep and goats are infected with a community of these Strongylid nematodes, whose combined clinical effect is the condition known as parasitic gastroenteritis (Zajac, 2006).

The most common species of nematodes associated with parasitic gastroenteritis in small ruminants in most sub-Saharan countries are Haemonchus contortus, Oesophagostomum columnatum, Trichostrongylus
colubriformis, Trichostrongylus axei, Bunostomum trigonocephalum, Cooperia curticei, Trichuris ovis, Trichuris globulosus, Strongyloides papillosus, Gaigeria pachyscelis and Chabertia ovina. Lungworms such as Dictyocaulus filaria, Muellerius capillaris and Protostrongylus rufescens cause parasitic bronchitis particularly in young animals. Haemonchus contortus, Teladorsagia circumcincta and Trichostrongylus spp. (T. axei, T. colubriformis and T. vitrinus) are the most important, (Hansen & Perry, 1994; Lughano & Dominic, 1996).

1.1.1.1. Life cycle:
The life cycles are direct, requiring no intermediate hosts, which applies to all of the economically important Strongylid parasites of small ruminants (Hansen & Perry, 1994; Urquhart et al., 1996). In these cycles, adult female parasites in the GI tract produce eggs that are passed out with the faeces of the animal. Development occurs within the faecal mass, the eggs embryonate and hatch into first-stage larvae (L1), which in turn moult into second-stage larvae (L2), shedding their protective cuticle in the process. During this time the larvae feed on bacteria. The L2 moult into third-stage larvae (L3), but retain the cuticle from the previous moult. The L3 constitute the infective stage, and these migrate onto surrounding vegetation where they become available for ingestion by grazing sheep and goats. Following ingestion, the L3 larvae pass to the abomasum or intestine, where they ex-sheathe. The L3 of the Trichostrongyle worms penetrate the epithelial layer of the mucus membrane (in the case of Haemonchus and Trichostrongylus) or enter the gastric glands (Teladorsagia). In normal development, the L3 moult within 2–3 days to become fourth-stage larvae (L4), which remain in the mucous membrane or in the gastric glands for a
further 10 to 14 days. Finally, the L4 emerge and moult to become young adult parasites. The time between ingestion of L3 and the parasite becoming mature adults (referred to as the prepatent period) which varies between parasite species, but generally is between 3 and 5 weeks. *Nematodirus*, *Trichuris*, *Bunostomum* and *Strongyloides* species are exceptions to the life cycle.

*Nematodirus* species, the larval stages develop inside the eggshell which is extremely tough, resistant to drought and freezing. Larvae take a very long time to develop and eggs dropped in early summer will have reached 3rd stage infective larvae by autumn at the earliest. *Trichuris* adult lives in large intestine. Female lays eggs that pass through feces and infective larvae develops in the eggs within few weeks. In moist surrounding *Tirchuris* eggs remain viable for months or a year. *Bunostomum* eggs require few days after passage in feces before infective larvae are produced. The larvae enter the body via skin or mouth. *Strongyloides* lay embryonated eggs. The eggs hatch quickly, and the larvae escape into the lumen of the small intestine. Some pass out of the body with the faeces, others develop quickly and penetrate the body through the side of the lower intestine, and migrate through the tissues until they reach the small intestine where they also become adults and reproduce. In this way *Strongyloides* multiply in the body (Soulsby, 1982; Urquhart *et al.*, 1996; Fritz *et al.*, 2001).

### 1.1.1.2. Factors affecting nematode abundance:

The epidemiology of parasitic diseases depends on factors such as the infection pressure in the environment and the susceptibility of the host species (or individual). The infection pressure, in turn, depends on factors that affect the free-living and intermediate stages, such as
temperature, rainfall and moisture. Furthermore, the availability of large numbers of susceptible definitive and intermediate hosts will increase the parasites’ ability to reproduce and result in high parasite abundance (Torgerson & Claxton, 1999).

1.1.1.2.1. Climatic factors:

The development, survival and transmission of the free-living stages of nematode parasites are influenced by micro-climatic factors within the faecal pellets and herbage. These include sunlight, temperature, rainfall, humidity and soil moisture (Lughano and Dominic, 1996). Under optimal conditions (high humidity and warm temperature), the development process takes 7 to 10 days (Soulsby, 1982; Hansen & Perry, 1994; Urquhart et al., 1996). In most African countries, the temperatures are usually favourable for larval development in the environment. Development of *Trichostrongylid* larvae occurs in a temperature range of approximately 10 – 36 °C, No development of *Trichostrongylid* larvae occurs below 5°C while temperatures above 40°C are lethal (Lughano and Dominic, 1996). The optimal humidity requirement for freeliving stage development of most species is 85%. Although desiccation is lethal for the free-living stages of parasite worms, the important nematode parasites can survive such conditions either as embryoynated eggs or as infective larvae (Donald, 1968; Tembely, 1998; O'Connor et al., 2006). The L3 of *Trichostrongylid* nematodes may survive for varying periods, depending on species and particularly the prevailing weather conditions. In the desiccated state L3 can survive for several months, but once hydrated they become active and rapidly exhaust their food reserves (Tembely, 1998; Torina et al., 2004; O'Connor et al., 2006).
Higher worm burdens and outbreaks of parasitic gastroenteritis in goats and sheep in sub-sahara regions are encountered during or immediately after the end of the rainy season (Lughano and Dominic, 1996). In the arid tropical climates of lowland areas of Ethiopia, parts of Somalia and Sudan, there exists an environmental gradation which ranges from deserts, to extensive pasturelands and browse plants, to intensive grazing areas around permanent water courses (lakes and rivers) and irrigated land. Thus, there exists a change of environments, which range from being hostile to those that are most favourable for development and survival of free-living stages of the parasites (Sissay, 2007).

Some Trichostrongylid larvae such as *Trichostrongylus colubriformis* and *Oesophagostomum columbianum* are known to be resistant to desiccation and this ability enables them to survive under extremely low or high temperatures (Lughano and Dominic, 1996).

Gastrointestinal nematodes can survive harsh conditions by hypobiosis or arrested development of larvae (usually L3 or early L4) within the host. In the absence of hypobiosis nematodes survive in hosts during the hot and dry season as adults. In general the humid tropical climate is favourable for the survival, development and transmission of gastrointestinal nematodes (Donald, 1968; Hansen and Perry, 1994; Urquhart *et al.*, 1996). However, the combined effects of these factors are responsible for the seasonal fluctuations in the availability of L3 on pasture, and subsequently in the prevalence of worm burdens in the hosts. This seasonal variation of parasite population dynamics has been described in a number of studies in many African countries (Assoku, 1981; Vercruysse, 1983; Van Wyk, 1985; Fakae, 1990; Fritsche *et al.*, 1993; Maingi *et al.*, 1993; Pandey *et al.*, 1994; Tilahun, 1995; Tembely *et al.*, 1997; Nginyi *et al.*, 2001; Debela, 2002).
1.1.1.2.2. **Management systems:**

Management systems for the animals have a strong influence on the epidemiology of gastrointestinal nematodes. High stocking density increases the contamination of the environment with nematode eggs or larvae and thus makes the infective stages to be more accessible to susceptible animals. High stocking rates and intensive management with little or minimal rotational grazing, are associated with high pasture contamination and outbreaks of clinical helminthosis. On the other hand, low stocking rates and extensive management systems in the traditional husbandry systems preclude a built-up of high worm burdens. The concentration of animals at watering points particularly during the dry season may also result in massive contamination of pastures with eggs or larvae leading to outbreaks of parasitic gastro-enteritis. In addition to contributing to pasture degradation and soil erosion, this forces the animals to graze closer to faecal material, which results in the uptake of higher numbers of infective larvae (Lughano and Dominic, 1996).

Anthelmintic treatment reduces the prevalence and severity of gastrointestinal nematode infections and may significantly influence their epidemiology (Lughano and Dominic, 1996), but developed resistance to one or more of the available anthelmintic groups has threatened the efforts of control globally (Sangster, 1999; Jackson and Coop, 2000; Kaplan, 2004; Miller and Waller, 2004; Waller, 2006).
1.1.1.2.3. Host factors:

The incidence rate and severity of infection with gastrointestinal nematodes can also be influenced by host factors such as age, breed, nutrition, physiological state and presence or absence of intercurrent infections, for instance, kids and lambs are known to be more susceptible than adults and there is a tendency for the worm burdens in goats and sheep to decrease with increasing age. Some breeds of goats and sheep are known to be genetically resistant to gastrointestinal nematodes infections than others (Lughano and Dominic, 1996). For example in sheep and goats, adult female nematodes may increase their egg output around the time of parturition. This phenomenon, known as the peri-parturient rise (PPR), is of great importance in the epidemiology of nematodes of small ruminants, and has been reported in different African countries (Connan, 1976; Agyei et al., 1991; Tembely, 1995; Ng'ang'a et al., 2006). A PPR in nematode egg excretion has been observed as early as two weeks before lambing and kidding, and persisted up to 8 weeks post-partum when lambing and kidding took place during the wet seasons, Thus, pregnant, or lactating, ewes become the major source of infection for the new-born lambs and kids. (Zajac et al., 1988; Agyei et al., 1991; Tembely, 1995; Ng'ang'a et al., 2006; Sissay, 2007).

1.1.1.2.4. Parasite factors:

The intrinsic multiplication rate of the nematode species determines the rate of establishment and size of nematode burden in the host. The multiplication rate is determined by the fecundity of the adult worms, the prepatent period and the survival and development rate of the parasite in the environment. For example, Haemonchus contortus is one of the most
prolific nematodes; a female *Haemonchus contortus* may produce thousands of eggs each day, and larval numbers on pasture can rapidly increase during the wet seasons (Soulsby, 1982; Hansen and Perry, 1994; Urquhart *et al.*, 1996). *Oesophagostomum columbianum* also have a high biotic potential such that establishment of these nematodes occurs very rapidly as long as environmental factors are favourable. *Trichostrongylus spp* has a lower biotic potential and hence its establishment is slower (Lughano and Dominic, 1996).

1.1.2. Trematodes:
The life-cycles of important trematode species (*Fasciola hepatica, Fasciola gigantica*, *schistosoma. Spp, Parampistomum .spp and Dicrocoelium .spp*) of small ruminants all involve intermediate hosts such as different species of aquatic or terrestrial snails, and ants for *Dicrocoelium* species (Urquhart, *et al.*, 1996).

Fluke infections in small ruminants depends on many variables, including the presence of suitable intermediate hosts as well as favourable climatic and ecological conditions. Such environmental factors include temperature, rainfall, humidity and moisture. The factors influencing the development and survival of both the larval stages of the flukes and their intermediate hosts are similar to those of the nematode parasites (Anon, 1994; Hansen and Perry, 1994; Urquhart *et al.*, 1996; Torgerson and Claxton, 1999).

In most parts of Africa, the temperatures and moisture are favourable for embryonation and hatching of the fluke eggs, development and survival of fluke larvae in the intermediate host, as well as for breeding of the snail host. In those African countries with distinct wet and dry seasons, it appears that optimal development of eggs to miracidia occurs at the beginning of the wet
season, and development within the snail is complete by the end of the rains. Shedding of cercariae commences at the start of the dry season, when the water level is still high, and continues as the water level drops. The animals then ingest the metacercariae while grazing on these areas during the dry season, and clinical problems, occur at the end of that season or at the beginning of the next wet season, depending on the rate of infection (Urquhart et al, 1996).

The most important intermediate host in the transmission for F. hepatica is the aquatic snail, Lymnaea truncata which is widespread. Lymnaea auricularia being most important intermediate of Fasciola gigantica. Lymnaea natalensis in Africa has also been found to serve as an intermediate host of Fasciola gigantica. Snails such as Planorbis spp and Bulinus spp serve as intermediate hosts of Paramphistomum spp. (Soulsby, 1982).

1.1.2.1. Life cycle:
Adult Fasciola spp lay eggs in the bile ducts and the eggs are transported to the gall bladder through the bile. When the gall bladder contracts the eggs enter the duodenum and then are expelled from the host with the faeces. Under optimum conditions of temperature and moisture the eggs hatch into miracidia. The latter actively penetrate snail hosts and develop through the sporocyst, redial and cercarial stages. The cercariae leave the snail hosts, encyst onto herbage just below the water level and become metacercariae, which are the infective stage. The metacercariae are ingested by grazing animals with infected herbage or water. They excyst in the duodenum, penetrate the intestinal wall and pass through abdominal cavity to the liver where they penetrate the liver capsule. The immature flukes migrate in the
liver parenchyma and then enter the bile ducts where they mature and start to produce eggs, (Soulsby, 1982).

The transmission of *Paramphistomum spp* is similar to that of *Fasciola spp*. However, after excystation and attachment in the duodenum, the immature *Paramphistomes* migrate up the alimentary tract and finally attach to the epithelium of the rumen and reticulum (Soulsby, 1982). The immature *Paramphistomes* in duodenum and ileum are plug feeders and cause haemorrhage which leads to bleeding and diarrhoea and bleeding for a prolonged period may cause anaemia, which further weakens the host (Soulsby, 1982).

*Schistosomes* have a complex life cycle, in which *cercariae*, free-living in fresh water, can penetrate healthy human skin. The head of the cercaria transforms into an endoparasitic larva, the *schistomule*. The *schistomules* pass several days in the skin then enter the venous circulation and eventually migrate to the lungs. They then travel through the circulatory system to the hepatoportal circulation where they mature into adult worms and mate. Depending on the species, the *schistosomes* migrate to their final infection site either on the bladder or the intestine where the females begin egg production. These eggs are attached to the wall of the lumen. The eggs penetrate the wall of the lumen, this is assisted by lytic factors secreted from the eggs and by forceful piercing of the tissues by the pointed end of the egg. They are then expelled in the feces or urine. The *miracidium*, liberated from the egg, seek out snail hosts where they enter a *sporocyst* stage that eventually results in free-living cercariae that seek out hosts (Fritz et al., 2001; Soulsby, 1982; Christensen et al., 1983; Semuguruka, 1992). In Sudan there are two species of *Bulinus*, (intermediate host of *Schistosoma*) found along the White Nile from Kosti to the Jabal Aulia Dam.
(William and Hunter, 1968). *Bulinus truncatus* and *Biomphalaria pfeifferi* snails has been reported by Sulaiman and Ibrahim (1985) in the same area.

### 1.1.2 Cestodes

The cestodes have indirect life cycles and the intermediate host may be the soil-inhabiting oribatid mites such as *Oribatula spp, Galumna spp* in case of *Moniezia* (Soulsby, 1982).

#### 1.1.2.1 Life cycle

The adult worms are found in the small intestine of goats and sheep. Proglottids and eggs are passed out in the faeces of the infected animal. In the environment, the eggs may be ingested by oribatid mites where they develop into *cysticercoids*. The *cysticercoids* which are the infective forms are produced in 4 months. Ruminants are infected by the ingestion of the infected mites with herbage. The prepatent period is 37-40 days (Soulsby, 1982).

#### 1.2. Coccidia:

These organisms are typical intracellular parasite. They occur chiefly in vertebrates and the majority of those of medical or veterinary importance belong to the families *Eimeriidae* and *Sarcocystidae*. The organisms are, with a few exception, intracellular parasites of epithelial cells. They have single host. Can multiply asexually and sexually (Soulsby, 1982).
1.2.1. Life cycle:

According to Soulsby (1982), the oocyst, which contains a zygote, is extruded from host tissues and passed to the exterior in the faeces. This is the resistant stage of the life-cycle, and under appropriate conditions it forms the mature infective oocyst. In the sporulated oocyst, there are four sporocysts in Eimeria and two Sporocysts in Isospora.

The parasite life-cycle of the coccidia is initiated when the infective oocyst is ingested by the appropriate host. Excystation releases the contained sporozoites, which enter the epithelial cell and become rounded up, as trophozoite. Within a few days, the nucleus of the trophozoite divides to become schizont (the first generation of schizogony). When the schizont is mature, the first generation merozoites are released and the number of merozoites varies according to species. Merozoite enters other epithelial cell in the area and continue the cycle of asexual development. In new host cell, the merozoite first round up to become trophozoite and then undergoes multiple fission as before. The second generation merozoite may proceed to a third or more generation of asexual reproduction or they differentiate into sexual or gametogonous form. The factors responsible for the initiation of the gametogonous cycle are not fully understood. Although it is generally considered to be genetically determined. Host responses may play a role, through phenotypic determination in termination of schizogony, and there are two distinct types of schizont and merozoite of both the first and second generation found in area of the intestine where microgamont or macrogamont developed. The microgamont arises in the same way as the macrogamont, but as it enlarges, the nucleus undergoes multiple division with production of a large number of microgametes. Liberated the microgametes will fertilize the macrogametes to form zygote. With a few
exception, sporulation does not occur until the oocyst is shed to the exterior of the body. The time required for sporulation to the infective stage is specific feature of each species of coccidia and used as a characteristic in identification. Oxygen and adequate moisture are necessary for the sporulation. The optimum temperature for sporulation is about 30°C in general.

1.3. Diagnosis of parasites in small ruminants:
The diagnosis of parasites of small ruminants is based on demonstrating the presence of eggs or oocyst and larvae, in faecal samples, or the presence of parasites recovered from the digestive tracts or other viscera of the animals. Although a great variety of methods and modifications have been described for such diagnosis, standardization of techniques, such as egg or larval counts, worm counts, pasture larval counts, etc., does not exist. Therefore, in practice, most diagnostic laboratories as well as teaching and research establishments apply their own set and protocols of test procedures (Kassai, 1999). However diagnostic procedures as described by (Soulsby, 1986; Thienpont et al., 1986 and Margaret et al., 1989) are usually adopted.

1.4. Control:
Successful control of parasitic diseases is highly dependent on available information on local conditions and the strength of the extension service transferring this knowledge to the farmer. Therefore, we need comprehensive information about the epidemiology of parasites of ruminants, on a regional or national basis, and also information about variables such as host resistance, climate, and management data which can
be used to adequately quantify the occurrence of disease (Niezen et al., 1996; Waller, 1999).

The issue of controlling gastrointestinal parasites is of particular economic importance in production systems worldwide (Rinaldi et al., 2007a & b). Conventional methods of worm control involve treatment(s) of the whole flock with synthetic anthelmintics. However, in this day the global problem of anthelmintic resistance in small ruminants ensures that attention also needs to be given to the sustainability of anthelmintic treatment regimes as well as to their immediate economic benefit (Cringoli et al., 2007a & b and Cringoli et al., 2008). There is currently a general agreement to replace the practice of treating the whole flock with targeted selective treatments, where only animals showing clinical symptoms or reduced productivity are given drugs (Van Wyk et al., 2006).

FAMACHA is a technique developed in South Africa that is used to identify anemic animals on a 1 to 5 scale. The system is based on examination of the lower eyelid of sheep and goats in comparison with the FAMACHA© color chart depicting varying degrees of anemia. This test is used to determine the need for anthelmintic treatment. Administration of treatment should follow only if anemia (a sign of parasitism) is present (Bath et al., 1996; van Wyk and Bath, 2002).

To control liver flukes must use narrow spectrum anthelmintics (Flukicide). Most broad spectrum anthelmintics (against most nematodes and cestodes) have little or no effect on liver flukes. If possible, delay grazing on flooded pasture until the area has been dry for at least eight weeks. Most fluke cysts will have been killed by then. It is also possible to leave the grass until it dries well and use it to make hay to feed the animals during the dry period.
Pastures that remain wet for long periods are ideal environments for the survival of internal parasite larvae. Drainage of fields reduces the larvae chances of survival and extend grazing periods. It is also important that animal watering areas be situated in well drained places (ESGPIP, 2007).
Plate(1.1): The FAMACHA© technique (picture from attra.ncat.org)
1.5. Prevalence of helminths in the world:

Worm populations in sheep and goats with greatest burdens are recorded around the peaks of the rainy seasons (Donald, 1968; Hansen and Perry, 1994; Urquhart et al., 1996).

In Bangladesh Mazid et al. (2006) reported that six species of trematodes, two species of cestodes and three species of nematodes were identified, and (94.67%) of sheep were positive for one or more species of helminth parasites. In Ethiopia the prevalence of gastrointestinal parasites was 75.3%, and 84.1% in Sheep and goats respectively, Strongyles and Eimeria were the most prevalent parasites encountered in the area (Fikru et al., 2006). An other study revealed that the prevalence rate of Monezia spp., were 27.65% in sheep and 24.20% in goats (Abebe, 2001).

In Pakistan 75.2% of Sheeps were positive for one or more nematodes species of six genera and the most prevalent nematode recovered was Haemonchus contortus (Muhammed et al., 1999). On the other hand 53.33% Sheep were infected with gastrointestinal parasite while 66.45% of goats were detected positive. Trichuris (40%), Haemonchus (28.88%), Coccidia (27.77%), Nematodirus (11.11%) and Fasciola (4.44%) were in sheep. In case of goats Haemonchus (64.19%), Coccidia (43.87%), Trichuris (35.48%), Nematodirus (13%), Trichostrongylus (4.51%), Strongyloides (3.22%) and Fasciola were (0.64%) were reported (Gadahi et al., 2009). A recent study reported that the Prevalence of Paramphistomum cervi in sheep was 28.57% and 23.80% in goats (Raza et al., 2009).
1.6. Prevalence of coccidia in the world

The coccidia have world wide distribution, and of various species. *Eimeria* is limited only by availability of the host, as no vector is needed for the transmission of infective stage. Sheep coccidiosis seem to be world wide in distribution and that it was reported in Europe, Americas, Australia, and Africa.

In Europe five species of *Eimeria* were recorded in Italy by Battelli and Poglayen (1980). These were *E.ahsata, E.ovina, E.ovinoidalis, E.parva*, and *E.intricata*. In North West Germany, Barutzki *etal* (1990) reported ten species and new five species were detected, those were :*E.crandalis, E.weybridgensis, E.faurei, E.granulosa* and *E.pallida*.

In England and Wales, similar ten species were detected and *E.weybridgensis*, was found to be the most frequent species (Catchpole *etal.*, 1975).

In the United State, 69% of apparently healthy sheep were found to have coccidia oocyst in their faeces. *E.ovina* was the most prevalent species.

In Australia, O’Callaghan *etal*(1986) reported that 80% of sheep were positive for coccidia and eleven species of *Eimeria* were identified, ten species were similar to those previously detected. *E.punctata* was the new species observed.

In Kenya, the prevalence of the disease in sheep was(42.7%)and (45.2%) during dry seasons and wet seasons, respectively and eight species of *Eimeria* were recognized (Maingi and Munyua,1994). A study was conducted to determine the prevalence and types of coccidia in Tanzania, revealed that, 91% of goats and 93% of sheep were infected with coccidia (Kusiluka *etal.*, 1996).
1.7. Prevalence of helminths in Sudan

Many attempts were performed to evaluate the occurrence of helminthes in different regions of the Sudan. Most cases of gastrointestinal parasites were more of a multiple infections than single endoparasites infections of different genera (Gadahi et al., 2009). ElKhawad et al. (1976) performed a survey of cattle, sheep and goats helminthes in Southern Sudan, and the results indicated that parasitic helminth were widely spreading. In another study on the incidence of helminthes parasites in ruminants slaughtered in Western States of the Sudan, the prevalence of different species in sheep was recorded: Haemonchus contortus, 45.5%; Oesophagostomum columbianum, 39.5%; Trichuris ovis, 20%; Moniezia expansa, 9% and Avitellina spp, 3%. The following prevalence were obtained in goats: Oesophagostomum columbianum, 49%; Haemonchus contortus, 39.4%; Trichuris ovis, 25% (ElKhawad et al., 1978).

In a study performed in Central Kordofan and White Nile State, results indicated that infections with nematodes, cestodes as well as tremarodes are common. Nematodes were the most prevalent and they belonged to the genera Haemonchus, Trichostrogylus, Strongyloides, Oesophagostomum, Coopria, Trichuris, and Skrjabinema. Paramphistomum spp. They showed low frequency in sheep from both areas (Ghada, 2000).

Several authors reported the genera of nematode parasites, in rumenants. Haemonchus contortus, Strongyloides papillosus, Oesophagostomum columbianum and Trichuris ovis were the most common identified parasites in Sudan (Gagoad and Eisia, 1968; Eisia and Ibrahim, 1970; El badawi et al., 1978; Atta El Mannan, 1983; Ahmed and El Malik, 1997; Ghada, 2000 and Gundi, 2004).
1.8. Prevalence of Coccidia in Sudan

Different reports of Eimeria infection of sheep and goat were documented in the Sudan from different localities.

Seven species of Eimeria infection were reported, for the first time from clinical cases of sheep in Khartoum state (Osman et al., 1990). The prevalence of these species was as follows: *E. ovina* (40%), *E. intricata* (23%), *E. ahsata* (13%), *E. parva* (7%), *E. crandalis* (7%), and *E. pallida* (3%).

Later, Abakar (1996) conducted a wide survey in various parts of Sudan and reported the prevalence of eleven species in Sudanese sheep. In addition to the above-mentioned four new species namely *E. faurei* (28%), *E. marsica* (13%), *E. granulosa* (8%) and *E. punctata* (0.03%). The overall prevalence of infection was 59%.

Abakar et al. (2001) reported the prevalence of 67% of enteric *coccidia* in sheep in South Darfur State and eight species were detected.

In the Red Sea State, cases of coccidiosis of sheep diagnosed at Port Sudan Veterinary Laboratory were represented as 13% and 33% during years 2000 and 2001, respectively (Anon, 2000a&b; Anon, 2001).
CHAPTER TWO

MATERALS AND METHODS

2.1 STUDY AREA

2.1.1 Location:
White Nile State is located in medial section of Sudan between geographical 
co-ordinates 12:00 and 15:15 North and 31:33 and 33:15 East.
It covers 39701 Kg; divided into eight localities , Kosti ,Tandalti ,Alsalam
,Aldiweam ,Omrimta ,Rabak ,Aljabalian ,and Algiteana its surround by
Khartoum, Algazeera, Sinar, Upper Nile, South Kordofan and North
Kordofan States .

2.1.2 Climatic conditions:
The State receives an average rainful of 150 – 700 mm annually, and is
covered by savannah grass. White Nile river the main source of water in this
state and it has many islands, these islands like Omjar island have big
number of animals. In dry season, most animals are found near the river .
Maximum day temperature was 41°C in April and minimum temperature was
24°C in January (Anon, 2003).

2.1.2 Animals populations:
The current cattle, sheep, goat and camel populations of state are
approximately 3,430,516 cattle, 2,414,697sheep, 2,341,120 goats and 28,919
camels.
Animal resource represents about 8% of the national herd. On the other hand 40% of people in the state are grazier and depend on livestock for living (Anon, 2008). According to tradition owning livestock equals wealth and it has not only economical but also a social value, including a role in religious rituals (Cecilia, 2006).

2.2 Study design:
The study was conducted on sheep and goats originating from four zones of White Nile State, particularly from Kosti, Rabak, Algazeera Aba and Omjar areas. Multi-stage random sampling procedure was used to select animals, and from each district, about 50 sheep and 50 goats were randomly selected, during April and May 2009.

2.3 Sample size:
Total of 409 fecal samples were collected directly from the rectum of sheep and goats (about 10 gram per animal), which grazed together. Total of 204 sheep and 205 goats, were chosen randomly. 20 animals about six month old, 20 animals about one year old, 30 animals about two years and 30 animals exceeded three years old were selected for each area. The collected feces were preserved in 10% formalin and were put into a plastic container and the data pertaining to the species, and feces consistency were recorded, and dispatched to Rabak laboratory.
2.4 Animals:
Sheep is of a local breed (White Nile sheep) and goats are also of a local breed. Type of management is traditional one. During the day the sheep and goats flock are herded on grazing pasture together with cattle, camels and equines.
Sample collection was carried out at the dry season when animals were barks.

2.5 Data collection:
Data on the livestock management and health was collected from each region, through interviews. The interviews were based on a questionnaire (see Appendix) with main questions.

2.6 Faecal examination:
The faecal sample were examined during this study and the following techniques were adopted.

2.6.1 The Willis technique:
This technique was described by soulsby (1986) as follows:
1. Two grams of faeces were transferred to a morter and mixed with saturated sodium chloride solution.
2. The mixture stirred gently until the faeces were thoroughly suspended it was then poured through a tea strainer into a container and gently pressing the excess fluid from the debris remaining in the strainer.
3. The mixture was immediately poured into test tube until it produced a convex meniscus.
4. A clean glass slide was then placed over the top of the tube and left for 10 minutes after which the slide was removed quickly.
5. A cover glass was applied on the slide which was then examined microscopically for parasite eggs.

The identification of eggs and oocysts was achieved according to (Soulsby, 1986; Thienpont et al., 1986 and Margaret et al., 1989).

2.6.2 The Modified Mc Master Technique:
Number of nematode eggs, cestodes eggs and coccidia oocysts were counted using the following technique, which is described by Soulsby (1986):

1. Two grams of faeces were weighed and transferred to mortar
2. Forty-two ml of tap water added, the faeces were rubbed using pestle.
3. The mixture was sieved through a tea strainer into another container.
4. The filtrate was stirred and immediately transferred into a test tube.
5. The tube was centrifuged at 1500 rpm for 2 minutes and the supernatant was discarded.
6. The sediment in the tube was agitated by a glass rod until it became homogenous and then the tube was filled with saturated sodium chloride to the same level as before.
7. The contents of the tube were mixed by inverting it several times. A Pasteur pipette was filled while the stirring of the faeces and salt suspension was still going on.
8. The small sample was rapidly run into one chamber of a McMaster counting slide. After another stirring a second sample was withdrawn and run into the other chamber.
9. The slide was left for 5 minutes to allow all eggs and oocysts to float before microscopical examination. Under microscope all eggs and
oocysts were counted within the drawn squares on each chamber of the slide. The number of eggs and oocysts per gram of faeces was determined according to the following equation.

\[
\text{Eggs per gram (EPG)} = \frac{\text{number of eggs in the two chambers} \times 100}{2}
\]

2.6.3 Sedimentation:
For high recovery of trematode eggs the following sedimentation technique was performed;

1. Five grams of faeces were mixed with sufficient volumes of normal saline.
2. After thorough disintegration, the suspension was passed through a tea strainer into a beaker and then into a conical flask.
3. To the filtrate more normal saline was added until it filled the flask.
4. The suspensions were allowed to settle and clarify the faecal mass.
   Most of the supernatant material was decanted carefully and the flask containing the sediment was refilled with normal saline.
5. The process was repeated several times until the supernatant become clear.
6. After discarding the supernatant fluid, and by using a pipette, few drops of the sediment were transferred to a glass slide. Then a cover slip was slid over it before microscopical examination.
CHAPTER THREE

RESULTS

3.1 Pasture status:
During the period of study in dry season, the pasture areas were generally dry and the amount of available grass was poor except at the banks of the White Nile River, Nile islands and the canals. Some areas were greener than others but it was never all green.

3.2 Microscopical examination

3.2.1 Prevalence of parasites:
204 sheep and 205 goats were examined; 158(79.96%) of sheep and 167(81.95%) of goats were found to harbor one or more parasite species as shown in table (3.1) and figure (3.1).
The parasites identified were *Coccidia, Strongylids, Schistosoma, Moneizia, Fasciola, Paramphitomum, Trichuris* and *Strongyliodes*. The prevalence rates of these parasite varied from one area to the other (Table 3.2 and figure 3.3, 3.4,3.5&3.6).
In general infection with *Eimeria, Strongylids, Schistosoma* and *Moniezia* were the most prevalent ( Table (3.2). The prevalence for *Moniezia* was higher in sheep than in goats.
Infection with *Schistosoma* were significantly higher in Omjar island than other areas(Fig:3.6).single and multiple infection can be seen in table(3.4)
3.2.2 Eggs and oocyst count:
The results of quantitative examination of eggs using McMaster method are presented in Table (3.5). The total eggs count and number of eggs per animal for strongyles were highest in Algazeera area while coccidia oocyst counts were higher in all areas investigated for both animal species. However, the highest infection rate for Strongyles was seen in Rabak area, while that of Coccidia, Moniezia and Paramphistoms was in Kosti area. Liver flukes were more prevalent in Algazeera Aba.

Eggs of some parasites detected can be seen in plates (3.1- 3.6).
### Table (3.1): Number Of Goats And Sheep Infected In the Region

<table>
<thead>
<tr>
<th>parasite</th>
<th>Goat (205)</th>
<th>Sheep (204)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of animals infected</td>
<td>Percentages</td>
</tr>
<tr>
<td><strong>Coccidia</strong></td>
<td>103</td>
<td>50.24%</td>
</tr>
<tr>
<td><strong>Strongyles /trichostrongyles</strong></td>
<td>64</td>
<td>31.22%</td>
</tr>
<tr>
<td><strong>Schitosoma</strong></td>
<td>55</td>
<td>26.83%</td>
</tr>
<tr>
<td><strong>Moneizia</strong></td>
<td>32</td>
<td>15.60%</td>
</tr>
<tr>
<td><strong>Fasciola</strong></td>
<td>14</td>
<td>6.83%</td>
</tr>
<tr>
<td><strong>Paramphitomum</strong></td>
<td>6</td>
<td>2.92%</td>
</tr>
<tr>
<td><strong>Trichuris</strong></td>
<td>6</td>
<td>2.92%</td>
</tr>
<tr>
<td><strong>Strongyliodes</strong></td>
<td>2</td>
<td>0.97%</td>
</tr>
<tr>
<td><strong>Total number examined</strong></td>
<td>205</td>
<td>81.95%</td>
</tr>
</tbody>
</table>
### Table (3.2): Number of goats and sheep infected with various internal parasites in four region in White Nile State

<table>
<thead>
<tr>
<th>parasites</th>
<th>Aljazeera</th>
<th>Kosti</th>
<th>Rabak</th>
<th>Omjar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Goats</td>
<td>Sheep</td>
<td>Goats</td>
<td>Sheep</td>
</tr>
<tr>
<td>Strongyles /trichostron gyles</td>
<td>17(33.33 %)</td>
<td>17(33.33 %)</td>
<td>11(22 %)</td>
<td>10(20 %)</td>
</tr>
<tr>
<td>Coccidia</td>
<td>29(56.86 %)</td>
<td>22(43.13 %)</td>
<td>33(66 %)</td>
<td>22(44 %)</td>
</tr>
<tr>
<td>Trichuris</td>
<td>0.00(0.00 %)</td>
<td>0(0.00 %)</td>
<td>3(6%)</td>
<td>0(0.00 %)</td>
</tr>
<tr>
<td>Moneizia</td>
<td>6(11.76 %)</td>
<td>7(13.72 %)</td>
<td>14(28 %)</td>
<td>8(16 %)</td>
</tr>
<tr>
<td>Fasciola</td>
<td>8(15.68 %)</td>
<td>4(7.84 %)</td>
<td>1(2%)</td>
<td>2(4%)</td>
</tr>
<tr>
<td>Paramphitomum</td>
<td>1(1.96 %)</td>
<td>0(0.00 %)</td>
<td>2(4%)</td>
<td>3(6%)</td>
</tr>
<tr>
<td>Schitosoma</td>
<td>9(17.64 %)</td>
<td>12(23.52 %)</td>
<td>6(12 %)</td>
<td>8(16 %)</td>
</tr>
<tr>
<td>Strongylidies</td>
<td>1(1.96 %)</td>
<td>0(0.00 %)</td>
<td>0(0.00 %)</td>
<td>0(0.00 %)</td>
</tr>
</tbody>
</table>
Table (3.3): Prevalence of internal parasites

<table>
<thead>
<tr>
<th>parasite</th>
<th>No. of animal infected</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongyles /trichostrongyles</td>
<td>114</td>
<td>27.87%</td>
</tr>
<tr>
<td>Coccidia</td>
<td>187</td>
<td>45.72%</td>
</tr>
<tr>
<td>Trichuris</td>
<td>7</td>
<td>1.71%</td>
</tr>
<tr>
<td>Moneizia</td>
<td>84</td>
<td>20.53%</td>
</tr>
<tr>
<td>Fasciola</td>
<td>26</td>
<td>6.35%</td>
</tr>
<tr>
<td>Paramphitomum</td>
<td>10</td>
<td>2.44%</td>
</tr>
<tr>
<td>Schitosoma</td>
<td>102</td>
<td>24.93%</td>
</tr>
<tr>
<td>Strongyliodes</td>
<td>2</td>
<td>0.48%</td>
</tr>
</tbody>
</table>
Table (3.4): **Single and multiple parasitic infections in sheep and goats**

<table>
<thead>
<tr>
<th>Location</th>
<th>Goats</th>
<th>Sheep</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Single infection</td>
<td>Double infection</td>
</tr>
<tr>
<td>Algazeeraba</td>
<td>22(43.13%)</td>
<td>15(29.41%)</td>
</tr>
<tr>
<td>Kosti</td>
<td>22(44%)</td>
<td>16(32%)</td>
</tr>
<tr>
<td>Rabak</td>
<td>23(43.39%)</td>
<td>16(30.18%)</td>
</tr>
<tr>
<td>Omjar</td>
<td>21(41.17%)</td>
<td>14(27.45%)</td>
</tr>
</tbody>
</table>
Fig:(3.1) Prevalence of internal parasites in sheep and goats in all of the regions
Fig:(3.2) Prevalence of internal parasites in all animals
Fig: (3.3) Prevalence of internal parasites in sheep and goats in Aljazeera Aba
Fig: (3.4) Prevalence of internal parasites in sheep and goats in Kosti
Fig; (3.5) Prevalence of internal parasites in sheep and goats in Rabak
Fig:(3.6) Prevalence of internal parasites in sheep and goats in Omjar
Table (3.5): Average of Strongyids and coccidia eggs per grame (EPG) of feaces

<table>
<thead>
<tr>
<th>EPG of feaces</th>
<th>Aljazeera</th>
<th>Kosti</th>
<th>Rabak</th>
<th>Omjar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Goats</td>
<td>Sheep</td>
<td>Goats</td>
<td>Sheep</td>
</tr>
<tr>
<td>Strongyles/ trichostrongyles</td>
<td>19950</td>
<td>14450</td>
<td>7400</td>
<td>1750</td>
</tr>
<tr>
<td>range</td>
<td>0 - 5750</td>
<td>0 - 4700</td>
<td>0 - 3100</td>
<td>0 - 500</td>
</tr>
<tr>
<td>Coccidia</td>
<td>41700</td>
<td>19050</td>
<td>44900</td>
<td>18450</td>
</tr>
<tr>
<td>range</td>
<td>0 - 9500</td>
<td>0 - 3500</td>
<td>0 - 1000</td>
<td>0 - 9200</td>
</tr>
</tbody>
</table>
Fig: (3.7) Average eggs/ animal of Strongylids and coccidia in Algazeera Aba
Fig:(3.8) Average eggs per gram (EPG) of Strongylids and coccidia in Kosti
Fig:(3..9) Average eggs per gram (EPG) of Strongylids and coccidia in Rabak
Fig:(3. 10) Average eggs per gram (EPG )of Strongylids and coccidia in Omjar
3.3 Questionnaires results

3.3.1 Parasites problem:
In this questionnaire, 79.62% of the owners stated that their animals suffer from high infection level with internal parasites, 12.96% indicated moderate infection level and 7.4% complained light infection. 77.4% of the owners know internal parasitic infection by clinical sign, while 22.6% of the owners do not care much about internal parasites. Only 5% of the owners examine their animals for parasites in veterinary clinics.

3.3.2 Control of parasites:
85.19% of owners control internal parasites by use of anthelmintic. Control of parasites by using grazing practices and management is not practiced (0.0%), while control by grazing practice and anthelmintic treatment together constituted 14.81%. The drugs used in control of parasites are Albendazole, Tetramisole, Ivermectin, Antifasciola and a combination of drugs (antifascioil & anthelmintic). 55% of owners follow the treatment doses prescribed by the veterinarians, whereas 44.5% of them use random doses.

3.3.3 Veterinary care:
62.25% of owners raising both sheep and goats practice regular treatment for their animals against internal parasites. 99.2% of owners raising sheep do treat for parasitic infection on regular level. On the other hand only 50% of those keeping goats treat their animals against internal parasites.
Table (3.6): Results of Questionnaires Survey

<table>
<thead>
<tr>
<th>factors of questionnaire</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parasites problem</td>
<td></td>
</tr>
<tr>
<td>1. Big</td>
<td>(79.62%)</td>
</tr>
<tr>
<td>2. moderate</td>
<td>(12.96%)</td>
</tr>
<tr>
<td>3. light</td>
<td>(7.4%)</td>
</tr>
<tr>
<td>parasites clinical sign</td>
<td></td>
</tr>
<tr>
<td>1. Yes</td>
<td>(77.4%)</td>
</tr>
<tr>
<td>2. No</td>
<td>(22.6%)</td>
</tr>
<tr>
<td>Laboratory examination</td>
<td></td>
</tr>
<tr>
<td>1. Yes</td>
<td>(5.55%)</td>
</tr>
<tr>
<td>2. No</td>
<td>(94.55%)</td>
</tr>
<tr>
<td>Control of parasites</td>
<td></td>
</tr>
<tr>
<td>1. anthemminthic</td>
<td>(85.19%)</td>
</tr>
<tr>
<td>2. grazing practice</td>
<td>(0.00%)</td>
</tr>
<tr>
<td>&amp; management</td>
<td>(14.81%)</td>
</tr>
<tr>
<td>3. both*</td>
<td></td>
</tr>
<tr>
<td>type of drugs</td>
<td>(6.8%)</td>
</tr>
<tr>
<td>1. Albendazole</td>
<td>(2.88%)</td>
</tr>
<tr>
<td>2. Tetramisole</td>
<td>(3.77%)</td>
</tr>
<tr>
<td>3. Ivermectine</td>
<td>(16.75%)</td>
</tr>
<tr>
<td>4. Antifasciola</td>
<td>(69.8%)</td>
</tr>
<tr>
<td>5. combination*</td>
<td></td>
</tr>
<tr>
<td>Dose as doctor guidance</td>
<td>(55.5%)</td>
</tr>
<tr>
<td>1. Yes</td>
<td>(44.5%)</td>
</tr>
</tbody>
</table>
2. No

Dose repeat
- 1. as doctor guidance (37%)
- 2. random (53.7%)
- 3. not repeat (9.3%)

Owners have sheep & goats
- 1. treat (62.25%)
- 2. no treat (37.75%)

Owners have sheep only
- 1. treat (99.2%)
- 2. no treat (0.8%)

Owners have goats only
- 1. treat (50%)
- 2. no treat (50%)

both* = anthelmintic and (grazing practical &mengement)

Combination* = antifasciola and anthelmintic drug
CHAPTER FOUR

DISCUSSION

The present study revealed that 339 out of 409 fecal samples examined were positive for endoparasites eggs. 77 %( 158) of Sheep; 81.95 %( 167) of goats were detected positive . Cases of single and multiple infections were observed.

Generally prevalence rate of endoparasites is supposed to be low because the survey was conducted in the dry season when environmental conditions on pasture are not favourable for the development and survival of the larva stage the heminthes and oocyst of coccidia.

The present findings disagree with Muhammad etal.(1999), Ijaz etal.(2008), Saiful Islam and Taimur (2008) in that parasitic infection seem to be very low during the dry months of the year. Strongylids and Eimeria infections are the most abundant. Fikru etal (2006) found similar finding in Ethiopia with variation in percentage.

There was a high prevalence rate of coccidia in all areas, compared to other parasites, regardless of the animal species, because coccidiosis is not usually treated ( most drugs was antiehimitics).

In general the prevalence rate of coccidia was higher in goats compared to sheep mainly in Algazeera aba, Kosti, and omjar. The present study is in agreement with Fikru etal.(2006) who reported prevalence of Eimeria species of 26.7% and 34.3% in sheep and goat respectively. Asif etal. (2008) repored that the prevalence of coccidia was slightly higher in goat (57.5%) compared to sheep (51.61%). Saiful Islam and Taimur (2008) found about
48% of goats and 31% of sheep examined were infected with *Eimeria* species.

In Bangladesh Kanyari *et al.* (2009) reported, *Coccidia* infection in 35% of sheep and 48% of goats.

On the other hand Borgsteede and Derksen. (1996) found that 82% of goats were infected with *Eimeria* species while Kusiluka *et al.* (1996) reported 91% of goats and 93% of sheep were infected with *coccidia*. O’Callaghan *et al.* (1986) reported that 80% of sheep were positive for coccidia in Australia. This variation may be related to the difference in climatic conditions and management.

The overall prevalence of *Strongylids* reported here is in agreement with the range of results obtained by Ghada (2000), Raza *et al.* (2007), Abo El Hadid and Lotfy (2007) and Ijaz *et al.* (2008).

In Rabak the prevalence rate of *strongylids* was higher in goats compared to sheep. Most of the sheep and goats which were sampled were not owned by the same owners, but Sheep and goats owned by many people usually grazed in the same area.

When goats and sheep belong to one owner, the veterinary care given to both species could be in the same level, but when only goats are found, the veterinary service may be very poor in most cases. Animals which are poorly managed are locally referred to as village animals, which are grazed without shepherd, of which 95% of them are goats. All village animals may attended by one shepherd with animals in pasture intermix.

The relatively higher prevalence of *Strongyles* in Algzeera aba and Rabak may by related to some environmental conditions at pasture that favored such high infection. one of these conditions that animals being graze on remains of scheme’s crop and green grass near irrigation canals.
The Low prevalence rate of *Strongylids* in Omjar island despite the relatively favourable conditions may be related to routine Anthelmintic treatment. Contrary to that, *Schistosoma* infections in both sheep and goats were higher at Omjar due to prevailing suitable conditions like presence of canals and water packets which harbor the snail intermediate host.

The high prevalence of *Schistosoma* in goats in Omjar may be due to prolonged exposure of goats to the infective stage of parasite, since most of the goats usually don't leave Omjar as they are used for daily milk production. In contrast sheep leave Omjar island during the rainy season and return by the dry season.

Prevalence of *Moniezia* species was higher in sheep than in goats especially in Algazeera aba, Rabak and Omjar. The present finding agrees with Kanyari *et al.* (2009) who reported higher prevalence of *Monieza* in sheep compared to goats (21% and 16% respectively). Saiful Islam and Taimur (2008) also found that tapeworm infections were more frequent in sheep (24.26%) in comparison to goats (16.52%). This higher infection in sheep may be related to species resistance.

The higher prevalence of *Fasciola* in goats Algazeera aba probably due to that goats usually graze near the river (Algasir) throughout the year where snails propagate. The infection by *Fasciola* in kosti, Rabak and Omjar areas was similar (2-6%) in both goats and sheep. Higher infection rates with *Fasciola* species in goats compared to sheep was also reported by El Sayed (1997) in Egypt and Ijaz *et al.* (2008) in Pakistan.

However Assessment of fluke infection by faecal examination may be limited due to the fact that many animals may be infected with acute stages not associated with ovidiposition (Rajat et al. 2009).

Braun et al. (1995) and Kumar et al. (2002) compared the apparent prevalence of liver fluke infection, detected by examination of liver, faeces and bile and found that examination of liver or bile samples was more indicative than faecal examination. Moreover the high temperature during summers and lower rainfall hampers the survival and availability of the infective stages of the parasite, as well as of the snail intermediate snail host (Rajat et al., 2009).

The prevalence rate of *Paramphistomum* was very low. This seem to be in agreement with other authors who reported very low prevalence (Khajuria and Kapoor, 2003; Hassan et al., 2005; Gicik et al., 2003; Tariq et al., 2008). Moreover the *Paramphistomum* egg output was low in almost all the examined animals (1-3 eggs), indicating low degree of pasture contamination and justifying the low prevalence of paramphistomosis reported. As paramphistomosis is a water snail borne infection, the low prevalence of paramphistomosis could be due to the low snail population. Sometime water bodies, the habitat of snails, dry up quickly due to frequent shortage of water (Tariq et al., 2008). The varairion in the prevalence of *Paramphistomum* among animals of the two species was not significant.

The lower prevalence rates of Strongyloides recorded in Sheep and goats as a whole, disagrees with most of the reports. A study performed in the same area (White Nile State) reported 7.8% the prevalence of *Strongyloides* (Ghada, 2000). Almalaik et al. (2008) reported that Strongyloides is one of most prevalent species in sheep and goats in Tulus locality in south Darfur State in western Sudan. Abebe and Esayas (2001) reported, in eastern part
of Ethiopia during the dry season a prevalence rate of 45.22 % for *Strongyloides* in sheep. The possible cause of this difference in the prevalence of infection could be due to different sampling procedure and variation in the climatic condition (Mazid *et al.* 2006). beside anthelmintic treatment.

In this is study the overall prevalence of Trichuris was 0.4% and 2.92% in sheep and goats respectively. This result seems to agree with Kanyari *et al.* (2009) in Kenya who found that the prevalence of *Trichuris* species was 0% and 2% in sheep and goat respectively. Similar prevalence rate in goats was reported by (Ghada, 2000), while Almalaik *et al.* (2008) reported lighter prevalence in sheep in south Darfur state. However the latter author found higher infection rates with *Trichuris globulosa* in goats than sheep with general prevalence rate of 0.6%.

Higher prevalence of *Trichuris* in goats compared to sheep was also reported by Asif *et al.* (2008) in Pakistan and Kanyari *et al.* (2009) in Kenya.

The load of *Coccidia* (*oocyst* per gram) seem to be higher in goats than sheep, especially in Algabeeraba and Kosti; this is may be related to management.

*Strongylids* egg count per gram (EPG) was low especially in Omjar regardless of species. Ghada (2000) performed a study in the same state and reported that EPG was very low in the dry season. This findings may influenced by many factors which are: in the dry season, larvae of nematodes are able to undergo a period of arrested development (hypobiosis) in the host (in the abomasal or intestinal mucosae) and following infection, larvae may become metabolically inactive for several months. Although the immune status of the host also has an influence on rates of hypobiosis, the greatest proportion of larvae usually become arrested
at times when conditions in the external environment are least favourable for
development and survival of eggs and larvae (Michel et al., 1975; Ogunsusi
& Eysker, 1979; Chiejina et al., 1988; El-Azazy, 1995; Eysker, 1997). This
suspension of development helps some nematode parasites to survive the dry
seasons. Resumption of development usually coincides with the onset of the
rainy seasons, the most favourable period for larval development and
transmission on pasture (Agyei et al., 1991; El-Azazy, 1995; Tembely,
1995). The stimuli for the onset of arrested development in tropical areas are
linked to the dry conditions (Allonby and Urquhart, 1975; Vercruysse,
1985).
However a variety of factors like age, sex, breed of the host, grazing habits,
level of education, economic status of farmers, standard of management and
anthelmintic used can influence the prevalence of helminthes in animal
(Asanji and Williams, 1987; Pal and Qayyum, 1992; Niezen et al. 1996;
Waller 1999; Valcarcel and Romero, 1999; Ouattara and Dorchies, 2001;
Saiful-Islam et al., 2008).
Result of questionnaire addressed to the owners indicated that most of the
animals in the areas investigated suffer from parasitic infection. Owners
suspect parasitic infection in animals by observable clinical signs, like
diarrhoea, emaciation, and decreased productivity and treat them
accordingly. They do not resort to proper clinical or laboratory examination.
Most of the Owners use anthelmintic mainly to control parasites whereas
few of them use their own grazing practices and management beside
anthelmintics, however the higher stocking rate (number of animals per
grazing area) result in more feces being deposited on the grazing area and
thus more parasitic eggs and more pasture contamination.
Combination of drugs (drug for *fasciola* and drug for round worm) like tetramisole for round worm plus oxyclosanide for *fasciola* was most used in treating parasites, but the concentration of each component in this combination may be decreased and less efficient against target parasites. This may lead to increased resistance of parasites against such drugs. Moreover many owners do not abide by the treatment recommendations (dose, frequency of application), and this may also contribute to development of resistance.

The results also indicated that sheep are usually well attended by owners more than goats, especially when the latter are kept alone. These goats receive less veterinary medical care and this may partially explain the higher prevalence of internal parasites in goats compared to sheep.
RECOMMENDATIONS

1. Survey of all parasitic diseases in sheep and goats in those areas.

2. Because rotational grazing is difficult apply in traditional pasture mass treatment under veterinary supervision must be use before animals inter new pasture.

3. Optimized anthelmintic usage to preserve anthelmintic efficacy and prevent resistance, include the use of the most suitable drugs, correct dosage and possible combination of drugs

4. extension services, which includes, goats must have more attention, sign of parasites and the relationship between parasites and productivity.
REFERENCE


Anon. (1994). Diseases of Domestic Animals Caused by Flukes: Epidemiology, Diagnosis and Control of Fasciola, Paramphistome, Dicrocoelium, Eurytrema and Shistosome Infections of Ruminants in Developing Countries. FAO (Food and Agriculture Organization of the United Nations), Report. Rome, Italy.


Appendix

Questionnaire form

1. Owner name…………………………………………………………
2. Location………………………………………………………………

3. Animal species
   - Sheep
   - Goats
   - Two species

4. Are internal parasites making a problem?
   - Big
   - Moderate
   - Light

5. How do you know that your animals are suffering from parasites?
   …………………………………………………………………………………
   …………………………………………………………………………………
   …………………………………………………………………………………
   …………………………………………………………………………………

6. Do you examine your animals for parasites periodically?
   - Yes
   - No

7. To control parasites in your animals do you use?
   - Anthelmintics
   - Grazing practice management
   - Both
8  type of drugs

…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………

9  Do you use dose as doctor guidance?

Yes □  No □

1. Do you repeat dose?  as doctor 's guidance □

Random □  not repeated □