Gastro-Intestinal Helminths And Public Health:: Overview Of A Neglected Sector

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Abstract

Gastrointestinal helminths and heamoparasites are said to be among the most devastating diseases for livestock. However the diseases are often overlooked because clinical symptoms are rarely apparent. Losses of production occur mainly from retarded growth and delayed fertility. Pigs are among the abundant livestock potentials which Nigeria is endowed with. Prominent among their usefulness are: provision of animal protein for human consumption, employment generation (livestock farming, processing and marketing) and revenue generation with significant contribution to the Nation's Gross Domestic Product (GPD). The above notwithstanding, sustainable development of this sector is faced with quite a number of constraints, prominent among which is diseases especially helminthiasis. The effects of helminths on their host are generally insidious, undermining host health and increasing susceptibility to secondary infections with ensuing mortality, particularly when compounded by additional stress such as poor hygiene, overcrowding and malnutrition among others. In addition to helminthic infections which cause direct economic losses due to reduced animal production, several helminthic infections remain major public health problem i.e. when the infections are transmitted to man – a condition known as Zoonosis e.g. Taeniasis caused by the helminth, Taenia solium. Some of these helminths have complex life cycles which require man as their final or intermediate host in order to complete their life cycles – a process which is harmful to man.

INTRODUCTION

The swine industry has witnessed an unprecedented increase in production and consumption over the past decade and this situation is likely to continue. This positive development mean an increase in: provision of animal protein for human consumption, employment generation, poverty reduction, contribution to the Nation's Gross domestic Product and general economic growth. According to Anon (1999) more pork is consumed than other meat in the world. In 1998, it represented 39% of the world's total meat consumption compared to 26.5% for beef and 28% for poultry. This positive development is mostly noticed in developed countries. Pork consumption varies widely among countries and regions with per capita intake in 1998 ranging from 2kg/year in many African countries to 60kg/year in Germany and Spain (Anon, 1999).

Swine industry in developing countries with particular reference to Nigeria is faced with a number of constraints prominent among which is disease. Mostly in focus are diseases caused by viruses and bacteria. However, helminthic diseases are equally important although often neglected. They constitute a major impediment to efficient and profitable livestock production.

Helminths are among the gastrointestinal parasites that are responsible for substantial loss of productivity in swine and other livestock industry. This is due to their deleterious effects on these animals. These parasites cause various problems ranging from gastro-enteritis, anorexia, abdominal distention, diarrhoea, emaciation e.t.c. all of which result in serious economic losses to the farmer as well as the nation in general (Junaidu and Adamu, 1997). Similarly, they constitute a major impediment to efficient and profitable livestock production (Akerejola et al, 1979). Three classes of helminths contribute to the disease entity in Nigeria, namely Nematodes, Trematodes and the Cestodes (Adejimi and Haniron, 1996).

In this review, the epidemiology and public health importance of gastrointestinal helminths and haemoparasites in swine are discussed in broad terms. Details are given on the habitat and mechanism of transmission including the life cycles of these parasites in swine. Food animals are distinct from animals kept as companions, or employed in other social roles such as guide or hearing or sniffing dogs. By their very nature, they are kept to provide revenue for the

farmer from the sale of products, the majority of which are consumed as food. Because of this role, the diseases that are transmitted to humans following the consumption of this produce are significant. These diseases are described as food borne zoonoses i.e. diseases contracted from eating foods of animal origin.

THE PARASITES AND THEIR PUBLIC HEALTH IMPORTANCE

Helminth infections of food animals cause significant economic losses. The effect of the infection is determined by a combination of factors of which the varying susceptibility of the host species, the pathogenecity of the parasite species, the host/parasite interaction and the infective dose are the most important (FAO2000).

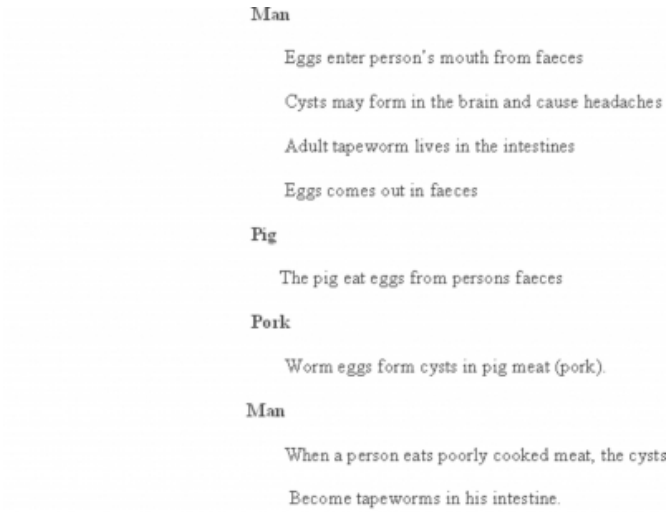
A variety of species of worms and haemoparasites which are of economic and public health importance are: Hyostrongylus spp (stomach worms) e.g. Hyostrongylus rubidus (causes hyostrangylosis), oesophagostomum spp (occur in the colon and caecum) the condition is known as oesophaqustomiosis, Ascari suum (large round worm in the intestines ascariosis), Metastrongylus spp (lungworms), Trichuris suis (infects the large

intestines others include: Stephanurus dentatus (kidney worms) and Fasciola hepatica which may occur in grazing pigs. According to Kazacos (1980), the pig may be infected by Trichinella spiralis and Cysticercus cellulosae which are both important in public health, he however stated that neither is of any clinical importance in the pig itself and that the latter has not been recorded in the U.K. for many years.

According to Mutua et al (2007), Taenia solium taeniasis (Cysticercosis) remains a major public health problem in many developing countries of Latin America, Africa and Asia. The same trend was also recorded by Sarti et al (1992). The life cycle of this parasite includes the pig cysts (Cysticercus cellulosae) and humans as the definite hosts, harboring adult tapeworms (taeniasis). Human can also serve as intermediate hosts if they consume T. solium eggs. In this case, if the eggs hatch in the gut of the host, either primary or intermediate, larvae penetrate the wall of the gut and then migrate to a preferred site, usually in muscle tissue or other organs. In the pigs, these normally migrate and encyst again in muscle tissue where the cyst may develop daughter cysts. They may also migrate to other organs and cause cysticercosis. The larvae encyst in sites as diverse as the brain or other areas of the central nervous system, eyelid and conjunctiva. Neurocysticercosis which is infection of the human brain by the larval stage of the parasite, is reportedly the major cause of preventable epilepsy in developing countries (Garcia et al, 2004).

Figure 1

Figure 1: The life cycle of Tapeworm



Source; Animal Health: The Tropical Agriculturalist. Netherlands.

The full impact of this disease and other helminthes of public health importance has been obscured as a result of unavailability of the sensitive and specific diagnostic tools necessary for collection of reliable epidemiological data e.g. the autigen ELISA (Enzyme-linked immounsobent assays), very little or inadequate epidemiological work and lack of or inadequate meat inspection practices among others. The transmission success of the majority of economically and public health important helminth infections of animals and man depends almost entirely upon ingestion of the parasites via certain food elements. Thus hosts become infected by the consumption of food elements contaminated with infective larvae, and the continuation of the parasites life cycles is secured by the host disseminating pre-infective stages onto the pasture or other food items. Direct host-to-host transfer in helminth infections is restricted to a few parasites where prenatal infections from the mother to the growing embryo may occur and to transmission via skin penetration (FAO,2000).

Figure 2

Table 1: Worms of pig and their life cycle.

Worms	Life cycle
Hyostrongylus rubidus	Worm eggs passed in faeces onto pasture, eggshatchto produce 1st stage larvae which moult twice to infectious third stage larvae. This stage is eaten up by animals and it moult twice before developing into adult worms in the stomach or intestines. Mature adult female worms then produce large number of eggs and the cycle starts again.
Ascaris suum	Eggs are passed out in faeces of infected pigs. The life cycle continues after the ingestion of the eggs. Eggs hatch to larvae which migrates to intestine via the liver and lungs. Adult worms develop in the intestine and start producing eggs which are passed out in faeces. Eggs are very resistant to extremes of temperatures and can survive up to four years in the environment.
Strongyloides ransomi	Eggs passed out in faeces, develop to both free living and parasitic larvae which can infect by oral ingestion or skin penetration. Young infected via the milk
Oesophagostomium spp.	Same as in *Hystrobghus rubidus* above
Trichuris suis	Infectious larvae develop from eggs passed out in urine. Infection is by the ingestion of or skin penetration by larvae or by the ingestion of transport hosts (earth worms). Larvae migrate through various tissues to the kidneys.

Apart from the above mentioned worms, Permin et al (1999) in their work discovered the presence of other haemoparasites. These were Babesia perroncitoi, Babesia trautmani and Eperytrozoon suis.

CLINICAL SIGNS

Problem identification is of utmost importance. Early in the decision making process, knowledge of the patient's status must be used to identify the problems that are present and the problems that should be investigated. Characteristically, this initial assessment is made based on signs, history and the observations and findings resulting from a physical examination.

Hence Clinical signs are central elements in the narrative history of gastrointestinal disease in animals. They serve as tentative, inexact or signposts pointing toward the patient's problem or problems. Physical examination often provide considerable “next step” specificity to the diagnostic process and can in some instances yield a definitive diagnosis. Clinical signs are correlated with physical findings to define problems and to plan for diagnosis and treatment.

The clinical signs and physical findings listed and described below are potentially but not exclusively of gastrointestinal origin.

These are:

- Anorexia – partial or total reduction of food intake
- Vomiting
- Abdominal distention
- Abdominal and pelvic pain
- Diarrhoea, rough hair coat
- Weight loss and depression among others

Young animals may die from anaemia due to massive worm infestation. In the case of taeniosis (Cysticercus cellulosae infestation in human), it is not of any clinical importance in the pig itself but in human being where they encyst in muscle tissue. They may also migrate to other organs and cause cysticercosis. The larvae can also encyst in the brain or other areas of the CNS, eyelid and conjunctiva. Infertility manifested by reduced fecundity and irregular returns to oestrus especially after furrowing have been reported in sows with high hyostrongylus egg counts

Figure 3

Table 2: Types of worms in Pigs and clinical signs

Worms	Site of attachment	Clinical signs
Hyostrongylus spp.	Stomach worms	Anaemia, inappetense and loss of condition in sows kept in poor condition.
Oesophagostomum spp	Colon and Caecum	High burden causes loss of Weight and perhaps diarrhea, Reduced milk yield in Lactating Sow and reduced piglets growth
Ascais suum	Small intestines	larvae migrate through the Liver causing scaning (milk Spot liver). Massive dose of Larvae` migrating through the lungs may cause acute coughing.
Metastrongylus spp	Lungworms	Invade the bronchi of the lungs and in heavy infestation cause coughing, breathing difficulty and reduction in growth rate
Trichirs suis	Caecum	Colitis and sometimes haemiarrhage In heavy infestation, can cause chronic diarrhea. The infections of pigs muscle is by *Trichinella* while that of the pigs liver is by *Cysticercus cellulosae*
Sstrongyloides ransomi	*stomach worms*	Heavy burdens cause wasting, diarrhea vomiting and sometimes death in piglets
Stephanarus dentatus	*kidney worms*	Larvae migrate through various tissues to kidneys causing tissue damage in liver, lungs ,blood vessels and spinal cord causing wasting loss of condition and sometimes paralysis and death in heavy infestations.

Source: Veterinary Pharmacology, 2007 Edition.

EPIDEMIOLOGY

The infection of animals and humans depends on the availability of infective larvae on food items which in turn is influenced by the local climatic conditions. Therefore, a sound control of the disease is only possible based on detailed knowledge of the local epidemiology (Kaufmann & Pfister, 1990 Zinsstag,1997). The infective larvae do not survive on dry concrete and theoretically this disease can be prevented under conditions of good husbandry. However, despite the high proportion of pigs housed under intensive production system, infections with gastrointestinal parasites remain common.

Eggs require moisture and a minimum temperature of 15-170C for infective larvae to develop. Thus hosts (man and animals) become infected when they consume food items already contaminated with infective larvae, and the continuation of the parasites life cycles is secured through the passage of eggs together with faeces. This in turn contaminates pasture and other food items. For example, people get tape worms when they eat uncooked or improperly cooked meat with these tapeworm cysts in it. People with tapeworms produce tapeworm eggs in their faeces. These eggs can infect animals – a condition which is common with scavenging animals such as pigs.

ANTHELMINTHIC TREATMENT AND CONTROL OF HELMINTHIASIS IN THE PIG

The strategic (aimed) control of gastro-intestinal parasites in livestock involves management improvements (maintenance of good husbandry practices such as ideal housing, feeding and hygiene among others) and the use of drugs at the right time, right dosage and for the right group of animals (Kaufmann & Prister, 1990) Anthelminthics may be given to pigs in feed or as injections to individual pigs known to be heavily parasitized. In feed formulations, they are usually either in powder, pellets or granules. If routine therapy is practiced, it is usual to carry out a programme which includes regular treatment of the breeding stock as well as the growers. A popular control programme is as follows:

Figure 4

Table 3

Animal group		Drug regimen (Administration)
Sows and gilts	-	Treat prior to entering the farrowing house and possibly at weaning of litters.
Wearers	-	Treat on purchase or movement to fattening house
Fatteners	-	Eight weeks after entering the fattening house
Boars	-	Every six months.

RECOMMENDATIONS

The rate of pork consumption in Nigeria is on the increase. This is a positive development because presently, Nigerians consume less animal protein. However the public health importance of this development should not be overlooked. Therefore, the following recommendations are advocated.

- A very good management practices which incorporates ideal housing system feeding and proper hygiene.
- Extensive or scavenging pig production should be discouraged as much as possible.
- An effective anthelminthic treatment programme should be carefully followed by pig producers.
- Meat inspection practices at both private and government owned abattoirs and slaughter slabs should be enforced by all stakeholders in the meat industry.
- Suspected meat or meat products should be thoroughly cooked and consumption of raw or undercooked meat from dubious sources avoided.
- Suspected carcasses or meat should be frozen for at least 3 weeks to kill the larvae.
- Viable eggs or embryos may also be present in water contaminated by faecal matter, therefore the usual precautions when drinking water of unknown quality should be applied (Muirhead and Alexander, 1998).

CONCLUSION

This paper reviews the public health importance of gastrointestinal parasites with particular emphasis on helminths. Porcine Cysticercosis caused by the larval stage of T.solium tapeworm is prevalent in many developing countries of Latin America, Asia and Africa (Sarti et al 1992). The life cycle involves human as a natural definitive host and pig as a natural intermediate host. This condition poses a threat to public health because occasionally, human can acquire the larval stage which when invade the brain tissue results into a serious condition known as neurocysticercosis yet there is not enough awareness and both structures, infrastructures, other logistics and human resources are inadequate at some of our abattoirs and slaughter slabs for proper inspection of meat for human consumption.

Apart from its zoonotic importance Taenia solium and other gastrointestinal parasites cause serious economic losses. The condition is associated with poor sanitary conditions and poor pig management practices. The main objective of the present review is to create awareness about the public health importance of the subject matter and identify possible risk factors associated with gastrointestinal parasites. The purpose was to provide baseline information that may be useful in planning a proper control programme for the disease thereby providing hygienic and disease free pork for public consumption.

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