**OVERVIEW ON: SCHISTOSOMA INFECTION IN CATTLE****Dr. Tewodros Alemneh Engdaw\* and Dr. Alemseged Gebru Abuhay**

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Gondar, Ethiopia.**ABSTRACT**

Schistosomosis also known as blood fluke disease is an infection of animals and man due to the genus *Schistosoma*. Schistosomes are dioecious (unisexual) worms, which are an exception among the trematodes. The species of *Schistosoma* in animals includes *Schistosoma bovis*, *S. mattheei*, *S. margrebowiei* and *S. leiperi*. Among these *Schistosoma bovis* is the common cause of infection in cattle rearing especially in or near to marshy areas. Egg morphology,

intermediate host spectra, and definitive host-parasite relationships are the major criteria's for species identification of the genus *Schistosoma*. *Schistosoma* has indirect life cycle and carried through the medium of snail hosts. The intermediate snail hosts play a significant role for the dissemination and transmission of bovine Schistosomiasis. The disease has serious economic impact on the livestock production system. Humans get the infection during the swimmer months; people swim or wade in the lakes, ponds, rivers and even ocean waters frequented by the wild birds and animals. The pathology and clinical signs of *Schistosoma bovis* are largely attributed to the spined egg causing tissue irritation. *S. bovis* causes emaciation, marked diarrhea mixed with blood or mucous, dehydration, pallor of mucus membrane, marked weight loss, decreased production and rough hair coat. Praziquantel is successfully recognized as a drug of choice against *S. bovis* and *S. spindale* of cattle, and all forms of human Schistosomosis. The prevention and control of Schistosomiasis in endemic areas renders on drainage of marshy and stagnant water bodies, and supply of clean water to prevent contact between the animals and the intermediate hosts. It is finally, concluded that the increasing water conservation and changing methods of husbandry may result in bovine Schistosomosis becoming a major veterinary concern in most parts of the world.

**KEYWORDS:** Schistosomosis, Cattle, Control, Prevention.

## INTRODUCTION

Parasitic Schistosomosis is an infection due to trematodes of the genus schistosoma. Although these parasites occur in many tropical and subtropical areas, the disease is important in livestock mainly in eastern Asia, African and India. Schistosomosis is also one of the major diseases of man in the tropics (Sewell and Brocklebsy, 1990). Other names given to schistosomosis are blood fluke disease and bilharzosis (Parija, 2004).

The schistosomes are different from most other members of the Digenea in that the sexes are separate. The term schistosome or schistosoma means split body and refers to the fact that the males have a ventral groove called a gynaecophoric canal (Marquardt, 2000).

As parasites of humans or other animals, the blood flukes lie in venules, usually in the lower abdomen, where they copulate, and the female lay eggs which reach the outside in either feces or urine. Schistosoma has only a single intermediate host. A signal and the forked-tailed cercaria (forke-cercaria) reach the definitive host by actively penetrating the unbroken skin (Jones *et al.*, 1997; Marquardt, 2000).

The blood flukes are not only very important to humans primarily as the cause of human disease in many tropical and sub tropical areas of the world but also considered as economically important parasites of cattle and other large domestic animals (Marquardt, 2000).

Livestock in Ethiopia represents major national resource and form an integral part of the agricultural production system. The country has the largest animal population amongst African countries with an estimated 35 millions tropical livestock unites (TLU). Though Ethiopia is recognized for its vast wealth of livestock, the economic benefit derived from the livestock sector does not commensurate with the potential (FAO, 1993). Development of large animal productions and rearing is constrained among other important factors, by wide spectrum of diseases like Schistosomosis.

Schistosomes are thin, elongated fluke, up to 2cm long primarily parasitize in blood vessels of alimentary and bladder (Urquhart *et al.*, 2003) responsible to cause Schistosomosis. Schistosomosis is common parasitic infection of domestic animals and man in Africa and Asia. Snail hosts favor intensive transmission of Schistosomosis, and the disease act as

important pathogen in Africa and Asia (Vanwyk, *et al*, 1974). Most infection in endemic areas occur at sub clinical infections cause significant losses due to long term effects on animal growth and productivity, and increased susceptibility to other parasitic or bacteria diseases (Mc Cauley, *et al.*, 1984). For this reason and in parallel with studies on species affecting man, schistosomosis of veterinary concern have received considerable interest over the last thirty years (Taylor, 1987).

The geographical distribution has been determined primarily the distribution of snail intermediate host particularly *Bulinus* and *Glanorbis* species which are important for bovine and ovine Schistosomosis (Urquhart *et al*, 2003).

Epidemiological studies conducted on bovine Schistosomosis indicated the disease is serious problem in some areas of the country like; Gewene, Awassa and Bahir Dar and the prevalence rate was found 1.5% and 5.5% noted by Lo and lemma (1973), respectively. In other studies around Bahir Dar 33.8%, 12.3%, 34%, 17.4% and 22.06% prevalence rate was indicated by Solomon (1985), Aemro (1993), Hailu (1999), Yalelet (2004) and Solomon (2008), respectively.

In Ethiopia, reports on animal schistosomes are very scanty and until recently it has been considered as an occasional finding in slaughter house and postmortem examinations (Shibru, *et al*, 1989). It has been reported that *S. bovis* is the only species reported with localized distribution in ten out of fourteen administrative regions in the country (Solomon, 1985). Detailed information on prevalence and intensity of infection of *S. bovis* in Ethiopia and various factors, which influence the host parasite relationship, are generally lacking. Therefore; the present review is carried out to provide detailed information about Schistosomosis in cattle including its life cycle, species of parasites, clinical pictures, diagnosis, treatment, and prevention and control strategies.

## REVIEW

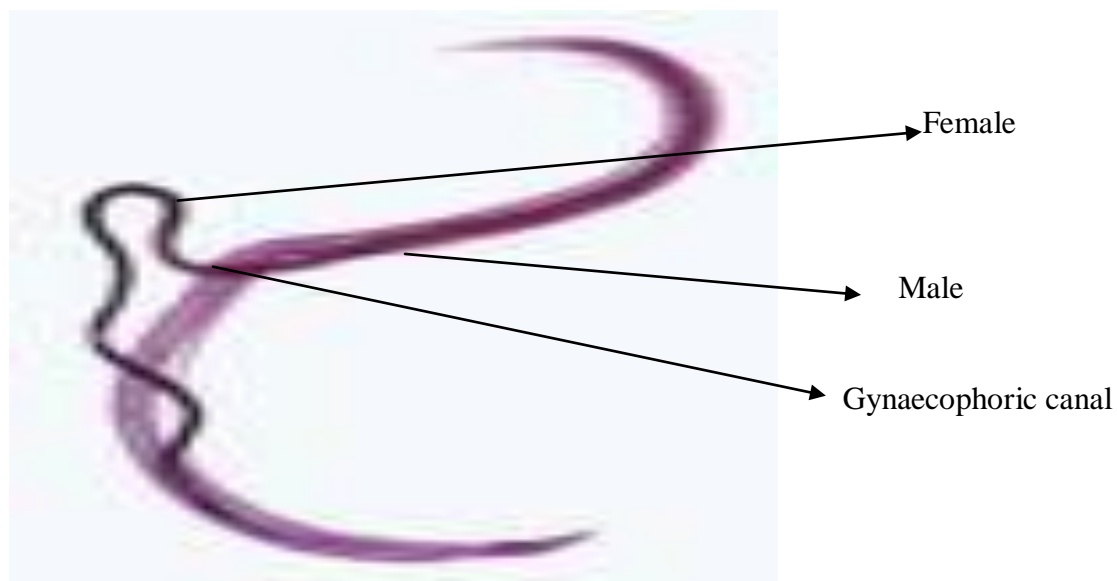
### Morphology of Schistosomosis

Schistosomosis (blood fluke disease or bilharzosis) is an infection due to the genus schistsoma.

Although this parasite occur in many tropical and subtropical areas, the disease is important in livestock mainly in Eastern Asia., Africa and India (Sewell and Brocklebsy, 1990).

Adult Schistosomes are obligate parasite of the blood vascular system of vertebrates. Schistosomes are dioecious (unisexual) worms, which is an exception among the trematodes. The mature female is more slender than the male and normally carried in ventral groove, the gynaecophoric canal which is formed by ventrally flexed lateral out growths of the male body (Bont, 1995).

A total of 19 different species are described world wide (Bont 1995). They can be differentiated through their morphological features. Life cycle, host specificity or enzyme; and DNA and behavioral characteristics (Rollinson and Southgate, 1987). Out of 10 species reported to naturally infected cattle, six have received particular attention mainly because of their recognized veterinary significance. Some of the species are *S. metheei*, *S. bovis*, *S. cunasoni*, *S. spindale*, *S. indicum*, and *S. nasale* (Hira and Patel, 1981).



**Figure 1. Mature Schistosome worm: female lying in the gynaecophoric canal of male.**

**Source:** Urquhart *et al.*, 1987).

### Life Cycle

Adult schistosomes are obligate parasite of the blood vascular system of vertebrate. Schistosomes are dioecious (unisexual) worms, which are an exception among the trematodes and have an indirect lifecycle, while water snail act as an intermediate host belong to the genera *Bullinus* and *planorbis* (Brown, 1980).

The infective stage for the disease is matured cercaria after they leave the snail invade the final host through the skin or mucus membranes penetration (Aiello, 1998). Visceral

Schistosomes mature in the hepatic portal veins, mate and migrate to the mesenteric veins where egg production starts (Bont, 1995). The female in the mesenteric vein insert her tail in to the venule. The eggs penetrate the venule endothelium aided by their spines and by proteolytic enzymes secreted by the unhatched miracidia (Urquhart, *et al.*, 1987). Egg lay by the female worm penetrate the wall of the veins and migrate to the intestinal lumen or the nasal cavity. (*S. nasale*) of the host are retained inside the body and it is the retained eggs and their products that responsible for most morbidity from Schistosomosis (Fekade *et al.*, 1989).

### **Pathogenesis and Pathologies of Schistosoma Infection**

After copulation of male and female Schistosomes with in the lumen of veins, adult female moves against the venous blood flow in to small venules, where she deposits 200 to 2000 eggs per day. The ova pass through the wall of blood vessel and then to adjacent tissues. The ova may be discharged in faces or urine and larger amount may be trapped in tissue of the final host (Jones *et al.*, 1997; Urquhart *et al.*, 1997) in the water, eggs are hatched and release miracidia. The miracidia then invade suitable water snails and develop in to the cercariae. When the cercariae are fully matured, they leave the snail and invade the final host through the skin or mucous membranes. After penetration cercariae develop in schistosomula, which are transported through the lymph and blood to their predilection sites (Jones *et al.*, 1997).

The migration of the eggs may cause mechanical damage and lesions. Moreover, Schistosoma eggs trapped in the tissue elicit granulomatous reaction that is mounted to destruct the eggs. These granulomas consist of several cell types, mainly eosinophils, macrophages and lymphocytes (Olds and Mahamoud, 1980). In the chronic stages of the disease, the pathology is associated with collagen deposition and fibrosis, resulting in organ damage and dysfunction (Kogulan and Lucey, 2005).

The major disease syndromes associated with Schistosomes include dermatitis, acute and chronic Schistosomosis (Macswen and Whaley, 1993). The intensity of lesions and signs depends on the duration of infection, number and location of eggs trapped in tissues, species of the parasite and with the immunity of the host to the parasite. Generally the pathologies of schistosoma infections are highly associated with the eggs.

Adult parasites in the vascular system can cause lesions. Cercaria induced skin lesions have been also described (Jones *et al.*, 1997).

### **Clinical Signs and Diagnosis**

The pathology and clinical signs of the disease are largely attributed to the spined egg causing tissue irritation (Bont, 1995). In cattle the clinical sign exhibited are emaciation, marked diarrhea mixed with blood or mucous, dehydration, pallor of mucus membrane marked weight loss, decreased production and rough hair coat (Bont, 1995).

Diagnosis of the disease is based mainly on the clinico-pathological pictures, history of access to natural water sources and demonstration of characteristic eggs based on the species in the feces is useful (Urquhart, *et al*, 1987). The eggs are characteristics in shape and size for each species. The Schistosomes eggs oval (as in *S. monsoni*, *S. haematobium*, *S. japonicum*) to spindle shaped (*S. bovis*, *S. mattheei*) containing a single spined protruding from the shell. (Jones and Hunt, 1997).

In general when schistosomosis is suspected, diagnosis is best confirmed by a detailed postmortem examination which reveal lesion and if mesentery is stretched, the presence of numerous Schistosomes in the veins (Urquhart, *et al.*, 1987).

## **IMPORTANCE**

### **Economic Importance**

In addition to the high prevalence rate and outbreak of the disease, it has an economic impact like production losses due to *S. bovis* result from mortality, delayed growth, partial liver condemnation and poor future reproduction performance and sub clinical infections cause significant losses due to long term effects on animal growth and productive capacity or milk yield, draft power and increase susceptibility to other parasitic or bacterial disease (Mc Cauley *et al.*, 1984). In humans' economic losses in terms of working hours has been shown (Aemro, 1993).

### **Public Health Importance**

Schistosomosis caused by *S. mansoni*, *S. haematobium* and *S. japonicum* is secondary only to malaria and affect approximately 200 million people in Africa, Asia, and South America (Bowman, 2003; Mohammad and Waqtola, 2006).

A form of cutaneous larva migrants often called "swimmers itch" (cercarial dermatitis) occurs in man and Schistosomes which have a limited migration in human skin (Urquhart, *et al*, 1987; Hendrix, 2006). Migratory water fowl frequently harbor schistosomes (blood flukes) in their blood vasculature. These schistosomes produce eggs that pass in the bird's feces to the

water environment. The eggs hatch, producing miracidia, which turn penetrate a aquatic snails with the snail, the miracidium undergo asexual reproduction and produce thousands of cercariae these cercariae exit the snail hope fully to penetrate the definitive host, the migratory water fowl ( Hendrix, 2006). Humans serve as incidental hosts for these avian schistosomes. During the swimmer months, people swim or wade in the lakes, ponds, rivers and even ocean waters frequented by the wild birds.

The cercariae produce within the snails penetrate the skin of humans instead of the skin of the migratory birds (Urquhart, *et al.*, 1987). It is a problem of individuals expected to infested water in agricultural workers and summers.

Schistosome infection of animals can be a serious factor in human transmission at least in the case of one species *S. japonicum* (Hall, 1985).

## 2.6 Treatment and Control

Over the years, different drugs with known schistosomocidal but also toxic effects such as antimonials, trichlorphon or neguvon have been tested against visceral Schistosome infection in cattle (Reinecke, 1989, Van Wayk *et al.*, 1974). Praziquentel is now recognized as a drug of choice against all forms of human Schistosomosis (Harnett, 1988).

In cattle it has been successfully used against *S.bovis* and *S.spindale* (Bushara *et al.*, 1982, 1983b Markovics *et al.*, 1985). Care has to be exercised in treating clinical cases of Schistosomosis since the dislodgment of the damaged flukes may result in massive thrombus formation in the liver. The subsequent occlusion of major mesenteric and portal blood vessels may have fatal consequences if highly efficient drug, which kill all worm are used (Urquhart, *et al.*, 1987 Reinecke, 1989).

Obviously, the most effective way to control cattle Schistosomosis in endemic area is fencing of dangerous waters and supply of clean water to prevent contact between the animals and the parasite. Unfortunately, this is not always possible in most parts of the world where nomadic conditions of management prevail (Bont, 1995). Other methods of control are targeted against the snail intermediate host population like chemical measures include the use of molluscicides. Of current available chemical Bayluscide (Niclosamide) and copper sulfate are the choices of molluscicide. In addition to these, a native Ethiopia plant, *phytoplaca dodecandora*, locally known as “endod” is also an effective molluscicide (Shibru *et al.*, 1989).

In 1993 a world health organization (WHO) expert committee concludes that in a certain important areas the disease could now be controlled with praziquantel treatment with selective snail control. However because of its easy application the major emphasis on control has been on chemotherapy infected peoples and animals (Sandy and Zak, 1999). But in humans, the most effective way of controlling Schistosomosis are eradication of human at risk, the provision of sanitary facilities and the provision of piped water since, it reduces human contact with contaminated water (Mohammad and Waqtola, 2006).

## CONCLUSIONS

Bovine Schistosomosis is one of the endemic diseases in Africa that deserve serious attention. Even though there has been little recognition of its veterinary significance, cattle Schistosomosis does cause significant loss throughout the world. This is due to the nature of the disease, which usually occurs at sub clinical level with long term effect on animal growth and productivity and increase susceptibility to other parasitic or bacterial infection. It is, therefore, important to obtain more information on natural schistosome's infection in cattle in general, and on the evaluation of the host–parasite relationship under condition of challenge in particular. Male and female cattle should be allowed to graze at the same time and the same place to avoid transmission in between; because females give a higher economic value as compared to males. Based on this, the following recommendations are forwarded: Schistosomosis should be taken in to consideration as one of the major limiting factor to livestock productivity; hence any Endeavour towards animal disease control strategy must include it in the priority list. Further detailed studies are needed to gather a rich database both on the parasite and its vector, which will be useful to envisage a cost effective and sound Schistosomosis control measure in the area. Cross breeds should be kept indoors and supplying of clean water then to be performed to prevent infection as they are highly sensitive to the disease, and also different ages and breed groups should not graze together. Available means in snail control and disease monitoring could be implemented as a short term activity. Indigenous knowledge deserves investigation in this regard. The native Ethiopian plant, *phytoplacca dodecandora*, locally known as “Endod” which is considered as potent molluscicide for the control of human Schistosomosis, could also be effectively used against intermediate host of *S. bovis*. Farmers should in need of awareness about the transmission of the disease at least to tell them not to let their cattle freely in swampy area and supply dry feeds sometimes.



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