

Fascioliasis: Live-stock diseases in eastern Uttar Pradesh and their control

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Abstract: A number of vectors of human and animal diseases are conspicuous nuisance pest as well. Many aquatic snails act vectors for the larvae of trematodes and thereby causes two diseases i.e. fascioliasis and schistosomiasis. The WHO and FAO have tested several thousands of synthetic compounds for the control of these vectors. Though effective, these pesticides have so far not proved themselves to be entirely satisfactory. With growing awareness of environmental pollution, efforts are being made to find out molluscicidal products from plant origin. Being products of biosynthesis, these are potentially biodegradable in nature. Several groups of compounds present in various plants have found to toxic to target organisms. No doubt that there is now a need to control the veterinary infection alongwith the human infection. Doubtless, understanding the epidemiology of parasitic diseases and the factors affecting them provides the foundation upon which effective prevention and control programme should be established.

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Introduction

Fascioliasis is a parasitic infection typically caused by *Fasciola hepatica*, which is also known as “the common liver fluke” or “the sheep liver fluke.” A related parasite, *Fasciola gigantica*, also can infect people. Fascioliasis is found in all continents except Antarctica, in over 70 countries, especially where there are sheep or cattle. People usually become infected by eating raw watercress or other water plants contaminated with immature parasite larvae. The young worms move through the intestinal wall, the abdominal cavity, and the liver tissue, into the bile ducts, where they develop into mature adult flukes that produce eggs. The pathology typically is most pronounced in the bile ducts and liver. *Fasciola* infection is both treatable and preventable.

In India, the freshwater snails *Lymnaea acuminata* and *Indoplanorbis exustus* are the intermediate host of *Fasciola hepatica* and *Fasciola gigantica* (Hyman, 1970; Singh and Agarwal, 1992, Yadav and Singh, 2010, 2011, 2013, 2014, 2020), which causes immense harm to domestic animals of this country. Singh and Agarwal (1981), reported that 94% of the buffaloes slaughtered in Gorakhpur District of Uttar Pradesh (India) infected by liver fluke *Fasciola gigantica*. Even though, snails are the vectors of several important disease both human being and live stock, serious attempts to control snails in India have not been made. Fascioliasis is found in more than 50 countries, especially where sheep or cattle are

reared. *Fasciola hepatica* is found in all continents except Antarctica. *Fasciola gigantica* has been found in some tropical areas except for parts of Western Europe, human fascioliasis has mainly been documented in developing countries.

The best method of control both the disease (viz. schistosomiasis and fascioliasis), however is chemotherapy using orally-administered drugs for individuals with moderate or severe level of infection. The disadvantage of this approach is that it does not eliminate the infection entirely, the cost of recurrent treatment may become prohibitive and drug resistance may become a problem. A sure way to tackle the problem of schistosomiasis and fascioliasis is destroy the carrier snails and remove an essential link in the life cycle of the flukes. This can be accomplished in a number of ways including the use of many synthetic or plant molluscicides (WHO, 1965; Thomus, 1973; Godan 1983; Marston and Hostettman 1985; McCullough 1986; Ndamba et al., 1995; Singh et al., 1996, Yadav and Singh, 2010, 2011, 2013, 2014).

People infected with *Fasciola*

People get infected by accidentally ingesting (swallowing) the parasite. The main way this happens is by eating raw watercress or other contaminated freshwater plants. People also can get infected by ingesting contaminated water, such as by drinking it or by eating vegetables that were washed or irrigated with contaminated water.

Fasciola cannot be passed directly from one person to another. The eggs passed in the stool of

infected people (and animals) need to develop (mature) in certain types of freshwater snails, under favorable environmental conditions, to be able to infect someone else. Under unusual circumstances, people have gotten infected by eating undercooked sheep or goat liver that contained immature forms of the parasite.

Sign and Symptoms of *Fasciola* infection:

Some infected people don't ever feel sick. Some people feel sick early on in the infection, while immature flukes are passing (migrating) from the intestine through the abdominal cavity and liver. Symptoms from the acute (migratory) phase can start 4 to 7 days after the exposure and can last several weeks or months.

Some people feel sick during the chronic phase of the infection, when adult flukes are in the bile ducts (the duct system of the liver). The symptoms, if any associated with this phase can start months to years after the exposure. For example, symptoms can result from inflammation and blockage of bile ducts.

The infection typically is diagnosed by examining stool (fecal) specimens under a microscope. The diagnosis is confirmed if *Fasciola* eggs are seen. More than one specimen may need to be examined to find the parasite. Certain types of blood tests also may be helpful for diagnosing *Fasciola* infection.

Diagnosis of *Fasciola* infection

- Microscopic examination of stool or duodenal or biliary material for eggs
- Antibody assays

Fascioliasis should be considered in patients with abdominal pain and/or hepatomegaly, and a dietary history of watercress ingestion or consumption of raw vegetables exposed to contaminated water.

When fascioliasis is suspected, patients should have stool examination for eggs and serum antibody assay. Supportive findings on blood and imaging tests done for evaluation of abdominal complaints include anemia, eosinophilia, abnormal liver tests, elevated erythrocyte sedimentation rate, and hypergammaglobulinemia, and hypodense lesions in the liver on CT scan during the acute stage of fascioliasis.

If stool examination and antibody testing are negative or equivocal but fascioliasis is still suspected (i.e., based on numerous supportive findings particularly eosinophilia), then endoscopy with duodenal and biliary aspiration should be done. Eggs and sometimes adult worms may be detected in specimens obtained during endoscopy.

Antibody detection assays are particularly useful in the early stages of infection before eggs are produced (egg production typically begins at least 3 to 4 months after exposure). Chronic infection when egg production is sporadic or low. Loss of detectable

antibodies occurs 6 to 12 months after cure. In chronic infections, eggs may be recovered from the stool or from duodenal or biliary materials. The eggs are indistinguishable from those of *Fasciolopsis buski*.

In endemic areas, eggs can also be seen in stool after ingestion of infected animal livers, which are not infective for humans, resulting in a misdiagnosis of fascioliasis. Thus, patients should be asked to follow a liver-free diet for several days before their stool is examined. Ultrasonography, CT, MRI, endoscopic retrograde cholangiopancreatography (ERCP), or cholangiography can detect biliary tract abnormalities in chronic disease.

Fasciola infection be prevented

People can protect themselves by not eating raw watercress and other water plants, especially from endemic grazing areas. As always, travelers to areas with poor sanitation should avoid food and water that might be contaminated. No vaccine is available to protect people against *Fasciola*.

Fasciola life-cycle

Fasciola has a complex life-cycle that involves intermediate snail and definitive mammal hosts, including humans. Eggs shed in the stool of the definitive host embryonate in fresh water releasing a single miracidium. The miracidium penetrates the tegument of the snail intermediate host to cause infection. Susceptible snails belong to the Lymnaeidae family. There are 30 snail species shown to be competent hosts in nature or in vitro but with different transmission efficiencies (Vázquez Perera et al., 2018). Snails from the *Galba* and *Radix* genus, particularly *Galba truncatula*, are responsible for most of *Fasciola* transmission around the world. The distributions of *Fasciola* risk and infection follow the distribution of the intermediate host which is key to sustain the parasite in endemic areas (Rondelaud et al., 2005). Importantly, the snail infection amplifies *Fasciola* production by generating large numbers of cercariae from a single miracidium. Free swimming cercariae disperse a few meters away from the snail host usually following water currents. These encyst into metacercariae that stay in the water or attach to aquatic plants (Rondelaud et al., 2020). The mammal definitive host acquires the infection by ingesting metacercariae in water or leafy vegetables that grow near water. After ingestion, metacercariae excyst in the intestine and release the immature parasites that migrate through the wall of the intestine, the abdominal cavity, and the liver parenchyma to reach the biliary tree. Once in the bile ducts, the parasites mature and start producing eggs.

Efficacy of molluscicides

Size of snail play an important role in the absorption of plant extracts, adult snail has been

shown to be more susceptible snail lethality than the juvenile snail (Rawi et al., 2011), Newly hatched as well as young snails were slightly less susceptible than older mollusc. This could be attributed to large surface area to body ration in adult snails that exposes snails to larger amount of plant extract (Abubakar et al., 2017). Detoxification of substance in snail body upon encounter with toxic substance snails make a heroic last-ditch attempt to detoxify its body by producing more mucus trying to excrete the noxious substance through its slime (Brook, 2013). This was earlier explained by Clark and Appleton (1996), that snails produce excessive mucus upon encounter with toxin. The mucus serves as a protective barrier preventing direct contact between the toxin and the epithelial of the skin or digestive tract thereby hindering the efficacy of the molluscicides (Henderson and Triebkorn, 2002).

Active compounds

Plant to obtain the active substance, it is impossible to isolate the entire constituent. Among the thousands of different substances, one or few are responsible for the therapeutic action (or the toxicity activity) (Abubakar et al., 2017). Another factor is lack of information on the distribution of the molluscicidal activity present in different plant parts; such information might have a predictive value, but is not available due to failure of most investigators to systemically study all part of plant (WHO, 1983).

Plant molluscicides on snails

Mode of action plant molluscicide is done to discover which molluscan systems are affected by molluscicide. The importance of understanding the mode of action of plant molluscicides has been stressed by various investigators (WHO, 1983), in hope that less toxic, cheaper, readily available molluscicides that could be used in control of snail intermediate host of various parasitic disease could be obtained. Based on their mode of action, plant molluscicide can be categorized into following categories; enzyme inhibitors, neurotransmitters inhibitors (or neuro toxin), stomach poisons, respiratory poisons, contact poisons and growth inhibitors.

Acetylcholinesterase (AChE) is a key enzyme in the nervous system of animals, the enzyme occurred in the outer basal lamina of nerve synapse neuromuscular junction and certain other tissues (Akinpelu et al., 2012). The enzyme is responsible for the termination of cholinergic impulse by hydrolysis of acetylcholine (ACh) released during synaptic transmission. The mechanism of action of AChE as described by Sharaf El-Din et al., (2012) is that AChE is released at the myoneural junction in organisms if an action potential is developed at the nerve ending

and diffuses though the gap between the nerve and the muscle. Achieving acute toxicity is the goal for an effective molluscicide, the early phase of metabolic activation is usually followed by a decrease and finally a cessation of enzymatic activity coincident with cell and animal death (Henderson and Triebkorn, 2002).

Mode of action and neuropathological effects of selegiline, bayluscide and ethanolic extract of *Anagalis arvensis* on the neurons of the cerebral ganglion in the freshwater snail *B. alexandrina*. Electron microscopical examination of treated animals revealed severe ultra-structural alterations in the cerebral ganglia. Proteins are critical chemical compounds that control everything that cell do, in addition they make up the material from which cell and cell parts themselves are made. The nature of the molluscan nervous system is such that any damage caused to it could result in a wide range of effects e.g. changes in heart rate, oxygen consumption and water uptake (Clark and Appleton, 1996).

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