INCIDENCE AND IMPACT OF FASCIOLOSIS ON RUMINS IN THE MOUNTAIN AREA

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Abstract

General progress, equally in the biological and medical sciences, has culminated in the classification of diseases with high specificity in mountain areas and with economic repercussions for cattle and sheep farmers in these areas. Fasciolosis is one of these diseases that evolves all over the world and throughout Romania, especially in hilly and mountainous areas, on wetlands with pastures and grasslands rich in limneid (snail) biotopes, with a higher incidence in hot summers and rain, favored in recent years by climate change. The disease affects a large number of farm animals, creating large losses from an economic point of view, through high mortality (especially in sheep), high morbidity up to 50%, significant decrease in meat production, milk and their recovery costs veterinary sanitary.

Keywords: *fasciolosis, sheep, cattle, biotope, economic, production.*

RESEARCH METHODOLOGY

This paper presents aspects of a medical condition of cattle in the mountain area, with major economic implications. Through the realization of this scientific paper I studied the national and international literature with scientific papers of many well-known authors in the field of veterinary medicine. But I must remember that my professional experience of over 30 years, as a veterinarian in the mountain area of the Dornelor Basin, helped me a lot. Many of these aspects are known, but we wanted to highlight and bring to the attention of breeders, more details about the implications and repercussions of this condition and to increase the attention of cattle and sheep breeders to avoid economic losses.

INTRODUCTION

Fasciolosis is a seasonal enzootic, hepato-biliary disease specific more to herbivores and especially to large and small ruminants with usually chronic and very rarely acute evolution, also known as "Yellow" (Şuteu and Cozma 2004). The disease develops in America, Asia, Africa, Oceania and Europe (Portugal, Spain, France, Italy, Belgium, Turkey and Romania) (Dorchies and Alzieu, 2008). The disease is found around the globe and occurs more aggressively in years with hot and rainy summers in small and large ruminants that graze on land with limneid (snail) biotopes, or that consume fodder obtained from such land.

Ruminants around the world are affected by this disease and cause huge financial losses for farmers, meat processing establishments and consumers (Schweizer, et al. 2005), and worldwide losses in terms of animal productivity in the cause of fasciolosis has been estimated at over $ 3.2 billion per year (Spithill et al. 1999). It is more and more common in humans, currently infesting over 2.4 million people in over 60 countries around the world

(Keizer and Utzinger, 2004). The disease is caused by a trematode called ***Fasciola hepatica***, with dimensions of 2–3/1–1.5 cm and is considered to be the most widespread in our country. The disease can also be caused by trematodes *Fasciola gigantica* with dimensions larger than 3.5–7/1 cm and *Fasciola magna*, but in our country very rarely.

BIOLOGY

The biological cycle takes place on two gases (Șuteu and Cozma, 2004):

- GI – intermediate host, represented by gastropods (freshwater aquatic snails) such as Galba truncatula, Limnea pallustris, Limnea stranguалis, Radix ovata, Radix peregra, etc.
- GD – definitive host, represented by sheep, goats, cattle, pigs, horses, hares as well as wild herbivores. Fasciolosis is also found in humans.

The bundle eggs are eliminated from the liver and bile ducts, they end up with the bile in the GD intestine, and from here they are eliminated together with the feces in the external environment, on the soil, pasture and water. Embryogenesis takes place on aquatic biotopes, canals, mudflats, ponds, shallow lakes, muddy lands near rivers, etc. From the egg, the first larval stage is the *miracidium*, which lives about 36 hours, has an increased mobility in search of GI, being attracted by the mucus of snails and enters their skin, called *Galba truncatula*. After the miracidium enters the snail, it transforms into a *sporocyst*, with a saciforum appearance in which the germ cells develop, and by multiplying them they will give birth to *redies.* The redies become free, they reach the hepatopancreas of the snails where they turn into redies and then into *cercariae*, which are shaped like amphibians and have a tail that helps them move through swimming. Dozens to hundreds of searches are formed from a network. They leave the body of the snail and reach the outside environment, swim actively until they catch the base of the grass threads, then lose their tail, form a shell and turn into *metacercariae*, which is the infesting form. About 20,000 metcercars can be formed from an egg that has been eliminated with feces in the external environment (Șuteu and Cozma, 2004). They last in nature for about 5–6 weeks and can last until next year if it is a less frosty winter. Herbivorous animals will be infested during grazing, watering or feeding, with hay harvested from wet and swampy land. Human infestation with Fasciola hepatica can occur by consuming plants with metacercariae, from the waterfront such as watercress (Lepidium stativum) or buttercup (Ficaria verna), but also by consuming water from rivers. Once ingested by herbivores (GD) in their digestive tract, under the action of digestive enzymes, the metacercase shell is destroyed and released, crosses the intestinal wall into the abdominal cavity, then perforates the Glisson capsule (liver capsule), advances through the liver parenchyma to and is located in a bile duct, begins to feed on blood and bile, becomes an adult, and in 2–3 months begins and lays eggs (Moglan and Popescu, 2009). These will be eliminated with the feces and thus the cycle resumes.

EPIDEMIOLOGY

The spread of fasciolosis worldwide has different prevalence and epidemiological aspects, being correlated with a multitude of factors:

- the presence of GI in biotopes and their behavior,
- the summer regime with heavy heat and rain,

– maintenance of animals in stables or pastures,
– the receptivity of many species of herbivores,
– organization of prophylactic and therapeutic measures.

The main sources of contamination are represented by:

- GD with subclinical or diseased forms that permanently eliminate eggs in the external environment;
- GI represented by limneides which by eliminating the searches pollute the pastures, hayfields, waters, on which the most resistant and polluting-metacercai elements are formed.

GD contamination has a variable amount; 2-year-old sheep have an increased receptivity then adult cattle, rabbits and goats. Fasciola hepatica eggs are resistant to the outside environment depending on certain factors, of which humidity and temperature are essential. In the faeces they last up to 30 days, at a temperature of 8°C and approximately 16 days at 18°C (Enigk and Düwel, 1959). Exposed to heat and dryness, the eggs are destroyed in 4 days, at –3°C in a few hours, on pasture protected under snow for several weeks. Thermal variations in biotopes of 12–14°C and relative humidity are viable for 6–10 months and at temperatures of 2–5°C, up to one year (Boray, 1963). Metacercars survive well in the fall and early winter. Summer with sunny days, with high temperatures, lasts 2–17 days. The oscillations between +10°C and –10°C are favorable for life, many months (Șuteu and Cozma, 2004). In hay kept in adequate conditions, the longevity of the matacercars can reach from 6 months to 2 years (Șuteu and Cozma, 2004). In green mass silos, metacercariae are destroyed in 35–60 days by fermentation. The autumn metacercars left on the meadows will be destroyed by the low winter temperatures.

BIO-ECOLOGY GI

The most susceptible gastropods to infection with fasciola larvae in our country are Galba truncatula snails. The snail species populates most of the freshwater habitats in all relief areas from low altitude to high altitudes of 3000 m (Euzeby, 1971). Biotopes can be permanent and do not undergo major changes over the years and temporary biotopes, favored by rainy years, such as pastures and grasslands with surface groundwater, shallow waters that appear seasonally, traces of hooves or wheels vehicles, which have a rather high epidemiological role. Plants with broad leaves, various algae and sludge amplify their development. When we have dry summers, the snails resist deepening in the mud and return to activity during the autumn rains of September, October. Of all the woody species, Galba is the most receptive species and infests at any age. Snail infestation and reinfestation generally take place in early spring and continue until late autumn, when the animals enter the stable. The receptivity of herbivores is influenced by a number of factors: species, age, physiological status and health status. Small ruminants have the greatest vulnerability: sheep, goats, followed by large ones – cattle. For example, grazing on polluted land, sheep develop acute fasciolosis after consuming 2,000 metacercares / kilogram of green mass, and cattle show symptoms after consuming about 100,000 metacercares / kilogram of green mass (Moglan and Popescu, 2009). Horses have a high state of specific resistance, regardless of the amount of metacercariae consumed. In older bulls, the disease develops subclinically or clinically, but in young bulls acute and subacute forms appear. This indicates that a certain resistance develops through the reinfection of adult cattle. Also the receptivity can be amplified by the contamination with other types of parasites, by the state of health, by the evolution of some chronic diseases or states of sub- or malnutrition (Șuteu and Cozma, 2004).

PATHOGENESIS

During migration until they reach the bile ducts and during stagnation in the liver, the parasite acts particularly aggressively, acting mechanically, spoliating, irritating, inflammatory, inoculating and toxic. The intensity of these actions is correlated with the doses of metacercars ingested and their aggressive capacity because the metacercars in summer are more aggressive than those in spring or autumn who benefited from a more moderate thermal regime. The *mechanical effect* appears from the beginning of the infestation, when the metacercars release the young forms that injure the mucosa when they cross the intestinal wall, advancing towards the liver. Here the Glisson capsule perforates, traumatizes the liver parenchyma, vast ruptures of capillaries occur, leading to liver infarction, then the bile ducts are perforated. In massive infestations, damage occurs over large areas of the liver. The *inoculating effect* of the fascioles is given in the migration phase, anaerobic bacteria (Clostridium nooyi) or pyogenic germs that give peritonitis or perihepatitis can be inoculated. By overlapping with other E.coli germs, staphylococci, streptococci, necrotizing hepatitis, self-poisoning, or super-imposed together can be triggered. Capillary-vascular destruction leads to damage to the suprahepatic and anteportal venous system, with venous circulatory disturbances that can cause ascites. The mechanical action of the fascioles has a massive impact on the bile ducts, by their obstruction preventing the biliary drainage, as well as the qualitative modification of its content. Chronic bile duct irritation leads to fibrosis and inflammation. Hematophagous nutrition of bundles can lead to anemia, with significant changes in blood parameters, decreased red blood cell resistance, decreased serum elements (calcium, zinc, copper, phosphorus) (Shuteu, & Cozma, 2004). The *toxic effect* is given by the metabolic products of the parasites (secretions, excretions) as well as by the disintegrated dead parasites. These toxins act through necrosis with hyperplastic and proteolytic effects of the bile ducts. Toxins produce large imbalances of the general metabolism, with alterations and dysfunctions of the endocrine system of the hematoforming organs (Șuteu and Cozma, 2004). All these overlapping effects lead to progressive weakening, weakened immune system, generalized intoxication, anaphylactic states, reproductive disorders and even death.

SYMPTOMS

How do we recognize animals with fasciolosis?

The sheep

The *acute form* occurs in massive infestation with metacercariae from summer to autumn, and in the first part of winter. After about 17–21 days post-infestation, or even up to 6 weeks, the first signs appear, translated as: fatigue, deviation, weight loss, decreased appetite, anorexia, anemia, accompanied by circulatory disorders, ascites, colic expressed by bruxism (gnashing of teeth) submaxillary and periorbital edema. This form lasts about 3–10 days with a lethal end in over 40% of cases, or will go into subacute or chronic form (Hiepe, Buchwalder, & Nickel, 1985). Healing occurs in a very small percentage, and covalescence is long-lasting (Lungu et al. 1956; Euzeby, 1971). The *chronic form* appears from the autumn months until spring (February–March), by the gradual ingestion of a small number of metacercars. This form lasts for several months. The onset of symptoms appear in September–November, after 6–8 weeks post-infestation, with subclinical evolution, adynamism, muscular hypotonia, myasthenia. The second period, December–January, occurs with weakening, pallor of the mucous membranes, anemia, gradual weakening, periorbital and submandibular edema (goiter), regional deglabrations, lack of appetite. If we palpate the abdomen, ascitic fluid is perceived and with a much enlarged liver area. The third final period, characterized towards the end of winter, appears with anemia, progressive weakening, up to cachexia, muscular atrophy, with the highlighting of the bony prominences. Aqueous diarrhea occurs due to ascites, with a dilated abdomen. In females device abortions and agalaxis. If calving is completed, the lambs are unviable or die in the first days after calving. If there is no intervention with treatment, after 2–4 months of disease evolution, mortality of 5–15% occurs, and in large herds neglected with treatment, up to 50% (Euzeby, 1971). When fasciolosis overlaps with other parasitic liver diseases, the changes can have a polymorphic appearance, much more varied and more severe. The chronic form can be aggravated by massive reinfestations with metacercariae and by overlapping with disorders of the acute form.

The cattle

Usually in cattle fasciolosis evolves chronically, but also subclinically with repercussions on production. *The acute form* occurs quite rarely, only when we have a numerically rich area in metasearches. In young cattle up to 18 months, the manifestations of the acute form are similar to the acute form in sheep, have a higher incidence in the autumn season and less dramatic clinical signs with low mortality. The chronic form in cattle has manifestations of hypertrichosis, with dull hair, weight loss, anemia, altered appetite, atony of the stomach, soft or diarrheal feces, decreased production and especially decreased and altered milk quality by bitter taste. The evolution can take several months, and the morbidity is higher in winter. The disease develops subclinically when the infestations are weak.

TREATMENT

The deworming of animals, diagnosed with fasciolosis at different stages, is well treated by a strategic method of treatment, using alternatively several anthelmintic products to avoid resistance during the invasion of beans in the body of the final hosts. We can list products such as: triclabendazole, albendazole, rafoxanide, oxyclozamide, closantel and clorsulon. All these products listed differ in price, safety parameters, effectiveness and availability. With maximum efficacy closantel and clorsulon or proven extremely effective in coil fasciolosis and in sheep and goats, oxyclozamide.

PROPHYLACTIC MEASURES

It is based on systematic deforestation, destruction of parasite-free forms and control of gastropods. In *sheep*, the first treatment will be instituted in the spring at least 2 weeks before going out to pasture and the second at about 2–3 weeks after entering the stable. **In the mountain area**, where there are more favorable conditions for the outbreak of the disease, due to the increased conditions of precipitation, heat and humidity, 2 to 4 treatments are recommended. The first before entering the pasture, the second in September, a third in autumn in November and a fourth in January–February. In *cattle*, the treatments are applied in two stages: one 2 weeks before grazing and one 2–3 weeks after entering the stable. In regions where there are buffaloes, the procedure is the same as for cattle. After treatments, depollution measures are required by collecting and storing the manure at the platform for biothermal sterilization, and the animals will be kept for 4–5 days on cultivated areas or on stubble. Grazing will be done by rotation and by species, so that the grazed areas will not be used for more than two months. Hay from contaminated land will be fed to animals six months after harvest. Silage leads to the destruction of metasearches. The sources for watering the animals will be well arranged and maintained. The control of gastropods by clinical methods is no longer used due to the increased risk of pollution of agro-mountain ecosystems. In small places where biotopes can be identified with certainty, copper sulphate in a 28% solution can be used, by spraying in the early spring after hibernation leaves or in late autumn after the animals are removed from the pasture.

ECONOMIC IMPLICATIONS

From an economic point of view, the disease can cause significant losses. The biggest losses for farmers come from reduced milk production and a low fertility rate. It has been shown that cows with fasciolosis required more inseminations to produce a conception product than those that were healthy (Oakley et al. 1979). Significant losses are found in the slaughterhouse at slaughter, by reducing meat production and condemning the liver for destruction. It also increased youth and fattened weight loss. In dairy cows with fasciolosis, the percentage of fat decreases considerably and often acquires a bitter taste. Fasciolosis is often ignored by farmers, especially in subclinical cases when the signs are less or not at all visible. But the economic analysis of losses in the agro-mountain economy, can reveal considerable values, starting from the quality and quantity of milk / cow / lactation, as well as by the substantial decrease of the quality and quantity of meat. Given the prevalence and economic losses that fasciolosis brings to mountain farmers, a financial analysis of the losses should be considered and a cost-benefit analysis should be considered and investment strategies should be implemented with research into diseases with a major impact on mountainous areas.

CONCLUSIONS

Analyzing the data presented in this paper can be formulated a series of conclusions, but also sustainable measures for farmers in the mountain area:

- Fasciolosis is an endemic parasitic disease that infests many species of domestic animals but the most important from an economic point of view are sheep and cattle.
- It is specific to all regions, but more pronounced in hilly and mountainous areas, being favored by the climatic conditions specific to these areas rich in biotopes of Galba truncatula snails, which is the intermediate host, which ensures the evolution of fasciola eggs.
- It has a high degree of mortality in sheep and generally a high prevalence throughout the year higher from spring to late autumn.
- It causes significant economic damage by lowering milk, meat and low fertility rates.

MOTIONS

- Implementation of mandatory programs for continuing education of farmers to produce an awareness and multidimensional approach to the dynamics and evolution of fasciolosis in animals and humans.
- Also by implementing these continuing education programs, farmers could learn about other diseases of economic importance specific to mountain areas as well as general knowledge of agro-mountain economics.

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