Popular Article

Trends in Agriculutre Science ISSN:2583-7850

Vol.2 Issue 7 July 2023, Page: 515-520

# Parasitic Gastroentritis (PGE) and its management in ruminants

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https://doi.org/10.5281/zenodo.8150908

## Introduction

Gastrointestinal nematodes (GI nematodes or gut roundworms) are major contributors to reduced productivity in cattle, sheep and goats all over the world. Parasitic Gastroenteritis (PGE) is the condition caused by large numbers of gastrointestinal nematodes that reside in the gut (abomasum and intestines) of the ruminant host. The clinical signs of PGE vary depending on nematode species and abundance. PGE is primarily a disease of lambs and first season grazing cattle. The most profound effect of parasitism in both sheep and cattle is the sub-clinical production losses (i.e., not visually obvious), the true extremity of which farmers are unlikely to be aware (Waller and Thamsborg, 2004).

**The main species of GI nematode that are of veterinary importance are:**

- *Cooperia onchophora* (Cattle)
- *Ostertagia ostertagi* (Cattle)
- *Teladorsagia circumcincta* (Sheep and goats)
- *Trichostrongylus* spp. (Sheep, goats and cattle)
- *Haemonchus* spp.(Mainly sheep and goats but sometimes cattle)
- *Nematodirus battus* (Mainly sheep but sometimes cattle)

## Life cycle

Most GI nematodes have a simple direct lifecycle, although there are species-specific variability in development rates and predilection site. The lifecycle has two distinct phases; 1) within the host, and 2) the free-living stage where the parasite is developing in the environment.

1. Unembryonated eggs are passed from the host in faeces
2. The eggs embryonate and develop into first stage larva (L1)
3. The L1 undergo two more moults (L2 and L3), and hatch out of the egg shell and migrate out of the faecal pat onto the pasture as L3
4. The L3 are infective at this stage and need to survive on the pasture until ingested by the ruminant host
5. Once consumed the L3 migrate to the gut and borrow into the gut lining
6. Here they undergo two more moults (as L4 and L5) before emerging and maturing into adult worms
7. The male and female worms reproduce
8. The female worms lay eggs which are passed out in the faeces

**Factors affecting PGE epidemiology**

The development of parasite within the host, or through the free-living stage is dependent on many different risk factors and these can be divided into 3 groups:

1. Animal factors
2. Environmental factors
3. Farm management factors

**Animal Factors**

Young animals in their first grazing season are most susceptible to PGE and then as they reach about 12 – 18 months they often develop strong immunity, although the immune response varies according to the worm species, and levels of exposure to the parasite.

The relative importance of the different GI nematodes differs with host age because of acquired immunity. The immune response to GI nematodes is directed at different stages of the parasite development and is a complex interaction of humoral and cellular immunity.

**Genetics and PGE**

Animals that withstand a heavy parasite burden and shed lots of eggs in their faeces but continue to grow and perform are known as resilient animals. These animals have the ability to resist the pathogen and grow well regardless of worm burden often coping well without treatment. However, the danger with these animals is they are contaminating the pasture for the less-resilient animals.



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Published: 15 July 2023

**Pregnancy and PGE**

Peri-parturient rise (PPR) also known as spring rise, or post-parturient rise, is the name given to a large increase in faecal egg counts that occurs about 2 weeks before birth, and for about 6 week afterwards. It occurs mainly in ewes, goats, sows and to a lesser degree in cattle. It is thought to be due to the relaxation of the immune system in late pregnancy, allowing for parasite infection, or hypo biotic larvae to mature.

**Environmental Factors and Nematode Survival:**

The free-living stages of GI nematode development are often overlooked by farmers yet they are imperative to enable parasitic infection. The free living stages can be sub-divided into 2 stages both of which are largely dictated by climate:

The first stage is egg development to infective L3

The second stage is L3 survival.

Climate influences development and survival of larva on the pasture, and the distribution and migratory behaviour during the free-living stages. The main factors are temperature and humidity but also sunlight (UV light) can increase mortality. Extreme heat and cold are detrimental to development and survival, but are tolerable within certain limits (Morgan and van Dijk, 2012).

**Farm Management Factors and PGE**

The grazing system and pasture management impacts on levels of pasture contamination, and therefore worm burden in stock. Different grazing management strategies can be used to minimise larval challenge by targeting, or avoiding the obligatory free-living stage on the herbage to provide 'safer' pasture for the stock to graze.

**Control and Prevention of PGE**

Parasitic gastrointestinal roundworms are ubiquitous on farms. Parasite control programmes are not there to eliminate worms fully but to reduce the burden and minimise the negative impact on health, and improve production.

Unfortunately, there is no silver bullet solution for eradicating worms from the farm, but instead there are a variety control measures that can be applied on farm to minimise challenge, and control worm burden. The control measures described below must be used in combination as no single measure works in isolation. Nevertheless, it should not be overlooked that any control measure in which there are GI nematode that survive is subject to evolutionary advancement in which these survivors will produce descendants that may be able to endure unfavourable conditions, enforced by the control measure.



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Published: 15 July 2023

Before any approach to control is attempted it is good to know what you are dealing with and a simple way to do this is through Faecal Egg Counts, and an Anthelmintic Resistance check.

**Faecal Egg Counts**

Faecal egg counts (FEC) are a diagnostic tool in which the number or worm eggs per gram of faeces is calculated, and can be used as an indication of parasite infection. FECs are conducted using either the McMaster technique or FECPAK which is a modified version of McMaster developed for farmers to use in the field. FECs are a good method for monitoring GI nematode infection, and potential pasture contamination especially when attempting a new control approach. Furthermore, they are often used by farmers as an indication to treat over a pre-determined threshold.

In cattle FECs are a useful measure of concentration of worm eggs being excreted onto the pasture, and are frequently used by researchers and clinicians to test for , however FEC is not necessarily consistently correlated to worm burden, or pathology. More can be read about this in the COWS technical manual: Controlling PGE in cattle.

**Anthelmintic Resistance**

Anthelmintics are anti-parasitic drugs used to treat worms, fluke and other helminth infections. Anthelmintic resistance (AR) occurs when the worms are able to tolerate a drug at its normal dose, and this ability is passed on to their offspring. The drug is essentially losing its effectiveness (efficacy). Reports of anthelmintic resistance in worms are widespread and, given reliance on drugs for worm control on farms, AR threatens the viability of the livestock industry worldwide. Resistant worms are an increasing concern, so far more in sheep than in cattle, and there is an urgent need to alter control strategies to take account of this. The most efficient way to limit the increase of anthelmintic resistance is the reduction of the selection pressure by drugs, and optimal timing to maximise their efficacy (Silvestre et al., 2002).

**How do you test for resistance?**

Resistance on farm is detected using a “Drench Check” or a Faecal Egg Count Reduction Test (FECRT), full details of which are on the SCOPS website or COWS. In short, FECs are carried out on a number of individuals pre-treatment, then the FECS are repeated a number of days (dictated by the drug used) post-treatment. Comparisons of the egg counts give an indication of drug efficacy and where this has fallen below 95%, anthelmintic resistance is suspected. A simpler version of the drench check uses pooled FEC from a minimum of 15 animals before and after treatment (as dictated



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by the drug used). This is less precise, but considerably cheaper and if conducted routinely should give an early indication of a developing problem.

Resistance levels evolve and tests should be carried out at least every 2 years. Ideally, drench checks should be incorporated into routine worming protocols. The rate at which resistance develops is dependent on many factors including the species of worm being targeted and the number of worms in refugia. The refugia populations are the worms that do not come into contact with the drug during treatment and therefore remain susceptible and include larvae on the pasture, worms in untreated animals, and inhibited larvae inside the host.

**Other Control measures:**

Practical grazing management systems require effort, forward planning and are initially difficult to quantify, however the following strategies have shown some success under experimental conditions:

- Mixed grazing
- Alternating stock
- Rotational and evasive grazing
- Extensive grazing and stocking density
- Cutting and reseeding
- Pasture composition

**Treating PGE**

Many factors should be considered before deciding when to dose animals, including age of animals, grazing and dosing history, performance/condition and clinical signs of scour/illness. One of the most practical recommendations to control anthelmintic resistance is the specific targeting of anthelmintic dosing to when animals actually need it (McCoy et al, 2005).

The majority of currently available anthelmintics used to control parasitic nematodes of cattle and sheep belong to only three main groups, the benzimidazoles, imidazothiazoles and the avermectins/milbemycins. In sheep there are two new groups: Monapantel (Zolvix) and Derquantel and Abamectin combination (Startect).

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