

Title:

Using eDNA for the detection of sheep helminths in a range of environmental sample types.

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Abstract:

Gastrointestinal helminth parasites are responsible for considerable economic and welfare burdens in UK agriculture. With the climate changing and UK weather conditions becoming warmer and wetter, the prevalence and distribution of some parasites has increased. Anthelmintic resistance is also increasing to drug classes including benzimidazole, levamisole and ivermectin. As the situation continues to change, livestock parasite management approaches need to be reconsidered in the UK. To achieve this, we need to look towards new improved ways to detect and treat livestock parasites.

All organisms shed DNA into their surrounding environment. This "environmental (e)DNA" as a biomarker enables the detection of species diversity and abundance, even for rare species. Isolating parasite eDNA in the environment from multiple matrices offers the opportunity to improve current diagnostic methods at the pasture level. The ability to detect parasite specific biomarkers in the environment has the potential to assess infection risk at the whole-farm scale.

This study will be carried out on sheep farms in Northern Ireland utilising grass, soil, and water as environmental sources for the detection of gastrointestinal helminth parasites. Availing of the improved sensitivity and quantitative capabilities of ddPCR technology to improve detection and risk prediction using specific primer-probes. Longitudinal collections of host dung samples will be obtained alongside environmental samples throughout the grazing season. Host dung samples will demonstrate the changes in parasite taxa as grazing progresses, whilst environmental samples will be used as source material for eDNA surveys of parasites. Paired environmental and host sampling of dung will strengthen links between the risk of helminth infection and confirmed infections. Throughout this study, eDNA degradation trials will be carried out to further understand how this parasite biomarker

decays in the environment under varying abiotic factors. Understanding these factors will allow us to better model parasite risk prediction. DNA extraction methods for different environmental matrices will be developed and assessed. Improved knowledge of changes in sheep parasite community throughout the grazing season coupled with improved knowledge of parasite distribution at the pasture level, will be used by farmers to guide grazing management and anthelmintic treatments.