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The effects of farm management practices on liver fluke prevalence and the current internal parasite control measures employed on Irish dairy farms

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ABSTRACT

Fasciolosis caused by *Fasciola hepatica* is responsible for major production losses in cattle farms. The objectives of this study were to assess the effect of farm management practices on liver fluke prevalence on Irish dairy farms and to document the current control measures against parasitic diseases. In total, 369 dairy farms throughout Ireland were sampled from October to December 2013, each providing a single bulk tank milk (BTM) sample for liver fluke antibody-detection ELISA testing and completing a questionnaire on their farm management. The analysis of samples showed that cows on 78% ($n = 288$) of dairy farms had been exposed to liver fluke. There was a difference ($P < 0.05$) between farms where cows were positive or negative for liver fluke antibodies in (a) the total number of adult dairy cows in herds, (b) the number of adult dairy cows contributing to BTM samples, and (c) the size of the total area of grassland, with positive farms having larger numbers in each case. There was no difference ($P > 0.05$) between positive and negative farms in (a) the grazing of dry cows together with replacement cows, (b) whether or not grazed grassland was mowed for conservation, (c) the type of drinking water provision system, (d) spreading of cattle manure on grassland or (e) for grazing season length (GSL; mean = 262.5 days). Also, there were differences ($P < 0.001$) between drainage statuses for GSL with farms on good drainage having longer GSL than moderately drained farms. The GSL for dairy cows on farms with good drainage was 11 days longer than for those with moderate drainage ($P < 0.001$). The percentage of farmers that used an active ingredient during the non-lactating period against liver fluke, gastrointestinal nematodes, lungworm, and rumen fluke was 96%, 85%, 77% and 90%, respectively. Albendazole was the most frequently used active ingredient for treatment against gastrointestinal nematodes (57%), liver fluke (40%) and lungworm (47%), respectively. There was a difference ($P < 0.05$) in the use of triclabendazole and albendazole between positive and negative farms, with triclabendazole use being more common in positive farms. This study highlighted differences in dairy management practices between Irish farms with dairy herds exposed or not exposed to liver fluke and stressed the need

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of fine-scale mapping of the disease patterns even at farm level to increase the accuracy of risk models. Also, comprehensive advice and professional support services to farmers on appropriate farm management practices are very important for an effective anthelmintic control strategy.

1. Introduction

Fasciolosis, caused by *Fasciola hepatica* (liver fluke), may have a great impact on global livestock productivity (Fox et al., 2011). Liver fluke is a significant trematode parasite of cattle in regions with a temperate climate (Bennema et al., 2011). The completion of the liver fluke life cycle is related to specific climatic and environmental conditions and, therefore, the use of both climatic and environmental variables can help in interpreting the observed temporal disease pattern (McCann et al., 2010a,b). The systematic use of anthelmintics and also drainage, fencing and pasture management practices are the major control measures against fasciolosis (Torgerson and Claxton, 1999).

In Ireland the climate is mild, with higher precipitation in the western half of the country and on highlands (Walsh, 2012). The temperate climate permits a dairy farming system that is lower cost and more dependent on grazed grass compared to other EU countries (Creighton et al., 2011; Läpple et al., 2012). Extended grazing of grass from early spring to late autumn when conditions allow, and spring-calving that synchronises the peaks of both grass growth and milk production, are key features of dairy farming management (Dillon et al., 1995; Läpple et al., 2012). However, the humid climate together with the seasonal grazing and the reliance on grazed grass can increase exposure to parasites such as liver fluke (O'Farrell et al., 1986).

Previous studies in Ireland have showed a herd prevalence of fasciolosis in autumn 2012 of 82%, using a liver fluke enzyme-linked immunosorbent assay (ELISA) on bulk tank milk (BTM) samples from dairy herds (Selemetas et al., 2015), and a prevalence of 65% of liver fluke infected livers from culled cattle during autumn 2002 and summer 2003 (Murphy et al., 2006). Parasites comprise a continuous and often high infectious pressure on grazing animals (Waller, 1999) and the degree of infection depends on previous parasitic exposure, the physiological state of animals and seasonal conditions affecting infection and grazing (Waller, 2006). While farm management factors are a major driver of liver fluke infection risk (Bennema et al., 2011), studies evaluating the association of farm management practices with liver fluke exposure and parasite control programmes in Ireland are limited.

The objectives of this study were (i) to identify the association between different farm management practices with liver fluke prevalence on Irish dairy farms and (ii) to document the current measures employed by Irish farmers for the treatment and chemoprophylaxis of different internal parasites, especially liver fluke.

2. Materials and methods

2.1. Study design and sample population

In total, 450 dairy farmers throughout Ireland were invited to participate in a survey between October and December 2013. The farmers were selected by Teagasc (Irish Agriculture and Food Development Authority) dairy advisors with the aim of achieving an even distribution of farms throughout the country. In order to assure an equal sampling probability of counties with dairy cattle density, the counties were divided in four groups based on the national percentage of dairy farms in each county. Therefore, the target number of sampled farms per county was 10 for the least intensive dairy farming counties, 20 for the moderately intensive counties, 40 for the more intensive, and 80 farms for the most intensive county of Cork. Most of the contacted farmers participated in Teagasc discussion groups, with the remainder selected by Teagasc dairy advisors to help achieve the even geographical distribution of farms. A questionnaire and a sampling kit with equipment and instructions for taking a BTM sample was posted to the farmers.

2.2. Questionnaire

Between October and December 2013 participating farmers were asked to complete a questionnaire on farm management practices and anthelmintic use, referring only in their adult dairy cows. The questionnaire was sectioned into four parts, (i) farm structure, (ii) pasture management, (iii) grazing management, and (iv) antiparasitic treatment control, and consisted of 44 questions, including 18 multiple choice, 16 open-ended and 10 binary closed-ended questions.

The first section of questions asked about farm structure: total number of adult dairy cows on the farm (dairy herd size), adult dairy cows contributing to BTM sample and if sheep, goats, horses or deer shared pasture with the dairy cows. A second section of questions on pasture management determined (i) the total area of grazed grassland (ha) and the number of paddocks, which enabled the calculation of the stocking density (livestock units (LU) per ha of grassland; one LU is the feed requirement equivalent of one standard dairy cow (European Commission, 2009)) and the mean paddock size (ha), (ii) the overall quality of land drainage (good, moderate or poor) and (iii) the percentage of grazed grassland (selection from four categories <25%, 25–50%, 50–75%, >75%) with snail habitats (streams, ponds, dykes, flooded ditches) based on the subjective evaluation of farmers. A third section of questions