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Epidemiology and risk factors for exposure to gastrointestinal nematodes in dairy herds in northwestern Europe

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ABSTRACT

In this survey, the epidemiology of gastrointestinal (GI) nematodes in dairy herds in five northwestern European countries was studied using a standardized *Ostertagia ostertagi* ELISA applied on bulk-tank milk, and a common questionnaire. The levels of exposure to GI nematodes were high in Belgium, the UK and Ireland, intermediate in Germany and low in Sweden, with a mean (95% confidence interval) ELISA result (ODR) of 0.83 (0.82–0.84) in Belgium, 0.82 (0.79–0.84) in the UK and 0.80 (0.78–0.83) in Ireland; significantly higher than the mean ODR of 0.66 (0.65–0.68) in Germany and 0.52 (0.51–0.53) in Sweden. Taking into account previous literature, these regional differences are likely to be systematic. Regional variations in exposure were significantly explained by differences in management (grazing time per day, mowing, the months of turnout, housing and anthelmintic treatment). However, after controlling for these factors, significant regional differences in levels of exposure remained, suggesting an importance for climate (temperature, rainfall) and unmeasured management factors. This study emphasizes that GI nematode-induced production losses should be considered on a large percentage of northwest European dairy herds. Proposals are made for the development of region-specific monitoring and control strategies. Further advances in this area are likely to come from intervention studies that investigate the feasibility of control measures and from studies on the potential effects of climatic conditions on shifts in levels of exposure between years and regions.

1. Introduction

During recent decades several studies have elucidated the impact of gastrointestinal (GI) nematode infections on milk yield and other production indices of dairy cows (Sanchez et al., 2004; Charlier et al., 2005a). Most west European dairy herds are pasture based and thus at risk of nematode-induced production losses. However, grazing contributes to varying degrees to the diets of the cows and this is to a large extent dependent on regional management conditions (Brocard et al., 2008). Moreover, other factors such as climate and weather vary regionally and may induce important variations in the levels of exposure to gastrointestinal nematodes between countries.

The exposure of a herd to gastrointestinal nematodes can be assessed by quantification of antibodies against adult *Ostertagia ostertagi* extracts by ELISA. An *O. ostertagi* ELISA has recently become commercially available

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Table 1
Sampling strategy per country including the total number of samples and the number of herds that participated in the questionnaire.

Country	Region	Sampling method	Total sample size (*n*)	Questionnaires (*n*)	Sample moment
Belgium	Flanders	Random	1759	529	November 2006
Germany	Friesland and Nordfriesland	Random	521	307	November 2006
Sweden	Whole country	Random	529	238	August 2006
UK	Whole country	By convenience	458	458	October 06 to September 07
Ireland	Whole country	By convenience	355	355	October 06 to September 07

(Svanova Biotech AB, Uppsala). Because this test is based on crude worm extracts, cross-reactions with antibodies against other helminths may occur. Nonetheless, antibodies against crude *O. ostertagi* extracts have long been used as a valuable means to quantify nematode exposure in experimental and field conditions (e.g. Ploeger et al., 1989, 1994). In addition, more recently they have been successfully used as a parameter to estimate nematode-induced production losses and predict production responses after anthelmintic treatment (Sanchez et al., 2002; Charlier et al., 2005a, 2007a,b).

Besides earlier European studies conducted independently in the Netherlands, Belgium and Spain (Ploeger et al., 2000; Charlier et al., 2005b; Almería et al., 2009), a first multinational survey comparing the levels of exposure to GI nematodes (based on *O. ostertagi* antibody levels in bulk-tank milk) between different European countries has been conducted by Forbes et al. (2008). They observed important between-country differences and raised the question whether these differences were consistent (i.e. dependent on set local and environmental conditions) or could vary from 1 year to another. On the other hand, in the study of Forbes et al. (2008), the number of sampled herds per country was rather limited and the sampled herds were not randomly selected. Therefore, they also suggested that more extensive epidemiologic surveys should be conducted in order to enhance and adapt the interpretation of the *O. ostertagi* ELISA to local conditions. The objective of this study was to assess and compare levels of exposure to GI nematodes in dairy herds in different west European countries through the measurement of *O. ostertagi* antibody levels in bulk-tank milk and to collect information on management practices using a standardized questionnaire. We aimed to give a more definitive answer as to whether national differences are systematic and what is their cause. Moreover, from the built-up experience we provide guidelines for future studies towards risk factors for increased GI nematode exposure.

2. Materials and methods

2.1. Sampling and laboratory procedure

Bulk-tank milk samples were collected in five European countries: Belgium, Germany, Sweden, the United Kingdom (UK) and the Republic of Ireland (Ireland). In Belgium and Germany the samples were randomly selected in the autumn of 2006 from a list of the dairy cooperative containing all commercial dairy farms in a specific region of the country (Table 1). The spatial distribution of the Belgian sample and of the infection levels of the included herds has been previously described (Bennema et al., 2009). In Sweden samples were used that were sent in to the Veterinary Institute randomly from the whole country within a nationwide BVD eradication campaign. In the UK and Ireland the samples were collected from over the whole country through practicing veterinarians from October 2006 until September 2007 (Table 1). Samples were analyzed in each country using a commercially available ELISA (SVANOVIR® *O. ostertagi*-Ab, Svanova Biotech, Uppsala). The ELISA results are expressed as optical density ratios (ODR). A ring-test performed before the survey showed a good agreement between test results from different labs (Charlier et al., 2009).

2.2. Questionnaire

A common questionnaire was designed in English and translated to the local languages to collect herd information in the different countries in a standardized way. Information was collected on location, herd size, pasture management and other husbandry practices, and anthelmintic control measures in heifers and adult cows (see Tables 2 and 3). Heifers were defined as animals from 1-year old until the 1st calving, from the 1st calving onwards animals were defined as adult cows. All questions were closed.

Table 2
Frequency and percentages of the herd characteristics of dairy herds sampled in Belgium (*n* = 529), Germany (*n* = 307), Sweden (*n* = 238), the UK (*n* = 458) and Ireland (*n* = 355) in a cross-sectional questionnaire survey conducted in 2006.

Variable	Belgium		Germany		Sweden		United Kingdom		Republic of Ireland	
	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*
Type of herd:										
Dairy only	62	326	59	181	87	194	78	349	60	201
Both beef and dairy	38	200	41	126	13	30	22	96	40	134
Herd size (adult cows: lactating + dry):										
<30	16	84	14	44	41	96	3	9	4	7
30–60	56	293	35	106	39	92	5	17	36	73
>60	28	149	51	157	20	46	92	325	60	122