Veterinary Parasitology 197 (2013) 212–220

Contents lists available at SciVerse ScienceDirect

Veterinary Parasitology

journal homepage: www.elsevier.com/locate/vetpar

The association between *Ostertagia ostertagi* antibodies in bulk tank milk samples and parameters linked to cattle reproduction and mortality

Arnaud Delafosse*

Groupement de Défense Sanitaire de l'Orne, 61004 Alençon, France

ARTICLE INFO

Article history:
Received 12 November 2012
Received in revised form 10 May 2013
Accepted 18 May 2013

Keywords:
Ostertagia
ELISA
Bulk tank milk
Production parameters

ABSTRACT

In Western Europe, gastrointestinal nematodes are widespread in dairy cattle. This study was carried out to evaluate the relationship between optical density ratio (ODR) measured on bulk tank milk with an indirect *Ostertagia ostertagi* ELISA and reproduction/mortality parameters. Data were collected between 2008 and 2010 from monitoring carried out on 1643 dairy herds (Normandy, Western France). ODR values of 3 samples from each farm taken from November 2008 to 2010 were averaged and then transformed into a categorical variable. Reproductive and mortality data were obtained from 1444 herds using cow records from government databases. Statistical analysis was carried out using ordinary logistic regression (OLR). The outcome variables were the case–control status of a herd for reproductive factors, age at first calving and inter-calving intervals, and mortality ratios of various age classes. The effect of the categorical ODR variable was studied and several potential confounder herd factors were used to improve the model fit. A significant relationship was found between high *Ostertagia* ODR levels and a late age at the first calving (>34.5 months) (odds ratio (OR) = 1.94, $p < 0.001$). No significant relationship was observed with OLR for inter-calving intervals although bivariate analysis showed that herds with high ODR levels had longer inter-calving intervals than herds with low ODR level (first inter-calving interval in herds with low vs. high ODR levels = 412 days vs. 422 days, $p < 0.001$; other inter-calving intervals = 408 days vs. 413 days, $p < 0.01$).

A high ODR level was also associated with high mortality of calves between 0 and 30 days of life (mortality ratio > 6%) (OR = 1.43, $p < 0.05$) and between 91 and 365 days (ratio > 3%) (OR = 1.72, $p < 0.01$). No significant relationship was observed with multivariate approach for mortalities in other classes by age, but bivariate analysis showed that herds with high ODR level had higher mortalities than herds with low ODR levels (mortality between 31 and 90 days in herds with low vs. high ODR levels = 1.89% vs. 2.91%, $p < 0.001$; mortality after 365 days = 1.67% vs. 2.93%, $p < 0.001$).

In conclusion, our results confirm the usefulness of ELISA as an indicator for production losses in dairy herds. This inexpensive tool could be advantageous, used to aid farmers and veterinarians to carry out appropriate control measures.

1. Introduction

In Western Europe, gastrointestinal (GI) parasitic nematodes are widespread, particularly in dairy cattle, and the most important species are *Ostertagia ostertagi* and *Cooperia oncophora* (Kenyon and Jackson, 2011). Infections with

* Tel.: +33 02 33 80 38 38; fax: +33 02 33 31 94 40.
E-mail address: arnaud.delafosse@gdsco.fr

0304-4017/$ – see front matter © 2013 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.vetpar.2013.05.023

GI nematodes were considered to be mainly important in first-season grazing calves but studies have demonstrated that subclinical GI-nematode infections can impair milk yield in adults (Gross et al., 1999; Sanchez et al., 2004b). The major problem however is to identify the herds where the infection level is high enough to justify an anthelmintic treatment (Vercruysse and Claerebout, 2001).

Diagnostic techniques such as faecal egg count and serum pepsinogen assays have been shown to be of limited use in adult dairy cattle (Ploeger et al., 1989, 1990; Berghen et al., 1993). Enzyme-linked immunosorbent assays (ELISAs) have been used as a diagnostic tool to quantify the impact of gastrointestinal nematodes in dairy cattle by measuring *O. ostertagi* antibodies in milk. Higher levels of *O. ostertagi* antibodies measured by ELISA methods, referred to as optical density ratios (ODRs), are associated with decreased milk production in dairy cattle (Sanchez and Dohoo, 2002a; Guiot et al., 2007).

The main impact of gastrointestinal parasites for farmers is linked to loss of milk production and weight gain. However, some studies suggest that *O. ostertagi* in cattle can provoke a non-specific immune suppression, reducing the ability of the animal to respond to heterologous antigens and increasing general susceptibility to disease (Wiggin and Gibbs, 1989; Hawkins, 1993). As a result, a high herd exposure to GI nematodes could increase the mortality of post-weaning calves, heifers and adult cows, and reduce fertility. Pre-weaned calves may also be affected by the absorption of antibody-poor colostrum. Another consequence of reduced weight gain in calves and heifers is an extended time in reaching breeding weight, thus involving reproductive costs.

The major problem remains of how to monitor GI nematode infections in an adult dairy cow to indicate if the infection is causing an impact on productivity. At the herd level, *Ostertagia*-specific antibody level determination in bulk tank milk is the most promising method for this purpose (Charlier et al., 2009).

A limitation of using bulk tank milk is that information is only obtained from the lactating cows, ignoring calves, heifers and cows in the dry period. However, significant relationship was found between an increased exposure to pasture of the heifers and higher ODRs, suggesting that bulk tank milk ELISA at the end of the grazing season is a tool to evaluate the herd's exposure to GI nematodes by the end of the grazing period (Charlier et al., 2009).

The effect of GI nematodes on reproductive performance was studied in dairy cattle but remains equivocal. Some studies of anthelmintic treated cows, compared with untreated controls, showed an increase in cow conception rate, calving rate, reductions in calf mortality and reductions in the calving to breeding interval (Hawkins, 1993; Gross et al., 1999). At the herd level, little work has been published on the relationships between ODRs and reproductive performance (Guiot et al., 2007). No studies have explored the relationship between GI nematode infections in cow at the herd level and mortality.

The present study was carried out to evaluate the relationship between ODRs measured on bulk tank milk and reproduction/mortality parameters. Data were collected between 2008 and 2010 by monitoring carried out on all dairy herds in the Orne department (Normandy, Western France). The aim was to clarify the significance of ODRs in bulk tank milk as an indicator for production losses in dairy herds.

2. Materials and methods

2.1. Sample collection and laboratory methods

All dairy farms in the Orne department (Normandy, Western France) were included in the study. A bulk tank milk sample was taken during a routine milk collection from the dairy cooperatives on 3 occasions: once in November 2008, once in November 2009 and once in November 2010. During the collection in 2008, 2091 herds were analysed against 2005 in 2009 and only 1927 in 2010. All samples arrived at the laboratory between 24 and 72 h after collection from the farms. During all handling procedures the samples were constantly stored at 4 °C. Bulk tank milk samples from each farm were tested with an indirect ELISA using a crude *O. ostertagi* antigen (SVANOVIR® *O. ostertagi*-Ab ELISA Kit). The test results were expressed as an optical density ratio (ODR). Analysis was conducted by two professional dairy laboratories (LILANO, ANALIS) following the manufacturer's recommendations.

2.2. Collection of farm and production data

For each herd, the optical density ratio (ODR) values from 3 years – 2008, 2009, 2010 – were averaged and then transformed in a categorical variable using 2 cut-off points producing 3 levels: low ≤0.70; medium >0.70 and ≤0.90; high >0.90. Only 1643 herds had results over the 3 years studied.

Information on reproductive and mortality parameters were obtained from computerized cow records from the governmental database (BDNI). Selected herds in the study had at least 25 breeding dairy females (>24 months) on 1 January 2008/2009/2010. Only 1461 herds met this criterion and 1444 had ODR values. Reproductive performance of dairy cows as measured by: 1 – age at the first calving; 2 – first inter-calving interval (interval between first and second calving); 3 – other inter-calving intervals (all inter-calving intervals other than the first). Data from each herd were calculated by year (2008/2009/2010) and then averaged for 3 years.

Mortality was estimated by several ratios depending on the age group. Cattle births (including stillbirths) were taken into account between 1 January 2008 and December 31, 2010. The output (including mortalities) was recorded until July 10, 2011 (the oldest animals were 1287 days = 3.5 years). Cattle that died or were sold during this period were included in the denominator for half the time.

- Mortality ratio to 0 day = number stillborn calves/number of calves born (including stillbirths)
- Mortality ratio from 0 to 30 days = number of calves died between 0 and 30 days/[(number of calves born – number dead 0J) – (0.5 × number of calves dead or sold between 0 and 30 days)]