ASSOCIATIONS BETWEEN ANTIBODY LEVELS AGAINST FASCIOLA HEPATICA AND PRODUCTION PARAMETERS IN DAIRY HERDS

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ABSTRACT

The objective of this study was to determine the relationships between Fasciola-specific antibody levels (ODRf) in bulk tank milk and measures of productivity in dairy herds. A bulk tank milk sample was collected in March 2004 on 1105 dairy herds from which production data were available for \( n= 463 \). The effect of ODRf on four production parameters (milk yield, milk protein\%, milk fat\% and inter-calving interval) was assessed by multivariable linear regression models. An increase in ODRf over the interquartile range (0.428 – 1.064) was associated with a decrease in the annual average milk yield of 0.7 kg/cow/day (\( P=0.002 \)), with a decrease in the average milk fat\% of 0.06\% (\( P<0.001 \)) and with an increase of the mean inter-calving interval with 4.7 days (\( P=0.03 \)). No significant relationship was found with the average milk protein\%.

SAMENVATTING

Het doel van deze studie was om de verbanden te onderzoeken tussen Fasciola-specifieke antistoffenniveaus (ODRf) in tankmelk en productiviteitsparameters op melkveebedrijven. In maart 2004 werd een tankmelkstaal verzameld op 1105 bedrijven waarvan er voor 463 bedrijven productiedata beschikbaar waren. De verbanden tussen ODRf en vier productieparameters (melkproductie, melkproteïne\%, melkvet\%, tussenkalftijd) werden onderzocht aan de hand van multivariabele lineaire regressie. Een toename in ODRf over de interkwartielafstand (0,428 – 1,064) was geassocieerd met een daling van de jaarlijkse gemiddelde melkgift met 0,7 kg/koe/dag (\( P=0,002 \)), met een daling in het gemiddelde melkvet\% van 0,06\% (\( P<0,001 \)) en met een toename van de tussenkalftijd met 4,7 dagen (\( P=0,03 \)). Er werd geen significant verband gevonden met het gemiddelde melkeiwit\%.

1. INTRODUCTION

\textit{Fasciola hepatica} is a parasite of cattle and sheep with a world-wide distribution. In cattle, fasciolosis occurs generally under the form of a subclinical infection, but is considered to produce marked economic effects (Torgerson and Claxton, 1999). However, until now surprisingly little studies have been conducted to estimate the effect of fasciolosis on productivity (Vercruysse and Claerebout, 2001) and these studies were mostly improperly controlled (Dargie, 1987). The objective of this study was to determine the relationships between Fasciola-specific antibody levels in bulk tank milk and productivity parameters (milk yield, milk solids content and inter-calving interval) in order (1) to estimate economical losses, associated with \textit{Fasciola} infections and (2) to investigate if a bulk tank milk ELISA is a promising tool to detect dairy herds with production losses due to \textit{F. hepatica}.

2. MATERIALS AND METHODS

Thousand hundred and five herds were selected by convenience from the Flemish dairy herd population (\( n= 8400 \)). A bulk tank milk sample was collected from these herds in cooperation with the Milk Control Centre Flanders (MCC Flanders) in March 2004.
Farm and production data were obtained from the milk production recording programme of the Flemish Cattle Breeding Association (V.R.V., Vlaamse Rundveeteelt Vereniging). The data were collected from April 2003 until March 2004. Following monthly herd-level data were subtracted or computed based on the individual test-day production data: average milk yield (kg milk/cow/day), average protein%, average fat%, average lactation number, average days in milk, average log transformed somatic cell count, number of milk producing cows, calving distribution, main breed and province. The average inter-calving interval in March 2004 was computed based on the inter-calving intervals of all the lactating animals in this month that had a previous lactation.

The antibody levels against *F. hepatica* were determined as described by Salimi-Bejestani et al. (2005) with modifications. The test results were expressed as an optical density ratio (ODRf) with the formula ODRf = (OD – NC) / (PC - NC), where OD is the optical density of the sample and NC and PC are the OD of the negative and positive control respectively.

The effect of ODRf on four different production parameters (milk yield, protein%, fat% and inter-calving interval) was assessed by multivariable linear regression models including covariates that were considered as possible confounders. The milk production parameters (milk yield, protein%, fat%) were averaged over the period of one year before sample collection and their relationship with ODRf was investigated with covariates also averaged over this period. These covariates were average number of producing animals, average lactation number, average days in milk, average log somatic cell count, calving distribution, province and main breed. Since there existed a negative correlation between annual average milk yield and fat% presumably due to a dilution effect, milk yield was also included as a covariate in the analysis to investigate the effect of ODRf on fat%. The relationship between ODRf and inter-calving interval was investigated with a model containing calving distribution, main breed, province and annual averages of number of producing animals and lactation number as covariates.

3. RESULTS

The average ODRf of the 1105 sampled dairy herds was 0.762 with a range from 0.177 to 2.313 and a standard deviation of 0.420. The interquartile range of the ODRf values was 0.428-1.064. The average ODRf of the herds for which production data were available was 0.706 with a range from 0.251 to 1.867. The standard deviation of these herds was 0.402 and the interquartile range 0.407 to 0.944. Milk production data and average inter-calving intervals were available for respectively 463 and 449 herds out of the 1105 sampled herds.

The regression coefficients of the multivariable linear models to determine the relationship of ODRf with annual average milk yield, protein%, fat% and the inter-calving interval are presented in table 1. An increase in ODRf over the interquartile range (0.428 – 1.064) was associated with a decrease in the annual average milk yield of 0.7 kg/cow/day (P=0.002), with a decrease in the average milk fat% of 0.06% (P<0.001) and with an increase of the mean inter-calving interval with 4.7 days (P=0.03). No significant relationship was found with the average milk protein%.

4. DISCUSSION

The study demonstrates that there exist significant negative associations between *Fasciola*-specific antibody levels in the bulk tank milk and production parameters. The estimated losses in herds with high antibody levels are considerable and suggest that control of liver fluke infections can be economically profitable. However, the obtained estimates may be biased by the association of *F. hepatica* infections with management factors that negatively affect production. The results suggest that liver fluke infections do not affect the protein content of the milk, whereas there is a negative effect on the fat content. This is in contrast with gastrointestinal nematode infections for which there are minimal or no effects on milk fat and milk protein%, (Mc Pherson et al., 2001; Charlier et al., 2005). The effect of helminth parasites on reproductive performance is a poorly studied area.
The longer inter-calving intervals for high antibody level herds in the present study indicate that studies investigating the economical losses due to *F. hepatica* infections should take into account reproduction effects.

The negative relationship between *F. hepatica* bulk tank milk antibody levels and production parameters suggests that an “economical” threshold can be determined that identifies the herds where the infection interferes with productivity. Antibody detection tests are already commercially available and could be re-evaluated by investigating if there are threshold levels that can predict positive production responses after control of *Fasciola*-infections.

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6. REFERENCES