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Short Communication

Investigating the impact of fasciolosis on cattle carcase performance

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ABSTRACT

Liver fluke is a manifestation of bovine fasciolosis and its presence is compulsorily investigated as part of routine official abattoir inspections. It is known that the presence of fasciolosis negatively influences beef production, interfering with weight gain and fertility. Recent reports suggest increased occurrence of this parasite worldwide. This paper aims to investigate the impact of fasciolosis on beef cattle performance by examining the association of liver fluke with carcase characteristics and its value. Cattle slaughtered between 2005 and 2010 (328, 137 cattle (of which 12.6% were positive to liver fluke) sourced from 2278 farms) are analysed adjusting for the effect of gender, age, breed, season and year. Carcases with liver fluke have lower cold weight than those carcases free of fluke, estimated coefficient −0.63 kg (95% confidence intervals (CI) −0.93, −0.33). Carcases with liver fluke have lower price than those carcases free of fluke, estimated coefficient −£1.5 (95% CI −2.24, −0.74). The presence of liver fluke is associated with lower carcase conformation scores compared to carcases with fluke absence, proportional odds ratio (POR) 0.89 (95% CI 0.87–0.91). Similarly, the presence of liver fluke is associated with lower levels of fat in the carcase compared to carcases with fluke absence, POR 0.97 (95% CI 0.95–0.99). These results indicate a potential negative effect of the parasitism on carcase performance. The downgrading of the carcase impacts its value and therefore the price paid to the farmer. Both farmers and abattoir operators share a common interest in the control of fasciolosis in order to optimise the profitability of beef production. This study shows the utility of abattoir post-mortem inspection as a tool to monitoring animal health and production.

1. Introduction

Bovine fasciolosis is a parasitic disease caused by members of the genus *Fasciola*, which in the Scottish latitudes is essentially restricted to a sole representative, *Fasciola hepatica* (Urquhart et al., 1996). Liver fluke is a manifestation of bovine fasciolosis and occurs as a result of migration of immature flukes through the liver parenchyma and the presence of mature flukes in the bile ducts. Bovine fasciolosis is commonly asymptomatic being an incidental finding at routine abattoir inspections of affected cows. However, acute and subacute disease may occasionally occur with heavy infestations (Urquhart et al., 1996). There is increasing concern that *Fasciola* is becoming more prevalent within Scottish farms, based on the increase in the *Fasciola* positive laboratory reports on the samples submitted to veterinary surveillance centres (Anonymous, 2009). This potential rise in the incidence of bovine fasciolosis has also been found in other European countries (Fairweather, 2011) and concerns regarding the presence of this parasite have been recently expressed worldwide (Khan et al., 2009; Brito Alberto et al., 2010; Espinoza et al., 2010; Kantzoura et al., 2011).

The losses for fasciolosis in cattle production are due to the negative influence of fluke infestation on

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production traits such as weight gain and fertility (Urquhart et al., 1996; Loyacano et al., 2002; Schweizer et al., 2005; Sargison et al., 2010). Additionally, two recent independent studies, Charlier et al. (2009) and Brown and Lawrence (2010), carried out in Belgium and the USA respectively, investigated the effect of liver fluke on the performance of beef cattle at slaughter. Both studies showed poorer carcase yield when the liver was affected. This latter scenario raises concerns among abattoir operators and meat processors about the presence of *Fasciola* in slaughtered beef as they need to add the potential reduction in carcase value to the cost of offal condemnations and subsequent disposal.

This study investigates the impact of the presence of liver fluke at slaughter on carcase characteristics and its value, utilising six-year period records obtained from a large beef abattoir in Scotland. This investigation complements previous work done on the impact of liver fluke on carcase characteristics by examining a large sample size across different years and seasonal periods and adjusting for the effect of relevant confounders. The analyses presented here particularly complement the study by Charlier et al. (2009) in Europe which focused only on one breed and two seasonal periods. Additionally, the application of multivariable analyses to adjust for the effect of other factors (such as age, breed, gender, season and year) contributes to produce robust results, while these covariates were not available in the previous study from Brown and Lawrence (2010). Overall, this study aims to contribute to the knowledge of the losses associated with fasciolosis and the potential relevance of this parasite to beef producers, abattoir operators and meat processors.

2. Materials and methods

2.1. Abattoir data

Beef carcase classification is mandatory under EU legislation, and therefore cold carcase weight, sex/category, conformation, fatness and age are recorded in those abattoirs slaughtering over 75 cattle per week. In Great Britain, inspectors from the Food Standards Agency (FSA) examine every carcase and its offal to ensure the meat is fit for human consumption. The presence of liver fluke is recorded by the FSA. An industry initiative named QBOX (Anonymous, 2012) was created in 2004 to compile different sources of animal production data together with abattoir reports in an electronic format. QBOX aggregates FSA data together with carcase characteristic information assessed in the abattoir. An individual eartag number (passport number) is used to identify each cattle and link together its specific information (e.g. farm of origin, date of birth, carcase characteristics, etc.).

2.1.1. The liver lesion

The presence or absence of liver fluke for each animal was accessed through QBOX. Liver fluke refers here to the lesion as it is reported by the FSA based on gross pathology examinations, typically a cholangiohepatitis ranging from mild to severe which is also described as “pipe stem” appearance (Stalker and Hayes, 2007).

2.1.2. Carcase characteristics information

The following information was available for analysis:

- Cold carcase weight in kilograms.
- Carcase value, the price per carcase in Pound Sterling (GBP).
- *Conformation*: carcases are classified according to the shape of the carcase profiles with eight categories indicating decreasing conformation: E, U^+, U^-, R, O^+, O^-, P^+, P^-, with E denoting excellent and P^- denoting poor carcase conformation.
- *Fatness*: there are five main classes according to fat cover, ranging from 1 to 5. Class 1 is the classification with the lowest fat level and 5 is the one with the greatest. Classes 4 and 5 are divided in low (L) and high (H).
- *Sex category*: heifer or steer.
- *Age*: days from date of birth to kill date.
- *Breed*: the study was focussed on 5 main breeds and/or their crosses (i.e. Aberdeen Angus, Belgian Blue, Charolais, Limousin and Simmental) and a group including other native Scottish breeds (Galloway, Highland and Luing).

2.1.3. The dataset utilised

The records included in this study belonged to cattle slaughtered at McIntosh Donald Ltd (Portlethen, Aberdeenshire, Scotland, UK) between January 2005 and December 2010. This dataset integrated carcase characteristics and liver fluke information, giving a total of 328,137 complete animal records (known fluke status and no missing covariates) split across 2278 farms.

2.2. Analyses

2.2.1. Statistical analyses for carcase weight and value

Linear regression was utilised to model cold carcase weight as a continuous response variable and liver fluke status at slaughter as a predictor. A similar approach was used to model the carcase value as a response. Other variables available in the study dataset that might have a potential confounding effect were included in the analyses. Simple linear regression models were used as a starting point to explore the main effect of fluke status and other covariates on cold carcase weight and its value. The modelling evolved into multivariable Gaussian generalised linear mixed-effects models (GLMMs) which adjusts for “farm effects” in the data, where these encompass the farm specific properties of each individual beef enterprise (e.g. farm characteristics and husbandry practices) that were not present in our dataset but could potentially influence the present of fluke and/or the animal development. Not allowing for such effects can result in standard errors, and hence *p*-values, which are smaller than is appropriate given the grouped nature of the data. An ad hoc stepwise selection strategy was followed to determine the final model. Akaike’s Information Criterion (AIC) – a standard goodness of fit measure for statistical model selection – was used for comparison among the different model structures and also