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Body condition score as a selection tool for targeted selective treatment-based nematode control strategies in Merino ewes

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ABSTRACT

Sheep nematode control utilising refugia-based strategies have been shown to delay anthelmintic resistance, but the optimal indices to select individuals to be left untreated under extensive sheep grazing conditions are not clear. This experiment tested the hypothesis that high body condition can indicate ability of mature sheep to better cope with worms and therefore remain untreated in a targeted treatment programme. Adult Merino ewes from flocks on two private farms located in south-west Western Australia (Farm A, $n = 271$, and Farm B, $n = 258$) were measured for body condition score (BCS), body weight and worm egg counts (WEC) on four occasions between May and December (pre-lambing, lamb marking, lamb weaning and post-weaning). Half of the ewes in each flock received anthelmintic treatments to suppress WEC over the experimental period and half remained untreated (unless critical limits were reached). Response to treatment was analysed in terms of BCS change and percentage live weight change. No effect of high or low initial WEC groups was shown for BCS response, and liveweight responses were inconsistent. A relatively greater BCS response to treatment was observed in ewes in low BCS pre-lambing compared to better-conditioned ewes on one farm where nutrition was sub-optimal and worm burdens were high. Sheep in low body condition pre-lambing were more than three times more likely to fall into a critically low BCS (<2.0) if left untreated. Recommendations can be made to treat ewes in lower BCS and leave a proportion of the higher body condition sheep untreated in a targeted selective treatment programme, to provide a population of non-resistant worms to delay the development of resistance.

1. Introduction

Internal parasites remain a major constraint on the health and productivity of sheep (Sutherland and Scott, 2010). *Trichostrongylus* spp. and *Teladorsagia circumcincta* are the predominant gastrointestinal nematodes in southern regions of Australia and have been associated with reduced growth rate or bodyweight, reduced wool growth and increased risk of fly strike associated with diarrhoea and faecal fleece soiling (Sutherland and Scott, 2010). The effectiveness of worm control is increasingly compromised because of widespread and increasing resistance to anthelmintics (Besier, 2012; Kenyon and Jackson, 2012), including in Australia (Playford et al., 2014).

On-going investigations into sustainable control strategies have focused on the “refugia” strategy which aims to minimise the development of resistance by ensuring the survival of sufficient nematodes of susceptible genotypes in the total population on a property to dilute resistant individuals surviving anthelmintic treatment (Van Wyk, 2001;

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Besier and Love, 2003; Kenyon et al., 2009; Leathwick et al., 2009). 'Targeted selective treatment' (TST) is a refugia-based approach by which anthelmintic treatments are restricted to animals judged likely to suffer significant production loss or health effects if not treated, while treatment to others in the group is avoided (Kenyon et al., 2009; Leathwick et al., 2009; Besier, 2012; Kenyon and Jackson, 2012). The concept that some individual animals exhibit greater resilience to parasites, seen as fewer signs of ill-health or better production in some individuals, can be exploited by TST strategies to ensure that a proportion of a worm population remains in refugia from anthelmintic exposure (Van Wyk, 2001) with additional benefits such as reductions in the costs of anthelmintics and labour (Besier, 2012).

The TST concept has been successfully utilised for some time through the FAMACHA test for the sustainable control of *Haemonchus contortus* in sheep and goat flocks (Vatta et al., 2001; van Wyk and Bath, 2002). More recent investigations have extended the TST concept for small ruminants to non-haematophagous nematodes (principally *Tel. circumcincta* and *Trichostrongylus* spp.), mostly using animal production indices to indicate which individuals in a flock are likely to benefit from anthelmintic treatment (for example, Hoste et al., 2002; Cabaret et al., 2006; Leathwick et al., 2006; Cringoli et al., 2009; Stafford et al., 2009; Besier et al., 2010; Gaba et al., 2010; Greer et al., 2009).

However, a key factor that has delayed utilisation of TST for trichostrongylids other than *H. contortus* is the absence of a convenient and accurate method for identifying animals that are likely to suffer compromised health, productivity and welfare if left untreated (van Wyk et al., 2006; Besier, 2012). The approaches used in the investigations cited were based on repeated measurements of production indices (for example body weight, worm egg count, ocular membrane inspection) in animals under parasite challenge as an indicator of resilience, but these require investment in labour and/or equipment that may limit their application on a large scale (van Burgel et al., 2011). Body condition score (BCS) is a practical and low-technology measure that is accepted as an indicator of general condition and body reserves (van Burgel et al., 2011) and therefore may act as an indicator of resilience to nematode infections.

The need to develop a more practicable basis for individual animal treatment for use in large flocks or where labour is scarce led to the hypothesis that mature sheep of lower BCS would generally suffer greater production loss due to worm infections than would sheep of higher scores, and that BCS may therefore provide a suitable selection basis (Leathwick et al., 2006; Besier et al., 2010). The aims of the experiment were, firstly, to investigate whether mature sheep in poorer body condition suffer proportionately greater production loss due to trichostrongylid infection than those in better condition when BCS is used as an index of the relative need for anthelmintic treatment. Secondly, the experiment investigated which parameter (BCS, bodyweight or faecal worm egg counts) provides the most appropriate indication of a reduced resilience to trichostrongylid infection (significant magnitude of response to anthelmintic treatment) in mature sheep.

2. Materials and methods

The experiment was conducted according to the guidelines of the Australian Code of Practice for the Use of Animals for Scientific Purposes, with approval from the Animal Ethics Committees of the Department of Agriculture and Food Western Australia and Murdoch University (R2329/10).

2.1. Experimental sites

The experiment was conducted in 2010 on two commercial farming properties located near Woodanilling (Farm A) and Kojonup (Farm B), approximately 265 km and 260 km southeast of Perth, Western Australia, respectively. The region has a Mediterranean climate characterised by hot, dry summers and cool, wet winters. The mean annual rainfall for Farm A and Farm B is 460 mm/annum and 530 mm/annum respectively, but 2010 was widely considered a drought year and the two farms received only 234 mm and 350 mm of rainfall respectively.

2.2. Experimental design and animal management

Merino ewes were selected at Farm A (n = 271, aged 3 years) and Farm B (n = 258, aged 4 years). Ewes were individually identified with numbered ear tags. All ewes at Farm B carried single pregnancies, indicated by transabdominal ultrasound scanning. Ewes at Farm A were not pregnancy-scanned so the parity status was not known. The possible effect of unknown ewe parity on response to parasitism at this experimental site is detailed in Section 4. Ewes were stratified on the basis of BCS using a range from one (thin) to five (fat) scale (Thompson and Meyer, 1994), liveweight and worm egg count (WEC) at the pre-lambing assessment. BCS was assessed by a single trained operator. Ewes were categorised to four initial (pre-lambing) BCS groups: <2.7, 2.7, 3.0 and >3.0. Within each BCS group, ewes were allocated randomly to two treatment sub-groups (worm-suppressed or non-worm-suppressed) with equivalent numbers in each. The mean pre-lambing liveweight and BCS was 55.0 kg (range 39.6–68.2 kg) and BCS 2.9 (2.3–3.5) at Farm A and 62.0 kg (46.2–80.8 kg) and BCS 3.0 (2.3–3.7) at Farm B. There was no significant difference in WEC between BCS groups or treatment groups at the start of the study for either site. Lambing commenced in June for both properties.

Ewes were grazed as a single group at each site in paddocks with predominantly annual rye-grass (*Lolium* spp.), subterranean clover (*Trifolium subterraneum*) and capeweed (*Arcotheca calendula*). Over the course of the experiment, pasture growth (assessed visually; Ferguson et al., 2011) was poorer at Farm A than Farm B and this necessitated a greater level of supplementary feeding at this site. Supplementary feeding of concentrate grain-based pellets (11.0 MJ/kg DM, 14.5% CP; EasyOne, Milne Feeds, Welshpool, Australia) commenced at Farm A in July 2010 at a rate of 700 g/hd/day to ensure the ewes did not fall to unacceptably low weights or body condition.