Endoparasite control for donkeys in the UK

The prevalence of endoparasites, their control and clinical relevance in donkeys can often cause confusion and concern to vets and owners alike. While donkeys can be affected by the same parasite species as horses, infection characteristics, presenting signs and symptoms of disease can differ. Donkeys do not always show obvious signs of disease until it is severe so it is important to know what to look out for when clinically assessing a donkey and how best to diagnose potential infection with parasites. There is a limited selection of anthelmintic products available for use in the donkey, so prescribing using the cascade is sometimes warranted. Careful consideration should be given to the choice and frequency of anthelmintic treatments in order to balance controlling disease with preserving anthelmintic efficacy.

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There are over 10,000 donkeys in the UK. The majority are kept as companion animals in pairs or small groups. While similar guidelines for strategic and evidence-based deworming should be followed as in horses, it is useful to be aware of the differences when designing endoparasite control programmes for donkeys.

A recent study that looked at the level of preventive care in 596 donkeys admitted to a sanctuary over 30 months, found only 21% had received any anthelmintic treatment in the previous 12 months (Barrio Fernandez et al, 2020).This was despite more than 80% of the donkeys having strongyle egg counts of more than 300 eggs per gram (epg). Other aspects of preventative care were also found to be quite poor, with low rates of vaccination and routine dentistry (Barrio Fernandez et al, 2020). These areas could therefore provide a good starting point for vets working with donkeys and their owners.

Donkeys show more subtle signs of disease than horses and can have high parasite burdens before showing ill thrift. Donkeys have evolved to conserve water as a physiological adaptation to dry environments. As such, water is highly reabsorbed from the distal colon and diarrhoea is seen less frequently with cyathostominosis than in the horse.

Overview of common endoparasites

Cyathostomins (small strongyles)

Cyathostomins are of increasing concern throughout the UK as there is growing evidence of single or multi-drug-resistant worm populations and donkeys are no exception to this (Trawford et al, 2003; Trawford & Burden, 2012; Lawson et al, 2015). Of particular concern in donkeys is the potential for cyathostominosis to go unnoticed until it hs become severe, as both encysted and emerging cyathostomes can cause acute and chronic disease (*Figure 1*).

Donkeys rarely display overt signs of diarrhoea but cyathostominosis should always be high on the list of differntial diagnoses for any acutely unwell donkey presenting with colic and/or colitis symptoms. A dull donkey, with reduced appetite or anorexia and evidence of hypoalbuminaemia on bloods may indicate larval cyathostominosis. Treatment is similar to that for other equids, with replacement of fluid deficits and analgesia. As in the horse, plasma transfusions can be useful to raise plasma oncotic pressure. Com-

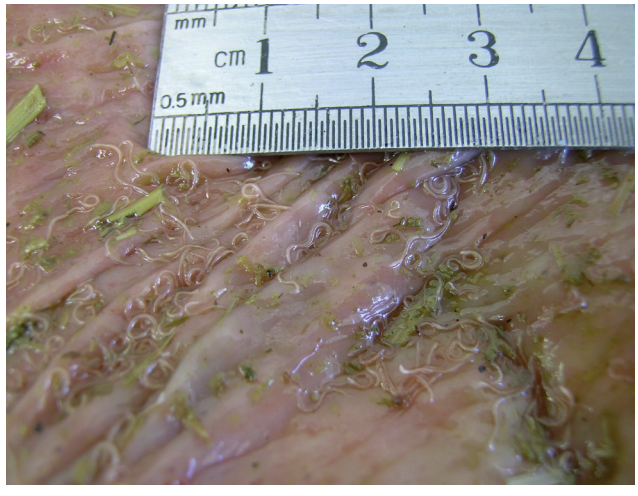

Figure 1. Emerging cyathostomins in a donkey's colon at postmortem.

Figure 2. Donkey with marked ventral oedema.

Figure 3. Parascaris equorum *recovered from a 2-year-old donkey at postmortem.*

mercially available plasma is safe to use in donkeys, or plasma can be obtained from a suitable donor.

It is essential that nutritional support is provided for any anorexic donkey to reduce the risk of concomitant hyperlipaemia. It is recommended that triglycerides are checked as part of the diagnostic work-up.

Chronic cases of cyathostominosis may present with any or all of the following signs: insidious weight loss, depressed demeanour, ventral oedema (*Figure 2*) and poor condition with hypoalbuminaemia again being a likely finding when bloodwork is completed. Evidence of thickened colon and caecal walls may be seen using percutaneous abdominal ultrasound. In both acute and chronic cases, the presence of live worms may be observed on rectal examination. However, this is not a consistent finding. Absence of worms on rectal examination does not preclude cyathostomins from being the cause of disease if clinical signs, history and laboratory tests suggest it.

Faecal worm egg counts (FWECs) offer a poor reflection of larval burden and the recently developed ELISA blood test to detect encysted cyathostomes in horses (Veterinary Practice 2019; Tzelos et al, 2020) has not yet been validated for use in donkeys, so is not a reliable diagnostic tool.

Although not licensed for use in the donkey, moxidectin has been used to treat cyathostominosis. Where the donkey is acutely unwell, consideration should be given to pre-treatment with corticosteroids. In the authors' experience, use of pyrantel in the first instance can have less risk of inducing colic symptoms, and moxidectin should be administered later when the donkey is in a more stable condition. It is acknowledged that, to the best of the authors' knowledge, there is no evidence to support the efficacy of pyrantel in treating larval disease. As such, concerns regarding the potential for adding to pyrantel resistance are valid and worthy of consideration. The treating vet must make a risk-benefit decision, weighing up whether to focus on stabilising the donkey first and then administering moxidectin once stable, or whether to begin with an adulticide. Moxidectin is not recommended for use in donkeys under 6 months of age or thin donkeys with low body condition score. Moxidectin should be dosed based on an accurate donkey weight to avoid risks associated with overdosing.

An annual targeted treatment with moxidectin in the autumn/winter to prophylactically treat encysted cyathostomes should be done on a case by case basis, taking due consideration of the need to preserve moxidectin efficacy.

Parascaris equorum (ascarids)

Unlike adult horses and ponies, donkeys do not seem to develop age-related immunity to *Parascaris equorum* (Thiemann and Sullivan, 2019) and a small-intestinal adult burden should be one of the differential list for causes of colic.

Large burdens (*Figure 3*) can cause acute severe colic and, particularly in foals and youngstock, intestinal impaction and rupture.

Adult donkeys may harbour patent infections, shedding eggs and heavily contaminating pasture. As the eggs are extremely resistant to environmental challenges and can survive for years on pasture, screening of any new donkey arrivals, and treatment as indicated, is recommended. There are multiple anthelmintics with labels claiming protection against *P. equorum* but there are resistance concerns, particularly with macrocyclic lactones. The Donkey Sanctuary has also noted a lack of efficacy of pyrantel based on results from faecal egg count reduction (FECR) tests, so fenbendazole administered at a double dose is the organisation's current treatment of choice. Faecal egg count reduction tests have shown fenbendazole to offer good efficacy against *P. equorum* (unpublished data). In addition, the use of fenbendazole as a targeted treatment for *P.equorum* helps preserve other anthelmintics for use against more susceptible parasites.

Oxyuris equi (pinworm)

In other equids, pinworm (*Oxyuris equi*) is reported to be an increasingly prevalent problem (Reinemeyer and Nielsen, 2014) and similarly at The Donkey Sanctuary the authors have become aware of an increasing number of donkeys showing signs of potential pinworm infections. Presenting signs typically include evidence of perianal excoriation, which may be noticed by an owner during routine grooming, or may be confused with 'sweet-itch' if increased bottom rubbing, hair breakage and alopecia over the rump and tail-head are seen. A standard sellotape test can be used to look for the presence of pinworm eggs under a microscope, although, fail-

ure to detect eggs does not remove *O. equi* from the list of differential diagnoses (Reinemeyer and Nielsen, 2014). Occasionally, adult pinworms may be noticed on the surface of recently passed faeces.

Currently, at The Donkey Sanctuary, fenbendazole or pyrantel (at a double dose) are used to treat *O. equi*. Anthelmintic use should be combined with topical washing of the perianal region to remove any eggs.

Anoplocephala perfoliata (tapeworm)

There is little information about the importance of tapeworms in the donkey. The available equine serum and saliva antibody tests have not been validated in the donkey and faecal testing is insensitive because of the intermittent shedding of eggs. Undoubtedly, this parasite is responsible for colic associated with the ileocecal junction in horses, and control measures are recommended in donkeys in late autumn. A double dose of pyrantel is currently the only licensed treatment option. No donkey-specific data is available on the use of praziquantel as a single ingredient or in combination dewormers, but such products may be prescribed under the cascade at the clinician's discretion.

Dictyocaulus arnfieldii (lungworm)

Dictyocaulus arnfieldii are particularly well adapted to the donkey host and are able to complete their entire lifecycle within the species. While often thought to be a common problem in donkeys, a recent study found only a 4% prevelance (Barrio Fernandez et al, 2020). Lungworms reach maturity in the donkey airways (*Figure 4*), producing eggs that are coughed, swallowed and passed out in the faeces (Matthews and Burden, 2013).

While affected horses will cough when parasitised by lungworm, donkeys do not, so they can act as silent carriers. Fortunately, good control can usually be achieved using macrocyclic lactones and control of lungworm in donkeys can be particularly beneficial for co-grazing equines. The parasite is extremely hard to eliminate from infected pastures, so any new arrivals should be tested, treated with a macrocyclic lactone and restricted from grazing for 48 hours.

Fasciola hepatica (liver fluke)

The liver fluke parasite (*Figure 5*) is probably better known to farm vets. Infections are commonly seen in cattle and sheep grazing wet pastures where the intermediate host, a specific species of snail (*Galba truncatula*), thrives. Donkeys can be at particular risk of infection if co-grazing with other infected livestock. While often considered more of a problem in wetter, western regions of the UK and Ireland (Matthews and Burden, 2013), there is some evidence that the incidence may be increasing and spreading geographically, likely caused by climate change (Howell et al, 2019; Williams and Hodgkinson, 2017). A recent study showed over 9% of donkeys to be positive for fluke on faecal tests.

Clinical signs are often mild and can be associated with eosinophilia and elevations in gamma glutamyl transferase. In the authors' own clinic, a case presented with weight loss, pyrexia and depression, and enlarged dilated bile ducts on ultrasound scan of the liver. Serological tests have not been validated for donkeys, so faecal egg tests are required for diagnosis. There are no licensed flukicides for use in donkeys, so treatment must be prescribed under the cascade. The Donkey Sanctuary has used oral triclabendazole at an increased dose rate of 18 mg/kg. However, there are growing concerns over resistance so repeat tests are advised at 14–28 days and 12 weeks after treatment. Where triclabendazole is ineffective, oral closantel at 20 mg/kg can be considered, with a repeat dose after 8–10 weeks, because the drug is only effective against adult-stage fluke.

Echinococcus granulosum (hydatid worms)

This parasite is included here as the authors have seen a number of donkeys with hydatid cyst lesions, either in the liver or lung tissues, when performing ultrasound scans (*Figure 6*) or at postmortem (*Figure 7*).

The cysts are very characteristic being thick walled with a hypoechogenic centre. Biopsies are not recommended as this risks spreading immature protoscoleces. Transmission occurs when dogs have access to raw infected sheep offal and donkeys graze

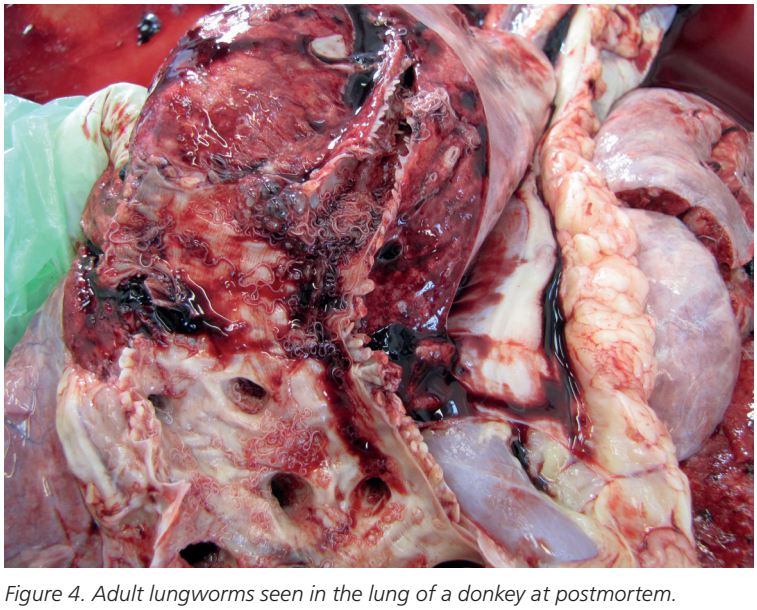

Figure 4. Adult lungworms seen in the lung of a donkey at postmortem.

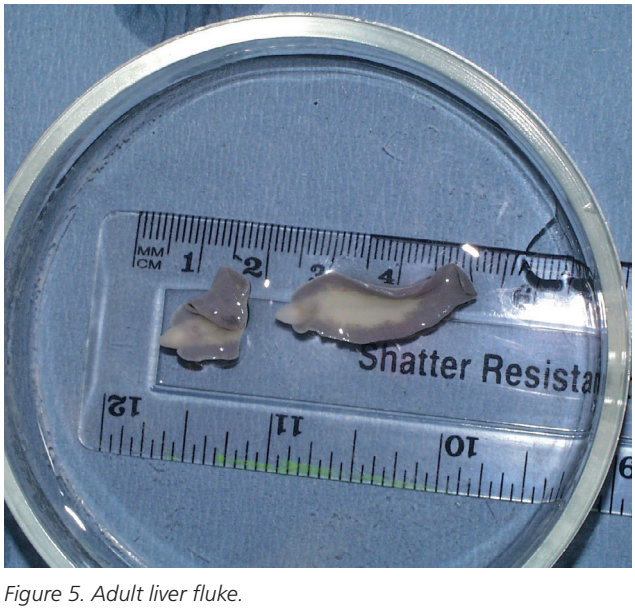

Figure 5. Adult liver fluke.

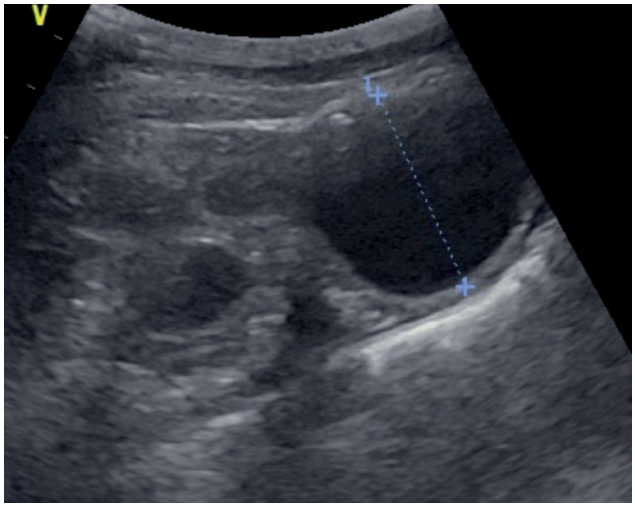

Figure 6. Hydatid cyst seen on an ultrasound scan of a donkey's liver.

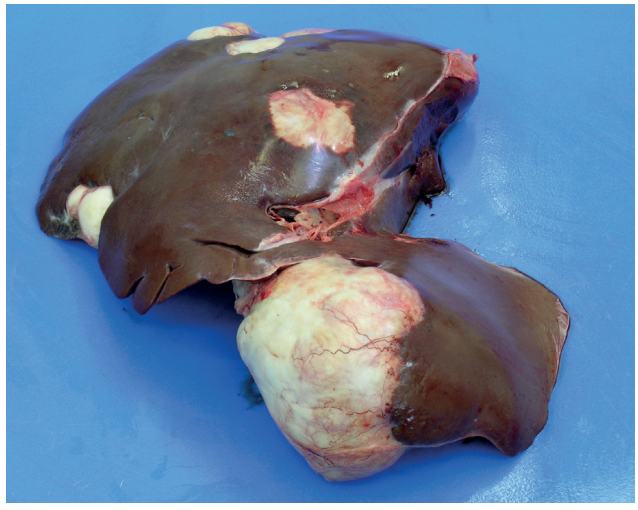

Figure 7. Hydatid cyst in the liver seen at postmortem.

pasture contaminated with dog faeces containing tapeworm eggs. Control is achieved by de-worming the canine and preventing access to offal. Treatment of the cysts in the donkey is rarely justified.

Diagnosing infections

As with horses, routine monitoring of FWECs, particularly during the grazing season, can help build a picture of each individual animal's parasite status and help target anthelmintic treatments at high shedding individuals who will be greater contributors to pasture contamination. By performing regular FWECs, the animal's risk of disease or potential to contaminate pasture can be better determined than with a single result alone.

The McMaster (or Modified McMaster) test, which is based on a floatation/dilution principle, is relatively simple to perform and widely used to demonstrate and count helminth eggs in faecal samples (Lester and Matthews, 2014; Matthews and Lester, 2015) More complex centrifugal-flotation techniques can be used when a higher sensitivity is required, giving an egg detection limit (EDL) to 1 epg. Faecal worm egg count methods with an EDL of ≤10 epg are recommended for FECR tests (Matthews and Lester, 2015). Care is needed with interpretation of FWEC results as a number of factors can influence the occurrence, recognition and number of eggs found (Nielsen et al, 2010; Denwood et al, 2012; Lester et al, 2012; Vidyashankar et al, 2012).

Additional diagnostic tests such as for liver fluke and lungworm should be considered on an individual basis. Diagnosis of lungworm in donkeys can be made by identifying first-stage larvae in faecal samples by means of the Baermann technique, which separates larvae from faecal material (*Figure 8*).

For the diagnosis of liver fluke, faecal sedimentation tests can be used. However, such tests do have limitations in that eggs only appear in faeces once infections are patent and fluke egg excretion can be intermittent.

Clients should be reminded of the importance of correct collection and storage of samples to ensure accurate results (Matthews and Lester, 2015). Faecal diagnostic tests generally require only small amounts of dung (from 3 g for a McMaster to 40 g for a full profile) so a small handful, made up from small pinches across different areas of a freshly voided faeces, is generally sufficient. To reduce egg development before testing, samples should be kept airtight and in cool conditions (<6°C) (Nielsen et al, 2010). If sending by post, samples should be packaged in accordance with current postage regulations and a UN3373 symbol attached to the outside packaging.

Figure 8. A Baermanns apparatus. The addition of warm water causes larvae to migrate from the faecal sample into the water and sink to the bottom of the tubing, where they are collected and microscopically identified.

Practical aspects of de-worming donkeys

In the UK, there are few anthelmintics licensed for use in the donkey and no products are licensed for mules. As such, it is essential that clinicians pay attention to the rules of the prescribing cascade, and clients are made aware of any off-licence use of products (Veterinary Medicines Directorate, 2015). It is the responsibility of the prescriber to record client consent and practices may use their own form or one of the standard forms produced by British Equine Veterinary Association (BEVA) or British Veterinary Association (BEVA, 2020).Where an anthelmintic is not licensed and the clinician has no previous experience of using it in the donkey, it is recommended that the product manufacturer is consulted for guidance. The Donkey Sanctuary team is also available to give advice where it has experience of using specific products.

Anthelmintic use should be guided by FWEC results, local geography and climate knowledge, as well as any clinical symptoms of parasite burden. It is difficult to state absolute FWEC cut off thresholds for de-worming, as these will vary according to the animal's history and environmental factors. As a general rule, strongyle egg burdens greater than 500 epg should be considered for treatment,

as should any positive results for ascarids, lungworm or liver fluke. If any adult donkey has a FWEC of 1000 epg or greater, a thorough clinical examination and blood test to assess total protein is recommended before anthelmintic treatment. For donkeys over the age of 15 years, who are routinely presenting with high FWECs, the authors recommend screening for pars pituitary intermedia dysfunction, as there appears to be an association.

Where anthelmintics are used, it is essential that the correct dose is given for the donkey's weight, to avoid parasites surviving the treatment, which can lead to parasites resistance.

The Donkey Sanctuary has produced a weight estimation chart (The Donkey Sanctuary, 2020) or a donkey-specific weightape (http://www.donkeyweightape.com) can be used. As a minimum, donkeys should be body condition scored before de-worming, as historic fat pads and thick coats can obscure what may be a thin donkey. Sadly, the converse is all too often true – the thick coat may go some way to hiding an obese animal.

Donkey broodmares and young stock

Many donkey pregnancies are unplanned, making estimates of the dates of foaling difficult, and few are kept in stud farms where youngsters and adults graze separately. In addition, donkey foals are very small, sometimes weighing as little as 10–15 kg. These factors put donkeys at risk of parasites at a young age. Practitioners should exercise caution when de-worming foals and try to get accurate weights (*Figure 9*).

Pregnant jennies should have regular FWECs performed, with treatments given accordingly. A final treatment should be given within a month of foaling. Moxidectin is not recommended for use in pregnant or lactating jennies, on account of the lack of donkey-specific data.

Strongyloides westeri (threadworm) can be transmitted to foals via the dam's milk, occasionally causing diarrhoea and poor growth. This parasite will be reduced if the jenny is de-wormed within a month of foaling, but if the parasite is causing illness in the foal, ivermectin may be used. Foals risk picking up other parasite infections once they start to graze pasture. A first treatment around 3 months of age with single dose fenbendazole at 7.5 mg/kg, followed by ivermectin at 0.2 mg/kg at 6 months is recommended. FWECs should then be performed every 6–8 weeks, with particular attention paid to the presence of *P. equorum*, which can pose a severe threat to foals with both respiratory and colic signs.

Figure 9. Special consideration should be given to anthelmintic use in foals.

KEY POINTS

- Poor levels of preventive care are commonly seen among privately owned donkeys.
- Donkeys are likely to show more subtle signs of parasitic infection.
- Cyathostominosis is a concern in donkeys and should always be high on the differential list for any acutely unwell donkey presenting with colic and/or colitis symptoms.
- Donkeys do not appear to show age-related immunity to *Parascaris equorum*.
- Lungworm are well adapted to the donkey host. Donkeys can act as silent carriers, necessitating preventive treatment of co-grazing horses/ponies.
- Environmental control measures are an essential part of parasite control plans.

Environmental control

While routine FWECs and targeted treatments can help reduce pasture contamination and treat clinical disease, they only impact the population of parasites within the animal. The vast majority of parasites reside in the environment (on pasture in all cases and on buildings/fences in some cases) and control of this population is essential too.

Recommended control measures are as important as with horses, and include:

- Quarantine and appropriate treatment of all new equines.
- Removal of faeces from grazing land at least twice per week (Corbett et al, 2014).
- Minimising stocking density.
- Rotating grazing with ruminants who can act as a 'biological hoover'.
- Harrowing the pasture (but only in very hot, dry weather).
- Disinfection of stables, fencing and fomites particularly where *Parascaris* or *Oxyuris* are present.
- Clearing out deep litter straw bedding at least once a fortnight to prevent cyathostomin eggs developing to third-stage larvae (Love et al, 2016).

Conclusion

Donkeys can be affected by a wide array of parasitic infections, but often do not show the same clinical signs as horses. This can be of particular concern with cyathostominosis, which can easily go unnoticed as donkeys may only show subtle symptoms. While the use of set thresholds can aid decisions on treating adult cyathostomins, for other parasites, such as *D. arnfieldi* and *P. equorum*, a

zero tolerance approach should be maintained. Once established on pasture, both can be very difficult to eradicate.

With relatively few licensed treatment options available for use in donkeys, coupled with increasing levels of resistance to many anthelmintics in the UK, it is imperative that worm control programmes balance treatment to control disease with the need to preserve anthelmintic efficacy. Excessive or inappropriate use of anthelmintic products should be discouraged and instead, efforts should be directed towards maximising refugia to help slow the process of selection for resistance. Once resistance is established, it cannot be reversed.

Further reading

Further information and advice on all aspects of donkey health, care and welfare, including details of The Donkey Sanctuary's diagnostic services, can be accessed via https://www.thedonkeysanctuary.org.uk/what-wedo/for-professionals.

Additional information resources that may be of interest to donkey owners/clients are also available at https://www.thedonkeysanctuary.org.uk/what-we-do/knowledge-andadvice/for-owners.

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