Assessing the efficacy of an anthelmintic programme on the health and welfare of working equines in Morocco

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Summary

An anthelmintic programme employed by the Society for the Protection of Animals Abroad (SPANA) in Morocco was assessed by obtaining faecal egg counts and conditions scores for 158 working equines (donkeys, mules and horses) from souks (markets) routinely visited by the charity and compared with a souk not previously visited. Results showed the current programme to be ineffective in reducing the long-term worm burden of the animals in the souks and recommends changes to the programme to encourage greater numbers of animals treated. Other data on the animals' liveweight, age and reasons for presentation for treatment were also collected and assessed.

Introduction

The Society for the Protection of Animals Abroad (SPANA) is a charity based in Great Britain providing veterinary and supportive care to animals living in less developed parts of the world. The charity currently works in eight different countries based around North and West Africa and the Middle East. In Morocco the charity's responsibilities includes care of the countries two million working equines, which through their work as beasts of burden are an essential part of the country's rural and urban economy. SPANA offers free veterinary care and husbandry advice through a network of 10 permanent clinics and 64 mobile clinics. The mobile clinics visit different souks (markets) each day to provide their services to the animals present.

A large part of the work undertaken at the souks is the intended prevention and treatment of gastro-intestinal parasitism through dosing with anthelmintic drugs. This project is a follow up study looking into the effectiveness of the anthelmintic programme currently performed by SPANA at the souks. It also gathers information on weight, age and reasons for presentation to the mobile units.

Parasitism in working equines has been shown to be a major source of ill health and the beneficial effects of an anthelmintic programme have been reported. Bliss and others (1985) showed extended parasitic control with a strategic use of anthelmintics (pyrantel and fenbendazole) in Greece. Khallaayoune (1991) demonstrated a significant reduction in the mean faecal counts of nematode eggs and an increase in body condition scores following anthelminthic (dichlorvos) dosing of donkeys in Morocco.

The species of helminths found in working equines is diverse and heavy. Khallaayoune (1991) showed donkeys in Morocco to be heavily infected with helminth parasites including *Tricchostrongylus axei* and *Habronema* species in the stomach, *Parascaris equorum* in the small intestines and *Strongylus vulgaris*, *Strongylus edentatus*, *Oxyuris equi* and small stronglyes in the large intestine. *Dictyocaulus arnfieldi* and *Setaria equina* were commonly found in the lung and peritoneal cavity respectively. Indeed verminous aneurysms due to the larvae of *S. vulgaris* were identified in 87% of donkeys necropsyed. Pandey (1980a, 1981) showed the seasonal pattern of *S. vulgaris* in Moroccan donkeys and horses, and found the overall mean percentage of arteries infected was 90.5 and 80 respectively. Pandey (1980b) showed *D. arnfieldi* infection to be present throughout the year in Moroccan donkeys with an annual incidence of 47.8%. The effects of high parasitic burdens can be severe. Among gastro-intestinal helminths, *S. vulgaris* is the most pathogenic in equines, causing unthriftiness, weakness, increased susceptibility to other infections and even death (Khallaayoune (1991).

Materials and Method

Anthelmintic programme
SPANA has been running an anthelmintic programme in the region of Marrakech since the 1930s. The routine preventative treatment for parasitism has evolved over the years but four years prior to assessment involved oral ivermectin (*Atlamec*,

Atlas Veterinaire) given at a set dose of 15ml to donkeys and 30ml to mules and horses (roughly 0.2 mg/kg). Following the initial dose repeat treatments are given one month subsequently, and every three months there after for life. It is the responsibility of the animal's owner to present it for treatment when required.

Location of sampling

Routine daily visits to souks in the region of Marrakech were used for sample collection. For the assessment of anthelmintic treatment souks were split into a treatment group (frequently visited by SPANA) and a control group (not previously visited by SPANA). Five souks made up the treatment group of which one was visited twice. One souk was used for the control group and visited on three occations. All souks were located within a 50km radius of Marrakech, all in geographically similar areas. Samples were collected in the month of August during the countries dry season. Samples were taken at random from equines presented to the mobile clinic. The souks used in the treatment group had been routinely visited by SPANA's mobile clinic at least twice monthly over a varying period of years. All equines presented had been assessed by a veterinary surgeon and treated accordingly. The control souk had not been visited by SPANA for 22 years with the likelihood of other anthelmintic treatment being extremely low.

Sample collection

97 donkeys, 49 mules, and 12 horses were sampled. Two parameters were chosen to estimate worm burdens (i) the number of eggs per gram (epg) in faeces, and (ii) the body condition score. Rectal faecal samples were used together with the modified McMaster technique to calculate the egg count. No species identification of the eggs was performed. Condition score was assessed subjectively using a scale from 1(emaciated) to 9 (obese) as outlined by Pearson & Ouassat (1996) for working donkeys in Morocco and adapted in this study for use in mules and horses.

Species, sex, age, reason for presentation and liveweight were also recorded for analysis. Age was estimated by dental examination of incisor teeth. Liveweight was estimated using the most accurate field techniques available: for horses using a weightape, and for donkeys and mules by measuring heart girth and body length with predictions taken from nomograms specifically developed for use in working donkeys (Pearson & Ouassat, 1996) and mules (Kay, Pearson & Ouassat, in press) in Morocco.

Results

Eggs per gram and condition scores

Table 1 and 2 show the results obtained for the mean number of eggs per gram (epg) and the mean condition scores for the treatment and control groups.

	SPANA visited souks	SPANA non-visited souk
Donkeys	**1058** (62) *850, 914*	**1509** (35) *800, 1525*
Mules	**1253** (36) *300, 2140*	**877** (13*)* *200, 1333*
Horses	**27** (7) *0, 48.8*	**200** (5) *100, 292*

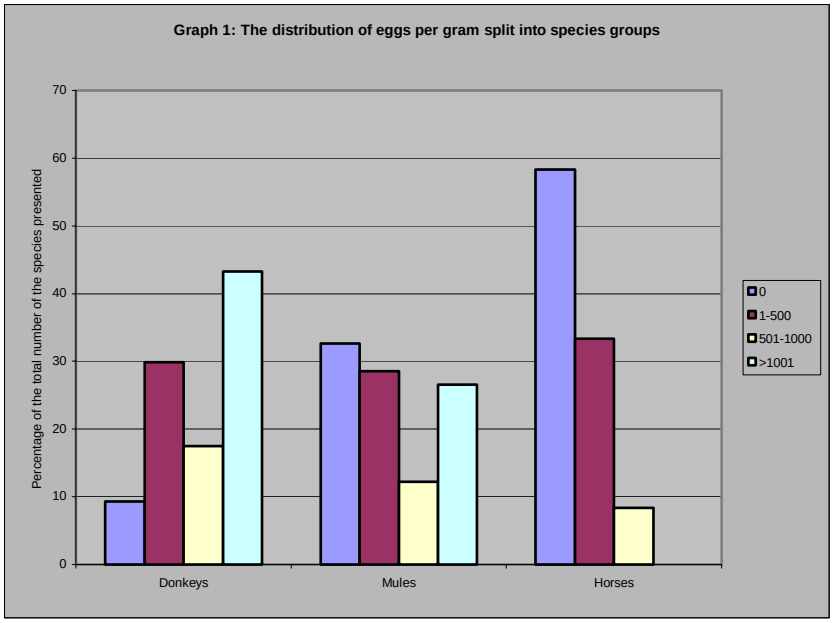
Table1: The mean values of epg in the souks routinely and not routinely visited by SPANA
Indicating: **mean**, (number of samples), *median, standard deviation*

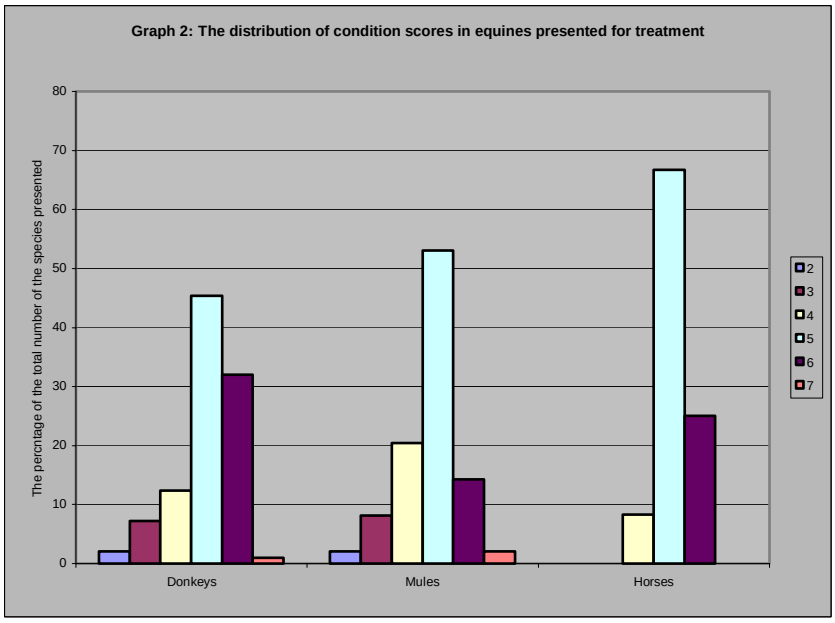
	SPANA visited souks	SPANA non-visited souk
Donkeys	**4.8** (62) *5, 0.93*	**5.3** (35) *6, 1.0*
Mules	**4.7** (36) *5, 0.93*	**4.9** (13) *5, 1.26*
Horses	**5.0** (7) *5, 0.58*	**5.4** (5) *5, 0.55*

Table1: The mean values of condition score in the souks routinely and not routinely visited by SPANA
Indicating: **mean**, (number of samples), *median, standard deviation*

Statistical analysis using Kruskal-Wallis tests showed that both egg counts and condition score were not significantly different for each of the three species when compared between SPANA visited and non-visited souks. Differences were considered statistically significant at $P<0.05$. No correlation was found between epg and condition score for each of the three species.

Graphs 1 and 2 show the distribution of eggs per gram obtained and condition scores measured for the equines presented for treatment.



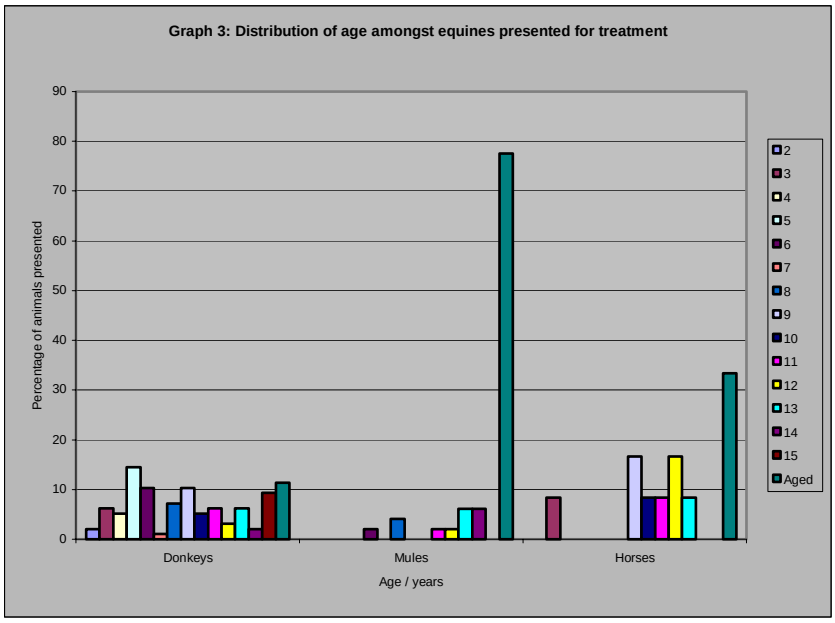


Weight

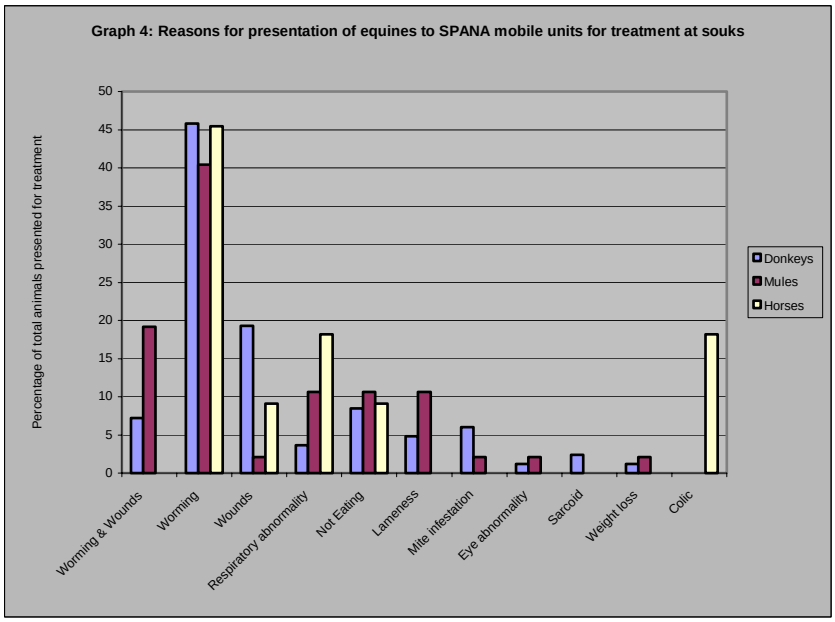
	Overall	Male	Female
Donkeys	**152.4** (97) *152, 24.8*	**152.3** (64) *153.5, 25.8*	**152.3** (33) *152, 23.1*
Mules	**227.1** (49) *227, 31.8*	**227.6** (12) *227, 28.9*	**226.9** (37) *227, 33.0*
Horses	**292.3** (12) *280, 48.0*	**301.3** (10) *285, 47.1*	**247.5** (2) *247.5, 24.7*

Table 3: Mean weights of equines.
Indicating: **mean**, (number of samples), *median, standard deviation*

Age
Graph 3 shows the distribution of ages amongst the equines presented for treatment.



Reasons for presentation
Graph 4 shows the reasons for presentation for treatment at the mobile units.



Discussion

Anthelmintic programme
It could be argued that the lack of correlation between epg and condition score would indicate a trend that does not show improvement to health status following anthelmintic treatment. However, it is the authors belief that the poor correlation is due to the effect of other contributing factors, such as nutrition and the amount worked, which have a major effect on the body condition. As such condition score of working equines is a poor indicator of parasitic burden in this environment.

The results show no statistically significant difference between helminthic parasitic burdens (estimated using egg counts of faeces and body condition score) of donkeys, mules and horses from souks routinely visited and a souk not previously visited by SPANA. Indeed the conditions scores of all equine species were higher in the newly visited souk and the mean egg counts found in the faeces of mules were lower in the previously untreated group. However, the mean epg of the SPANA visited souks was much less than the control group for donkeys and horses, indicating some effect of treatment. Two likely reasons for the lack of significant effect in the results are:

(i) Too few equines sampled in the treatment group had previously received anthelmintic treatment (as previous treatment was not assured).

(ii) The treatment was not having the desired effect to reduce gastro-intestinal parasites in the souks analysed.

Though it is possible that the some of the animals in the treatment group had not previously received an anthelmintic dose, the duration of time that SPANA has been visiting the souks and number of animals treated at each visit, should have resulted in sufficient treated animals being sampled. It therefore appears that the programme of anthelmintic control is not proving totally effective in its goal.

The programme's shortfall indicates a swift re-infection of helminths following treatment. This is enhanced by:

(i) The sharing of communal pastures with animals that are untreated with a high gastro-intestinal worm burdens is likely to give a high exposure to larval stages of the helminths and encourage rapid re-infection in the treated animals.

(ii) The efficacy of ivermectin against encysted helminth larval stages in the intestinal tract of the animals is low, thereby resulting in swift re-infection soon after treatment. Evidence of the low efficacy of ivermectin against 4^{th} stage encysted larvae is well documented (Klei and others, 1993; Xiao and others, 1994), enabling re-emergence and re-infection once the therapeutic levels of the drug in the body have waned.

Thus the efficacy of the anthelmintic worming strategy employed by SPANA could be improved. The normal benefits associated with the treatment are not being met and so new dosing strategies should be sought.

Suggestions for possible changes to the anthelmintic programme are:

(i) Improved education of the importance of anthelmintic treatment thereby increasing the number of animals presented to the mobile units.

(ii) Shorter anthelmintics dosing intervals of ivermectin, reduced from 12 to 8 weeks.

(iii) Use of an anthelmintic that has improved efficacy against encysted larvae found in the mucosa of the gastro-intestinal tract.

(iv) Systematically treating all animals in a region through an entire grazing season to lower the level of pasture contamination.

Education of owners to the importance of anthelmintic dosing is the key to improve the health status of equines. Treatment is most easily performed when the animals are presented and this only occurs if the owners are aware of the need for and availability of wormers.

The current dosing interval of 12 weeks is greater than the period of effective parasitic control offered by ivermectin. A shorter period, such as 8 weeks (Intervet 3 year worming plan, 2002), would maintain lower adult worm burdens within the intestinal lumen, and thereby concurrently reduce the pasture larval contamination. The study by Bliss and others (1985) in Greece found only frequent dosing of working equines every 4 weeks were effective in reducing worm egg counts, though in this instance fenbendazole and pyrantel were used.

The reactivation of encysted cyathostome larvae in intestinal mucosa is major source of adult worm numbers. Ivermectin has been found to have a poor efficacy in eliminating these encysted larvae (Xiao and others, 1994). Moxidectin, however, has been shown to have a reasonable efficacy against these larval stages (Bairden and others, 2001) and has been shown to have a much greater control over encysted larvae than ivermectin (Xiao and others, 1994; Monahan and others, 1996). Due to its persistent activity within the body moxidectin also has a longer duration of action than ivermectin (Demeulenaere and others, 1997; Mercier and others, 2001; Martin-Downum and others, 2001) allowing prolonged control of nematode infection. However, financial factors must be assessed prior to switch to this preferable drug.

An ideal strategy would be to dose all animals in an equine population at similar times during a grazing season. This would both lower intestinal worm burdens and pasture larval contamination. This is supported by Khallaayoune (1991) who in his study of donkeys in Morocco found relatively high faecal egg counts during the summer months and goes on to suggests improved parasitic control in a population of equines by systematically treating all donkeys in the same region. However, obvious practical and financial limitation must be overcome to make this feasible.

Though some research has been effective in providing evidence of the importance of anthelmintic dosing to over come gastro-intestinal worm burdens in working equines (Bliss and others, 1985; Khallaayoune, 1991), further studies need to be performed to accurately determine the correct dosing interval and dosing frequency of specific anthelmintic drug types in working equines raised under peasant farming conditions.

Weight

The mean liveweights of donkeys (152.4kg), mules (227.1kg) and horses (292.3kg) with a strong similarity between sexes, provides information on the correct average drug dosages when seeking a mean treatment dose for a species.

Age

The age distribution amongst donkeys is relatively even, with a spread from 2 years to aged (over 15 years). The life expectancy of donkeys is low with only 11% of donkeys sampled being over the age of 15 years. Mules, however, are predominately much older with the vast majority (77%) being aged. This low life expectancy of donkeys is consistent with surveys done in Mediterranean countries (Svendsen, 1991) and Morocco (Pearson & Ouassat, 1996) where few donkeys were found to be over 12 years of age. This is in stark contrast to those found in countries such as Britain where they have an average life expectancy of 37 years (Svendsen, 1991). The reasons behind this are numerous but are based around the fact that donkeys in the UK perform less work, receive on the whole better veterinary care and are exposed to fewer tropical diseases. This contrast highlights the need for an effective anthelmintic programme to aid the health status of animals.

Reasons for presentation

The largest reason for presentation to the mobile units at the souks is for worming with 44.0% of all treatments. Worming and wound treatments combined accounts for 67.4% of the work performed, with respiratory abnormalities and a dysphagia the next largest reasons for presentation. Respiratory abnormalities and colic are more common in horses. This may be due to horse being kept in superior housing and being fed a greater amount of concentrated feeds, though this hunsdandry information was not gathered.

Conclusion

Despite the great efforts in using anthelmintics, the current worming programme employed by SPANA has shortfalls in reducing the overall worm burdens of working equines in regions of Morocco. Alterations to the programme with priority to encourage greater animal participation thereby reducing gastro-intestinal worm burdens leading to lower pasture larval contamination would greatly improve the health and welfare status of the animals involved. Further scientific studies into the correct dosing interval and frequency of anthelmintic treatments would be of huge benefit to modify the programme currently used.

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