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The Effectiveness of Various Brands of the Drugs Fenbendazole and Ivermectin in Treating Horses with Strongyle Nematodes in Holeta, Oromia, Central Ethiopia

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Abstract

Background: Gastrointestinal parasites have always been a problem, and they are likely to continue to be a long-term issue that threatens the livestock industry.

Methods: The purpose of this study was to assess the efficacy of various Fenbendazole and Lvermectin brands against strongyle nematodes in naturally infected horses in Holeta, central Ethiopia. A total of 120 horses were divided into three groups at random. Group 1 horses were left untreated (n=12), while Group 2 horses were given five different brands of Ivermectin (Sg-ivermectin 1%, Tecmectin, Ivertong, Ivermectin 1%, Ivervik 1%), and Group 3 horses were given four different brands of Fenbendazole (Fenbendazole, Fenacure 750mg, hunter 22%, Fenacure 22%). Fecal samples were collected rectally and parasitological processed using the modified McMaster method and fecal culture, respectively, to determine Egg Per Gram (EPG) and strongyle species. The efficacy of these Anthelmintics was determined by comparing the EPG before (day 0) and after treatment using a Fecal Egg Count Reduction Tests (FECRT) (day 14).

Results: The results of this study revealed that the efficacy of Ivermectin brands was superior to that of fenbendazole brands. Horses treated with Ivervik 1%, Hunter 22%, SG-Ivermectin 1%, Tecmectin, Ivertong, and Fenacure 22% had the highest reduction in fecal egg counts, followed by horses treated with Fenbendazole, Ivermectin 1%, and Fenacure 750 mg. *Strongyle spp*. and *P. equorum* were the most common strongyle species in the study area's horses.

Conclusion: This field study found that the various tested brands of Ivermectin and Fenbendazole were effective against *Strongyle spp*. and *P. equorum* in horses.

Introduction

Equines (donkeys, mules, and horses) are used as draft animals in many parts of the world for packing, riding, carts, and agriculture. Both rural and urban transportation systems rely heavily on horses. It is the best and cheapest option in areas with underdeveloped road infrastructure, where the steep hilly terrain and narrow roads make product delivery difficult [1,2]. As a result, these animals are frequently overworked and forced to graze and feed on garbage in their spare time. These can hurt their well-being and quality of life [3]. *Strongyle spp*., *Cyathostomess spp*., *Triodontophorus spp*., *Strongyloides westeri*, *Parascaris equorum*, and *Dictyocaulus arnfieldi* are the most commonly reported equine gastrointestinal worms in different parts of the country [2,4,5]. Strongyle infections are common in equines when it comes to GIT helminths. *Strongylus vulgaris* and *S. edentates* are the most common and significant GIT parasites of horses, with *S. vulgaris* infection reaching 100% in foals. *S. equinus*, on the other hand, occurs only infrequently in comparison to other Strongyle species. These parasites are significant because they cause multiple organ damage, including circulation damage, which can be fatal in some cases. The primary goal of strongylosis management and control in horses is to reduce the number of eggs and infective L3 in Pasture areas, which helps to reduce clinical and subclinical infection. Thus, anthelmintic are the most effective way to treat Strongyle infection, particularly virulent *S. vulgaris*. However, the effectiveness of Anthelmintics has declined in recent decades due to drug resistance caused by the irrational and widespread use of these drugs [6,7]. Resistance to Benzimidazole (BZ), Macrocyclic Lactones (ML), and Tetrahydropyrimidines have resulted from the widespread use of Anthelmintics [8,9]. The recurrence of alleles coding for resistance when the worms are exposed to the medication determines the rate of resistance development. Continuous use of Anthelmintics exposed more generations of nematode parasites to the medication, particularly when prepatent periods were shorter than when parasites had longer prepatent periods. This condition is almost certainly related to the advancement of AR [10,11]. Anthelmintic drug resistance is defined as parasites' ability to withstand portions of medications that would normally kill parasites of similar species and stages. It is acquired and chosen because overcomers of medicines pass qualities for impediment onto their descendants. These resistance genes are initially uncommon in the population or emerge as uncommon mutations; however, as selection progresses, their prevalence in the population grows, as does the prevalence of resistant parasites [12].

Using various laboratory techniques, the level of GIT parasitic infestation in the horse can be estimated and identified [13]. Fecal Egg Counts (FECs) and Fecal Egg Reduction Count Tests (FECRTs) are the simplest and cheapest diagnostic options for estimating parasite load. They are also used to assess the efficacy of anthelmintic drugs after administration, i.e. to estimate the level of infection reduction.

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According to various studies, the FECRT is the gold standard test for estimating anthelmintic resistance in vivo screening tests [13-16]. Anthelmintic selection should be more evidence-based, and instruments that illuminate levels of contamination, effective diagnosis, and anthelmintic adequacy should be powerful. As a result, the current study was carried out to evaluate the efficacy of commonly used Anthelmintics in naturally infected horses from the Holeta region.

Materials and Methods

Study area

The current study was conducted at three different locations in Holeta, Oromia Regional State, central Ethiopia, 29 kilometers from the capital Addis Abeba. The elevation is 2400 meters above sea level at a latitude of 9° 00′ N and a longitude of 38° 30′ E. Furthermore, the area receives 1144 mm of rain per year [17].

Study animals and experimental design: Horses of both sexes and different age groups were used in the study, and they were kept under a strict husbandry system on communal grazing land with similar water access points. During the night, all selected horses from each farm were kept in pens at their respective owners' homes. The horses' ages were determined based on their dentition and classified as young (between 1 and 4 years) or adults (over 5 years) [18]. The horses' body condition was assessed using the guidelines [19]. For screening purposes, 200 horses were chosen from three different sites, and 200 fecal samples were collected from each one, tested for parasite infection, and individually determined for the number of Eggs Per Gram of faces (EPG) of strongyle nematodes using the McMaster technique. The helminth parasite species were identified using the technique described by Hendrix and Robinson [20]. Furthermore, experimental horses were chosen based on inclusion criteria such as having not received any anthelmintic in the previous 12 weeks, sharing the same grazing area and watering point, farmers' willingness to participate, and a McMaster Faecal Egg Count (FEC) of 300 eggs per gram of feces [21].

Sample collection, processing, and McMaster technique: Following that, fecal samples were collected from each horse per rectum, and the fecal egg count was determined pre- and post-treatment at days 0 and 14, respectively, following the recommendations of [22]. Samples were placed in individually sealed containers, labeled with the horse identification number, stored in a cool icebox, and transported to the Parasitology Laboratory for a faecal examination as soon as possible. The samples were kept in the laboratory refrigerator at 4°C until processing. The fecal samples were then examined using fecal flotation analysis and McMaster egg counting [23]. The helminth species were then identified using the technique described by Hendrix and Robinson [20]. EPG was determined using the modified McMaster technique. Furthermore, each horse's level of Strongyle infection was determined using Strongyle egg shedding or Egg Per Gram of feces (EPG) following the guidelines of [21] and [24], and If the egg count level was between 0-300 EPG, it was classified as mild, 301-500 EPG was moderate, and 500 EPG was severe. Before administering any treatment, the different types of GIT helminth species were identified using McMaster techniques. FECRT was used to evaluate efficacy [22].

Grouping of treatment animals: Based on the above criteria, 120 naturally infected horses were chosen and randomly assigned to three main groups. Furthermore, 12 horses were assigned to each anthelmintic drug brand and control group. The horses in Group I were not treated (n=12). Group II horses were given Ivermectin (n=60), while Group III horses were given Fenbendazole (n=48). Each horse was treated with the manufacturer's recommended dose (Ivermectin, 200 mcg/kg, and Fenbendazole, 7.5mg/kg).

Data analysis: The collected data was saved in a Microsoft Excel 2016 spreadsheet and analyzed with STATA version 13. The chi-square test was used in the study to compare the prevalence of strongyle infections. The mean percentage reduction of the mean egg excreted on day 14 post-treatment was calculated using the arithmetic mean of the egg count and nematode burden [22]. The FECR (fecal egg reduction test) was used to determine the effectiveness of deworming. Furthermore, the level of anthelmintic resistance in horses was assessed using the World Association for the Advancement of Veterinary Parasitology (WAAVP) guidelines. As a result, the anthelmintic resistance cutoff values for fenbendazole and ivermectin are 90% and 95%, respectively, based on the agreed-upon cutoff value of fecal egg count reduction.

$$\text{FECR\%} = \frac{pretreatmentepg - posttreatmentepg}{pre-treatmentepg} \times 100$$

Ethics approval and consent to participate: During sample collection, best practices for veterinary care were followed, and ethical approval was obtained from Wolaita Sodo University's Institutional Review Board (IRB). The study's purpose was well explained to the study participants, and informed consent was obtained via a verbal consent form approved by the institutional ethical board (Ref. No: WSU41/22/2242).

Results

Prevalence of Helminth infections in horses at Holeta

The study found that Strongyle infections were common in the area's horses, as all 120 horses tested positive for Strongyle eggs. Furthermore, the study found more Parascaris equorum eggs (17.5%) in the study area (Table 1).

Horse age and faecal egg output

The current study found that the mean number of EPGs was higher in younger horses (less than 5 years) than in adult horses (X2= 0.05, p = 0.39); however, there was no significant difference in the mean EPG between the two age groups. Thus, the study found that strongyle nematodes were more common in young horses than in adults in the study area. P. equorum, on the other hand, had no significant (p> 0.05) difference in EPG between adult and young horses.

Anthelmintic efficacy on Strongyle species

The current study found that all brands of Fenbendazole and Ivermectin were effective against strongyle infection in horses in the study area. Horses treated with Ivervik 1%, hunter 22%, SG-Ivermectin 1%, Tecmectin, Ivertong, and Fenacure 22% had the highest reduction in fecal egg counts, followed by horses treated with Fenbendazole, Ivermectin 1%, and Fenacure 750 mg. FECRTs of 90.8%, 92.8%, 98.6%, 99%, 100%, 100%, 100%, 100%, 100%, and 100% were also recorded for Fenbendazole, Ivermectin 1%, Fenacure 750 mg, Ivervik 1%, hunter 22%, SG-ivermectin 1%, Tecmectin, Ivertong, and Fenacure 22%, as shown in (Table 3).

Discussion

All 120 horses were infected with various types of strongyle infection, with a prevalence of 100%. Strongylus spp. (83%) and Parascaris equorum (17%) eggs were the most common in the McMaster technique study. A study conducted by [25] in Australia also revealed that 80% of horses were infected with GIT parasites. Similarly,

[5] in Hossana and [2] in the Hawassa area reported that Strongyle spp. infection is common among working horses, with prevalence rates of 48.2% and 56.1%, respectively. Additionally, research on the degree of infection that was determined using EPG revealed that 59% of the horses were severely infected by strongyles, while mild infection of *P. equorum* (13.8%) was reported in a horse from the study sites. In line with this study, [26], [15] in Gondar, and [14] in Hossana reported a higher level of strongyle species per gram of feces in infected hoses. The differences in the prevalence of helminth infection in horses could be explained by egg presence or absence of intervention. In and around Holeta, there is anthelmintic treatment coverage given to the horses, according to the response we obtained from the owners during the assessment. The presence and distribution of strongylosis in horses were investigated in a field study based on the number of Fecal Eggs (FEC).

Most horses are treated with anthelmintic drugs, so it is believed that strongyloidiasis eggs are mainly produced by adults. Thus, the eggs raised from suppressed larvae are known to be resistant to anthelmintics. A possible justification for the high levels of EPG in young horses could be that young horses, in general, have more mucosal larval stages than older horses, 61.4%, and 38.6%, young and adult, respectively [27,28]. Age-related immune development showed fewer worms in older individuals than younger individuals in experimental studies using ponies of different ages [29]. Lower worm fertility is another sign of immunity that may explain the age difference observed in mean EPG values. For example, the strong immunity of ponies has been shown to reduce the fertility of worms [30, 31]. An additional reason for the higher EPG values in younger horses ought to be that the anthelmintic remedies carried out previously had been less effective in younger horses than in adult animals. This recommendation is based totally on the interactions that have been located between anthelmintic remedy and horse age [27,28].

The present study aimed to evaluate the efficacy of the different brands of ivermectin and fenbendazole. The results confirm that all anthelmintic drugs were effective in treating strongyle species. In line with the results of [14] and [15] in Ethiopia and [3] in France, the efficacy of all brands of ivermectin was effective against strongyle. However, some brands of Fenbendazole groups were not effective against strongyle infection, as described by [14] in the Hossana area, Ethiopia, and other European countries [32], which disagreed with the current findings. In contrast, the results of other studies indicate the inefficacy of fenbendazole treatment, which might be due to resistance development on fenbendazole [33,34]. Moreover, this might be ascribed to factors such as the quality of generic repacked or reformulated products and management and the quality of drugs [7,14], which might be responsible for these varied reports. Resistance to a benzimidazole group of anthelmintics has now been widely reported [7,34,35]. The observed differences between studies may be related to production systems and environments. In a wide range of production systems, the selectivity for the worm population is much lower because most parasites are in shelters and treatment is infrequent [35].

FECRT, however, is known to be a less sensitive method for the early detection of AR, and owners and veterinarians need to consider individual cases related to effective anthelmintics for horses. Evaluation of the efficacy of FECRT treatment should be integrated into the routine administration of anthelmintics in these areas. If AR is suspected based on a stool test or herd history, more sensitive tools and approaches should be used to investigate true herd resistance [36]. All brands of ivermectin and fenbendazole in horses except *P. equorum* are considered dose-limiting species and hence have a lower threshold for the development of AR [37]. Resistance to anthelmintics found in any brand of fenbendazole may be related to the infrequent use of low-quality anthelmintic therapy compared with other anthelmintics and the development of drug-resistance genes.

Conversely, the lack of resistance can also be explained by the fact that FECRT is not sensitive to the detection of resistance levels below 99% [38]. FECRT detects clinical treatment levels rather than the complete elimination of parasites [22]. In this regard, the discovery of Strongyles after anthelmintic treatment means that a small number of these parasites have escaped or are resistant to treatment and that the animal can continue to shed eggs on these parasites. This result was in agreement with the reports of previous studies [14,39,40]. This has the potential to lead to the selective existence of resistant isolates of the parasite; therefore, resistance to anthelmintics is largely genetic, thus posing a risk of future resistance [41,42].

Conclusion

The results of the field test study revealed that, although the efficacy of the two chemical groups and the various brands of the two chemical groups varies, all brands of fenbendazole and ivermectin were effective against Strongyle species and P. equirum nematode parasites. This advice is excellent for preventing the worry of anthelmintic resistance. To assess the efficacy of anthelmintics frequently used in various agroecology, management systems, and a large number of animals, national studies utilizing standardized protocols are required.

Consent for publication

Not applicable.

Data Availability Statement

The data will be provided upon the request of the corresponding author.

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