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Comparative efficacy of a combination of albendazole and praziquantel; ivermectin and fenbendazole against gastrointestinal nematodiasis in dogs

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Abstract

Gastrointestinal parasitism is one of the common causes of diseases of dogs. Factors associated with the prevalence and risk for mechanical transmission of a number of canine gastrointestinal nematodes, and the role of dogs in such transmission has been a worldwide concern. The present study was undertaken as a part of P.G research work to evaluate the comparative efficacy of three commercially available anthelmintics viz. Ivermectin (Neomec), Fenbendazole (Panacur) and a combination of Albendazole and Praziquantel (Praziplus). A total of 24 dogs of different age, sex and breeds positive for gastrointestinal helminthic infection were randomly divided into 4 groups for the study. An experimental 30 days of observation period revealed that administration of a single dose of Ivermectin (@ 200 µg/kg body weight) resulted into early reduction of EPG, than oral administration of Fenbendazole (@ 50 mg/kg body weight for three consecutive days) or an oral administration of a single dose of a combination of Albendazole and Praziquantel (@ 1 tab/kg body weight). Further, the overall percent efficacy of Ivermectin, Fenbendazole and a combination of Albendazole and Praziquantel was found to be 96.47%, 93.25% and 92.49% respectively. Also, Fenbendazole was found to be effective and safe anthelmintic for therapeutic use in pups and adults against gastrointestinal nematodiasis.

Keywords: Albendazole, dogs, fenbendazole, ivermectin, nematodes, praziquantel

1. Introduction

Gastrointestinal helminthiasis is the most commonly encountered disease in dogs rearing across the globe including India [1]. Among the gastrointestinal helminths, both *Ancylostoma* spp. and *Toxocara* spp. are the important nematode affecting dogs, especially in newly whelped or neonates, and causing a tremendous health hazard. The role of dogs as a definitive host for a number of zoonotic parasites has been widely studied and recognized as being a significant public health problem worldwide, especially in developing countries and communities that are socio economically disadvantaged [2]. Depending on the density of gastrointestinal nematodes, parasitized animals exhibit a variety of symptoms, with *Ancylostoma caninum* being the most common and highly pathogenic nematode of dogs. Hookworms, most notably *Ancylostoma* spp. larvae, can be transmitted through milk from the lactating mother to the puppies and are also capable of penetrating skin and thus making their way to the intestine [3]. All species of hookworms feed by grasping the intestinal mucosa with their mouthparts and damaging the surface to obtain nutrients: largely blood in the case of *Ancylostoma* spp. (as they require oxygen from the blood) [3], and ingests the mucosal lining along with some consumption of blood (up to 0.1mL in 24hr [4, 5]). Such blood feeding can cause significant anaemia when present in high numbers or over a period of time, and can even result in acute anaemia with the death of young pups. The survivability of *Toxocara canis*, yet another ascarid nematode, that is found in the intestine of the dog, depends on many factors like age, geographical area, and worming history [6]. Dogs are infected by ingesting infective eggs or by consuming paratenic host, but in pups the most important route is through transplacental infection. Toxocariasis is a parasitic zoonosis that causes significant morbidity worldwide, and infection mostly in children occurs by ingestion of eggs of *T. canis* via hands contaminated by direct contact with puppies, through the hair of the dog [7], or by ingestion of

vegetables or soil contaminated with *Toxocara* eggs [8]. Eggs containing infective larvae of *Toxocara* species are commonly found in soil samples from public areas such as parks and playgrounds, and the eggs survive and remain infectious for many years.

In addition to these two parasites, a number of different nematodes have been reported by different authors that infect dogs and causes gastrointestinal nematodiasis and even death in severe cases. Since no single anthelmintic compound is effective against mixed infections of nematodes and other parasites, the proposed programme was planned as a part of the post graduate research work where in three different groups of drugs were used in different group of dogs to see their efficacy for treatment, control and prevention of gastrointestinal nematodiasis.

2. Materials and Methods

2.1 Ethical approval

Ethical approval for the study was obtained from the Institutional Animal Ethics Committee of College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati-781022, Assam.

2.2 Management profiles

The dogs were maintained in the caged system of management, and the floors of the cages was cleaned regularly with a broom and water by the concerned persons no bedding material being provided in any of them. Separate feeding troughs were used for feed and water and deworming of the required animals were done as per the programmed schedule.

2.3 Selection of animal

Relevant data regarding breed, age, sex, and previous history of infection were recorded for all the animals to ascertain the significance of these factors with positive cases of nematode infection. During the study, apparently healthy looking

animals were selected, and the status of parasitic infestation was evaluated on the basis of fecal examination and history of deworming whenever required.

2.4 Grouping of animals

A total of twenty-four dogs, positive for gastrointestinal helminthic infection were randomly divided into four groups viz., Group A, B, C and D, consisting of six dogs in each group. A healthy control group marked as Group E was constituted with six apparently healthy and regularly dewormed dogs. The dogs of Group A were treated with a combination of Albendazole and Praziquantel (Praziplus® @ 1tab/ 10kg body weight orally as a single dose), while the dogs of Group B and Group C were injected and treated with Ivermectin (Neomec® subcutaneously with @200µg/kg body weight as a single dose) and Fenbendazole (Panacur® @ 50 mg/kg body weight orally for three consecutive days) respectively. The dogs of Group D were kept as infected and non-treated control.

2.5 Collection of fecal samples and assessment of efficacy

The efficacies of drugs were assessed based on reduction/absence of eggs per gram (EPG) of faeces and gradual disappearance of clinical signs. The EPG was performed on 0, 7th, 14th, 21st and 30th day of post anthelmintic treatment by using Stoll's Technique [9].

3. Results and discussion

In the present study, there was a significant decrease in mean EPG value in post treatment animals, in comparison to the respective values of pretreatment animals in all the groups. The treatments with Praziplus®, Neomec® and Panacur® resulted in a gradual decline in EPG count from 0th day to 30th day post treatment (Table 1). The number of eggs after treatment was reduced similarly for all the three drug formulations when compared with pretreatment egg counts, whereas these counts increased in Group E.

Table 1: Comparative Efficacy of different Anthelmintics against gastrointestinal nematodiasis in Dogs.

Groups	Pre-treatment	Post-treatment				
	0 day	3 rd day	7 th day	14 th day	21 st day	30 th day
Group A	2750±1125.09 ^b (67.88%)	883.33±309.21 (94.55%)	150±80.62 (100%)	0.00 (100%)	0.00 (100%)	0.00 (100%)
Efficacy (%)	92.49					
Group B	1416.67±228.67 (82.53%)	250±114.75 100%	0.00 (100%)	0.00 (100%)	0.00 (100%)	0.00 (100%)
Efficacy (%)	96.47					
Group C	1333.33±284.8 (72.50%)	366.67±122.93 (93.75%)	83.33±54.26 (100%)	0.00 (100%)	0.00 (100%)	0.00 (100%)
Efficacy (%)	93.25					
Group D	1316.67±252.21	1383.33±249.56	1416.67±248.2	1483.33±215.12	1566.67±237.58	1666.67±253.86
Group E	0.00	0.00	0.00	0.00	0.00	0.00

Mean bearing same superscript in a column do not differ significantly

A: Albendazole & Praziquantel, B: Ivermectin, C: Fenbendazole, D: Infected Control, E: Healthy Control

The average EPG count in Praziplus treated group showed considerable reduction of 67.88% on 3rd day and 94.55% on the 7th day. By 14th day all the dogs were found to be free from parasitic ova and the overall efficacy was 92.49%. The present finding was in agreement with the earlier reports [10], and a somewhat similar result was reported with a combination of febantel and praziquantel in dogs, wherein a minimal effective dosage was established in combination with 10 mg of febantel and 1 mg of praziquantel/kg of body weight, that eliminated 99.5% to 100% of the major nematodes and cestodes identified (i.e., *Ancylostoma*

caninum, *Trichuris vulpis*, *Toxocara canis*, *Dipylidium caninum*, and *Taenia pisiformis*) [11]. In a trial with a combination of febantel/praziquantel (Vercom) paste, and febantel tablets alone, the results indicated that the nematocidal efficacy of febantel against gastrointestinal nematodes in dogs remained unchanged in both the formulations [12].

As a vermicide, albendazole causes degenerative alterations in the intestinal cells of the worm by binding to the colchicine-sensitive site of β -tubulin, thus inhibiting its polymerization or assembly into microtubules (it binds much

better to the β -tubulin of parasites than that of mammals) [13, 14]. Albendazole leads to impaired uptake of glucose by the larval and adult stages of the susceptible parasites, and depletes their glycogen stores. It also prevents the formation of spindle fibers needed for cell division, which in turn blocks egg production and development, and existing eggs are prevented from hatching [15, 16]. Though praziquantel, has a wide therapeutic index and is highly effective against both immature and adults stages of *Taenia* species and *D. caninum* [17], yet it does not have any ovicidal activity and hence eggs continue to shed and contaminate the environment.

The EPG count was reduced by 82.53% on 3rd day of post treatment of dogs in Group B and by 7th day all the dogs of this group were free from parasitic ova and the overall efficacy being 96.47%. The present findings simulate the findings of earlier workers against canine ancylostomiasis [18, 19, 21, 22]. In a report, asinificant reduction in EPG was found in dogs treated with ivermectin both orally and subcutaneously, but no significant difference was observed in EPG between oral and subcutaneous treated dogs in various intervals of study [23]. A 90–100% efficacy was reported by some workersthrough subcutaneous administration of ivermectin [24, 25].

Ivermectin kills the parasite by interfering with nervous system and muscle function, in particular by enhancing inhibitory neurotransmission. The drug binds to glutamate-gated chloride channels (GluCl_s) in the membranes of invertebrate nerve and muscle cells, causing increased permeability to chloride ions, resulting in cellular hyperpolarization, followed by paralysis and death [26, 27, 28].

A decline of average EPG count by 72.50% and 93.75% on 3rd and 7th day post-treatment was observed in the dogs of Group C. On the 14th day of post-treatment, all the dogs of this group were free from parasitic ova having an overall efficacy of 93.25%. The present study is in agreement with the findings of Arle *et al.* [29]. Fenbendazole has a broad spectrum anthelmintic effect against both mature and immature stages of gastrointestinal nematodes [17].

The EPG of untreated group (Group D) remained almost the same in both pre and post treatment period.

4. Conclusion

Although, Ivermectin was found to be more effective, it has got some toxic effects in certain breeds of dogs and pups. This toxic effect might be due to that, these breeds have (MDR-1) gene that causes a defect in the p-glycoprotein responsible for a multidrug comparatively more permeable blood brain barrier to the drug or due to an autosomal recessive trait transporter in the blood brain barrier and thus leading to passage of ivermectin in to the brain at low dosages [30]. In the present study, a cross breed dog showed the signs of toxicity following ivermectin injection. Toxicity of Ivermectin in different breeds of dogs viz. Collie, Australian Shepherds and Pomeranian has also been reported by several workers [33]. On the other hand, Fenbendazole is an anthelmintic of a wide range of safety with prophylactic and therapeutic property. Hence, it can be recommended for the purpose of regular deworming both in puppies as well as adult dogs against gastrointestinal nematodiasis. Also, regular fecal examinations should be performed at least annually as part of the routine physical examination of every dog.

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6. Competing Interests

The authors declare that they have no competing interests.

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