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Different Treatment Regimen for Eradication of Pinworm (*Syphacia obvelata*) Infection in Mice Colony

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ABSTRACT

Syphacia obvelata infection was diagnosed in mice during routine health monitoring of rodent colony at Animal Facility, ILS-NISER, Bhubaneswar. Entire mice colony was treated with fenbendazole mixed in drinking water @70 mg / liter in combination with topical spray of injectable 0.1 % ivermectin solution to arrest the disease. At the same time mice were isolated and grouped (n=18) to compare other treatment regimens using ivermectin (oral & spray) and fenbendazole (oral) and chalk out an effective therapeutic strategy for large rodent colonies. Use of cocktail of oral fenbendazole and 0.1 % ivermectin spray was able to eradicate pinworm infection in mice colony but study with individual use of fenbendazole in drinking water was not able to treat the infection in group. Oral use of ivermectin was able to treat pin worm infection in mice but is not recommended for treatment due to its deleterious effects. Use of 0.1% ivermectin as spray alone resulted in complete eradication of *Syphacia obvelata* hence suggested to be safe and effective method for pin worm eradication in large rodent colonies.

Keywords: *Syphacia obvelata*, mice, fenbendazole, ivermectin

Pin worm infestation is routinely reported in various modern rodent housing facilities and even under strict bio exclusion procedures (Effler *et al.*, 2008). Among the several species *Syphacia obvelata*, *Aspicularis tertraptera* and *Syphacia muris* are the most common pin worm detected in mice and rats (Pritchett and Johnston, 2002). *These species may present alone or detected concurrently* (Wightman *et al.*, 1978; Kellogg and Wagner, 1982). *Though the pinworms do not cause life threatening diseases but have several research implications* (Mohn and Philipp, 1977; Sato *et al.*, 1995; Agersborg *et al.*, 2001).

The clinical signs for the pinworm infection are rare. The infection is diagnosed commonly by perianal tape test method. The anal swabbing and microscopic examination of caecal and colonic contents provide more accurate diagnosis (Klement *et al.*, 1996; Goncalves *et al.*, 1998).

Treatment regimen includes administration of anthelmintic drug topically or in drinking water and

feed along with stringent environmental sanitation. Most widely and commonly used anthelmintics include ivermectin and fenbendazole (Skopets *et al.*, 1996). Oral ivermectin though effective may interfere with research and also affect the breeding performance of mice (Jackson *et al.*, 1998, Lankas *et al.*, 1997, Skopets *et al.*, 1996). However topical administration is regarded as a safer choice (Sueta *et al.*, 2002). Another popular drug used is fenbendazole which has a wide safety margin and no documented inference with research is reported. It is generally administered with feed for therapeutic as well as prophylactic measures against pin worm (Barron *et al.*, 2000; Pritchett and Johnston; 2002; Sueta *et al.*, 2002).

Pinworm outbreak was diagnosed in mice at ILS-NISER animal facility during routine health monitoring of rodent colony by perianal tape test method. Similar outbreak was earlier detected in the same facility which was managed by using oral ivermectin with drinking water. However



detailed evaluation of breeding record that time pointed out towards decreased fertility and birth defects in neonates (*unpublished*).

Hence oral we used oral suspension of fenbendazole mixed with drinking water with topical 0.1% ivermectin spray as immediate measure to arrest the disease. At the same time we isolated mice positive for pin worm infection and divided them in three groups (n=18) to compare different treatment regimens and chalk out effective therapeutic strategy for large rodent colonies.

MATERIALS AND METHODS

Two different strains of mice named Balb/c and C57BL/6 were currently housed in static and IVC cages under barrier conditions at CPCSEA approved animal facility of ILS, Bhubaneswar, India. The present outbreak of pinworm was detected, during routine health monitoring by perianal tape test method.

Diagnosis

Cages in all the rooms were sampled for presence of pin worm. The pin worm eggs were examined microscopically under low power by perianal impression using cellophane tape.

Parasite Isolation

The cellophane test positive mouse was sacrificed by cervical dislocation and the caecum & colon were longitudinally dissected in normal saline solution. The worms were collected after examination under the dissection microscope and washed thrice in saline. Thereafter it was observed under low power magnification for identification of parasite based on the morphological characters.

Treatment

600 Balb/c and 412 C57/BL6 mice were treated with fenbendazole mixed in drinking water @70 mg / litre in combination with topical spray of injectable 0.1 % ivermectin solution. Fenbendazole was administered through drinking water for 3 weeks with week on-week off rotation. At the same time these animals were topically sprayed with 0.1 % ivermectin solution once a week for 5 consecutive weeks.

At the same time Balb/c mice (6-8 week) positive for pin worm were grouped with n= 18 (9 male, 9 female) for assessment of different treatment regimens using ivermectin and fenbendazole as shown in table 1.

First group was administered with oral ivermectin @2mg/kg based on drinking water consumption for three weeks with week on-week off rotation.

Another group was treated with topical ivermectin 0.1% sprayed as mist over animals with cage and bedding once a week for 5 weeks

The third group of animals was given fenbendazole orally in drinking water @ 70mg/liter for 3 cycles based upon a week on-off schedule. All the animals were tested for presence of pinworm after regular interval by perianal tape test. Animal care and treatment procedures were used in accordance with CPCSEA guidelines.

Table 1. Treatment regimen for pin worm with dosage and schedule

Groups	Dose and Schedule	Duration
Oral ivermectin in drinking water	2mg/kg based on drinking water consumption for three weeks with week on-week off rotation	Five weeks with three week administration and two week off on alternate basis
Topical ivermectin as spray	0.1% spray sprayed as mist over animals with cage and bedding once a week	Once in a week for five weeks
Oral fenbendazole in drinking water	70mg/liter for 3 cycles based upon a week on-off schedule	Five weeks with three week administration and two week off on alternate basis

RESULTS AND DISCUSSION

Examination of slides with taped impression of perianal region and gut contents confirmed presence of pin worm. The morphological appearance of egg and larvae were consistent with that of *Syphacia obvelata* (Pritchett, 2007).



Figure 1: Perianal tape test detecting Pinworm eggs: The sticky side of cellophane tape was attached to the perianal region mice and then it was pasted on microscopic slide. The slide was examined under microscope with 10X magnification and these eggs were observed.



Figure 2. Adult pinworm from the caecal and colonic washings: Mouse found positive for pinworm by Perianal tape test were sacrificed and the caecum and colon were dissected out. The contents were washed with luke warm saline solution. The washings were observed under microscope with 4X magnification and the adult worms were detected.

Investigations revealed that mice treated with oral fenbendazole and topical 0.1 % ivermectin spray together was found negative for pin worm. Examination of animals grouped for assessment of different treatment regimens

showed that all the mice in group treated with ivermectin through oral route as well as topically through spray (0.1%) was found to be free from pinworm infection. Use of fenbendazole alone in drinking water did not result in complete extermination of pin worm as all the animals were found to be positive for infection, however qualitative observation pointed towards low egg count as compared to beginning of treatment.

Oral ivermectin is one of the most widely used agents for eradication of pin worm infection in rodents. Our study as well as previous reports show that when used orally @2mg/ Kg body weight is highly effective against *Syphacia obvelata* (Pritchett and Johnston, 2002). However author's previous experience with use of ivermectin in breeding colony of mice pointed towards decreased fertility and increased neonatal birth defects. Deleterious effects of oral ivermectin in mice and its effect on research has been well documented (Lankas *et al.*, 1993; Skopets *et al.*, 1996; Jackson *et al.*, 1998). Hence oral use of this drug although effective, should be discouraged in experimental animals and breeding colony of rodents.

Topical spray with 0.1% ivermectin resulted in complete elimination of parasite from the group of mice. Similar study carried out by Sueta *et al.* (2002) also resulted in effective eradication *Sypacia obvelata* with no toxicity and unwanted effects on reproduction in mice.

Results with cocktail of oral fenbendazole in drinking water and ivermectin spray were promising but use of oral fenbendazole alone did not eradicate infection in mice which was found to be contrary to previous published reports (Coghlan *et al.*, 1993; Barron *et al.*, 2000; Huerkamp *et al.*, 2000). Interestingly we found that in all previous reports of successful treatment with this drug fenbendazole was administered in commercially milled diet. Fenbendazole is hydrophobic (Arias *et al.*, 2008,) and was used with drinking water in our study. Hydrophobic nature of this drug may be one of the reasons for poor delivery of drug in mice leading to unsuccessful treatment/eradication. Drug delivery of fenbendazole through drinking water needs further investigation.

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Competing Financial Interests

Authors declare no competing financial interest.

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