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## Efficacy of Fenbendazole against *Ascaridia* Spp. in Large Macaws

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### Abstract

Ascarids are common endoparasites in psittacines. Fenbendazole has been reported for treatment of ascarid infection in many avian species. In this study, the efficacy of fenbendazole against *Ascaridia* spp. in large macaws was evaluated. Seventeen pairs of naturally infected large macaws were divided into 3 groups. Birds in group 1 (6 pairs) were treated with fenbendazole per os at 35 mg/kg and repeatedly on day 10. Birds in group 2 (5 pairs) were treated with fenbendazole mixed in feed at 35 mg/kg and repeatedly on day 10. Birds in group 3 (6 pairs) served as untreated control group. Ascarid eggs in feces were counted before treatment, on the first day after the first medication and on days 1, 14, 28, 42, 56, 70 and 84 after the second medication. Results showed that ascarid egg count of both treatment groups dropped dramatically after the second medication. The overall efficacy of fenbendazole per os and mixed in feed was 94.7 % and 83.1%, respectively. No adverse side effects were found. The results indicated that two doses of fenbendazole could be effectively used for ascarid infection treatment in large macaws.

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**Key words:** *Ascaridia*, efficacy, fenbendazole, macaws

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## Introduction

Large macaws are popular pets due to their bright feathers. Large macaws are classified in order Psittaciformes. Gastro-intestinal parasites are common problems in psittacines (Pratipa et al., 2013). Of these parasites, ascarids are the important parasites and at least seven species of ascarids were reported. *Ascaridia hermaphrodita*, *A. sergiomeirai*, *A. ornata*, *A. nicobarensis* and *A. platyceri* are specific for psittacines. *A. galli* and *A. columbae* are commonly found in gallinaceous and columbiformes birds but also found in psittacines (Kejerova et al., 2004).

Mild ascarid infection can cause anorexia, weight loss, malabsorption, stunt, and diarrhea. Heavy infection may cause intussusception, intestinal obstruction, and death (Wilson et al., 1999). Diagnosis is based on the finding of ascarid eggs in feces. For treatment, there are many anthelmintics that are effective against ascarids. However, information on anthelmintic effectiveness against ascarids in large macaws is still limited. Dosage and frequency used of anthelmintics in psittacines are dictated by anecdotal report (Tully, 2000). Fenbendazole is a broad spectrum anthelmintic and used for ascarid infection treatment in many bird species (Pollock et al., 2005). In addition, fenbendazole can be administered in feed (Ssenyonga, 1982). Fenbendazole acts by binding to nematode  $\beta$ -tubulin and inhibiting formation of microtubules. Fenbendazole has higher affinity for nematode  $\beta$ -tubulin than host  $\beta$ -tubulin (Lanusse et al., 2009). The purpose of this study was to determine the efficacy of fenbendazole for treatment of ascarid infection in large macaws.

## Materials and Methods

**Animals:** One hundred and twenty pairs of mature large macaws from a private zoo were used in the study. Macaw species included blue and yellow macaw (*Ara ararauna*), blue-throated macaw (*Ara*

*glaucogularis*), great-green macaw (*Ara ambiguus*), green-winged macaw (*Ara chloropterus*), hyacinth macaw (*Anodorhynchus hyacinthinus*), military macaw (*Ara militaris*), red-fronted macaw (*Ara rubrogenys*), and scarlet macaw (*Ara macao*). Each pair of birds was kept in separate suspended cage (1.5x4x2 m: WxLxH) with perches and a nest box. The concrete floor under the cage was washed with tap water every day. Feed was provided twice a day with mixed potato, pumpkin, beans and grains in the morning and mixed fruits in the afternoon. Water was provided ad libitum.

### Screening of ascarid infected bird by fecal examination:

Fresh fecal samples were collected from the concrete floor under the cage. Samples were kept in plastic bags at 4 °C. Fecal samples were processed for qualitative examination by direct fecal smear and simple flotation method to find ascarid eggs. For direct fecal smear method, small amount of fecal sample was placed on a glass slide and mixed with 1 drop of normal saline. The cover slip then was placed and examined under light microscope. For simple flotation technique, 4 g of feces were mixed with 20 ml of saturated salt solution. The mixture was filtered through fine mesh sieve. The fecal suspension was pour into a tube. The tube was gently topped off with the suspension to attain convex meniscus then a cover slip was placed on the top. The tube was left to stand for 5-10 min. The cover slip was removed and placed on a glass slide. The slide was examined under a light microscope. Ascarid infected birds were used in the study of the efficacy of fenbendazole against *Ascaridia* spp.

### Efficacy study of fenbendazole against *Ascaridia* spp.:

Seventeen pairs of ascarid infected large macaws were used in the study. The birds were divided in to 3 groups. Groups 1 and 2 were treatment groups (n = 6 and 5, respectively). Group 3 was untreated control group (n = 6). Birds in group 1 were administrated with fenbendazole suspension (Panacur® 10% suspension, Intervet, Thailand) at a dose of 35 mg/kg per os after

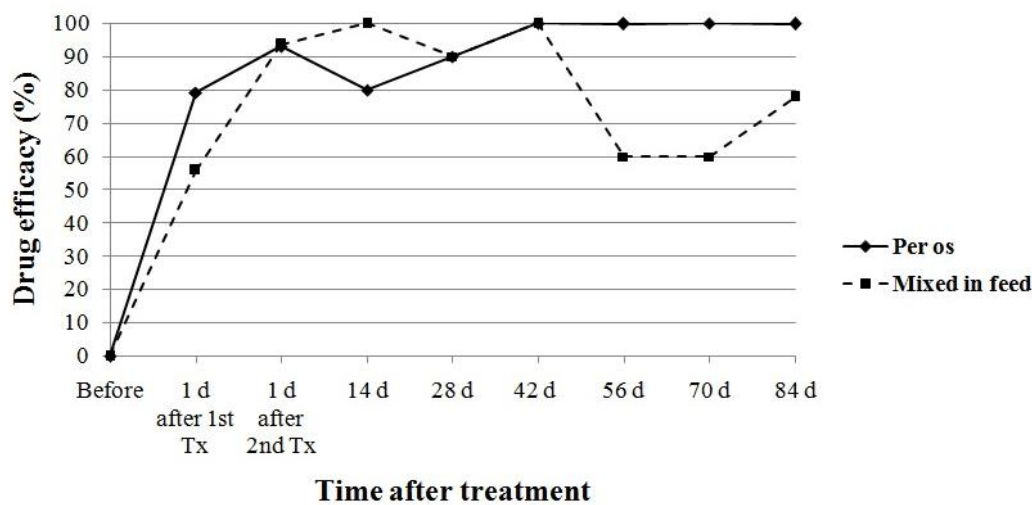
**Table 1** Quantitative evaluation of ascarid eggs in fecal samples

Group	No.	Egg Per Gram (EPG)								
		Before treatment	1 day after 1 <sup>st</sup> treatment	Days after 2 <sup>nd</sup> treatment						
				1	14	28	42	56	70	84
1 (per os)	1	50	0	0	0	0	0	0	0	0
	2	4750	450	0	0	0	0	<50	0	<50
	3	34200	1300	50	0	0	0	0	0	0
	4	250	0	0	<50	150	0	0	0	0
	5	250	250	100	250	0	0	0	0	0
	6	6050	650	<50*	0	0	0	0	0	0
2 (mixed in feed)	1	1100	1100	0	0	0	0	12500	1700	3000
	2	550	100	0	0	0	0	0	0	0
	3	100	0	0	0	<50	0	0	0	0
	4	9550	200	<50	0	0	0	0	0	0
	5	950	2100	300	0	0	0	1000	1400	100
3 (control)	1	2950	700	1000	3300	2600	4700	4700	2100	5500
	2	1750	0	500	550	50	700	1050	750	1850
	3	200	0	0	0	0	0	0	0	<50
	4	50	150	0	0	0	0	0	0	50
	5	50	150	650	5200	2500	2550	50	1500	3000
	6	50	0	0	50	0	0	3950	1150	2350

\* simple flotation method - positive, McMaster technique - negative

**Table 2** Efficacy of fenbendazole against *Ascaridia* spp.

Group	No.	Efficacy (%)							
		1 day after 1 <sup>st</sup> treatment	Days after 2 <sup>nd</sup> treatment						
			1	14	28	42	56	70	84
1 (per os)	1	100	100	100	100	100	100	100	100
	2	90.5	100	100	100	100	98.9	100	98.9
	3	96.2	99.8	100	100	100	100	100	100
	4	100	100	80	40	100	100	100	100
	5	0	60	0	100	100	100	100	100
	6	89.3	99.2	100	100	100	100	100	100
	mean	79.3	93.2	80	90	100	99.8	100	99.8
2 (mixed in feed)	1	0	100	100	100	100	0	0	0
	2	81.8	100	100	100	100	100	100	100
	3	100	100	100	50	100	100	100	100
	4	97.9	99.5	100	100	100	100	100	100
	5	0	68.4	100	100	100	0	0	89.5
	6	89.3	99.2	100	100	100	100	100	100
	mean	55.9	93.6	100	90	100	60	60	77.9

**Figure 1** Efficacy of fenbendazole against *Ascaridia* spp.

meal in the morning and repeatedly on day 10. Birds in group 2 were administrated with fenbendazole powder (Fencare® 4%, Virbac, France) at a dose of 35 mg/kg mixed in feed in the morning and repeatedly on day 10. Fecal samples were collected before treatment, on the first day after the first medication and on days 1, 14, 28, 42, 56, 70 and 84 after the second medication. Fecal samples were processed for qualitative examination by simple flotation method to find ascarid eggs. Subsequently, all fecal samples were processed for quantitative examination by using McMaster technique to count the ascarid eggs. Briefly, 2 or 4 g of feces were diluted 1:15 with saturated salt solution and thoroughly mixed. The fecal suspension was filtered through fine mesh sieve. The filtrate solution was stirred with pasteur pipette and then filled in McMaster counting chamber. The chamber was left to stand for 5 min to allow the eggs to float to the surface. The chamber was counted under light microscope. The number of eggs within the grid was multiply by 50 to calculate the number of eggs per gram (EPG). The efficacy of fenbendazole was determined with percent reduction of the ascarid eggs by using the formula; efficacy % = [EPG (pre-medication) - EPG (post-medication) × 100] / EPG

(pre-medication). Overall efficacy was the average of efficacy after the second medication.

## Results

Seventeen samples of 120 fecal tested samples were positive for *Ascaridia* spp. (14.2%). Thus, seventeen pairs of ascarid infected large macaws were divided in to 3 groups. All birds were clinically normal with normal appetite. In group 1 (per os), EPG decreased after the first medication (Table 1). The efficacy of fenbendazole was 100% on days 42 and 70 after the second medication. The lowest efficacy was 80% on day 14 after the second medication (Table 2). The overall efficacy after the second medication was 94.7 %. In group 2 (mixed in feed), EPG tended to decrease after the first medication and decreased after the second medication (Table 1). The efficacy of fenbendazole was 100% on days 14 and 42 after the second medication. The lowest efficacy was 60% on days 56 and 70 after the second medication (Table 2). The overall efficacy after the second medication was 81.3 %. The efficacy results were summarized in figure 1. No side effect was observed in both treatment groups. Ascarid eggs were found in fecal samples from group 3 (untreated control group) until the end of the study (Table 1).

## Discussion

In this study, two administrations of fenbendazole at the dose of 35 mg/kg per os and also mixed in feed showed good therapeutic efficacy on ascarid infection in large macaws. No adverse side effect was found. The results indicated that fenbendazole could be effectively used to treat ascarid infection in large macaws.

The efficacy of fenbendazole mixed in feed is less than per os. The difference may be due to an improper intake of medicated feed. One bird might consume less than the other in the same cage because of its dominant behavior. In addition, the birds might not finish the whole medicated feed or the feed might spill out. Thus, some birds might receive fenbendazole less than 35 mg/kg and increased dose of fenbendazole mixed in feed would have increased the efficacy. However, fenbendazole can cause toxicity in some bird species even at recommended dose (Weber et al., 2002; Bonar et al., 2003; Gozalo et al., 2006), therefore further studies are required to assess safety use.

The 1 of 6 fecal samples from group 1 collected on day 84 after treatment and 2 of 5 fecal samples from group 2 collected on day 56 after treatment were positive for ascarid eggs. Previous studies have reported that ascarid eggs are resistant to the environment. Thus, cages, perches and nest boxes may remain contaminated (Jansson et al., 2010). In addition, the life cycle of ascarids is direct and the prepatent period of some ascarids in psittacines is only 40 days (Mine and Green, 1983) and reinfection may occur. This finding suggested that birds should be dewormed at intervals. Cleaning and disinfection are also essential for ascarid control. Therefore, further studies should be performed.

In conclusion, this study is the first report of fenbendazole effectiveness against ascarid in large macaws. The study demonstrated that fenbendazole was a good drug for treatment of ascarid infection in large macaws. However, reinfection can occur after treatment. Fenbendazole can be routinely used to control ascarid infection in large macaws.

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## บทคัดย่อ

### ประสิทธิภาพของยา fenbendazole ต่อพยาธิ *Ascaridia* spp. ในนกกมาคอร์ดขนาดใหญ่

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พยาธิไส้เดือน (*Ascaridia* spp.) เป็นพยาธิที่พบได้บ่อยในนกกมาคอร์ดขนาดใหญ่ ยาเฟนเบนดาโซล (fenbendazole) เป็นยาที่นิยมใช้ในการถ่ายพยาธิไส้เดือนในนกกหลายชนิด การศึกษาครั้งนี้ทำการศึกษาประสิทธิภาพของยาเฟนเบนดาโซลต่อพยาธิไส้เดือนในนกกมาคอร์ดขนาดใหญ่ โดยแบ่งนกที่ตรวจพบไข่ของพยาธิไส้เดือนทั้งหมด 17 คู่ เป็น 3 กลุ่ม คือ กลุ่มที่ 1 จำนวน 6 คู่ ป้อนยา ขนาด 35 มก/กก 2 ครั้ง ห่างกัน 10 วัน กลุ่มที่ 2 จำนวน 5 คู่ ผสมยาขนาด 35 มก/กก ในอาหาร 2 ครั้ง ห่างกัน 10 วัน และกลุ่มที่ 3 เป็นกลุ่มควบคุม จำนวน 6 คู่ ทำการนับจำนวนไข่พยาธิในอุจจาระก่อนให้ยา หลังให้ยาครั้งแรก 1 วัน และหลังให้ยาครั้งที่สอง 1 14 28 42 56 70 และ 84 วัน ผลการศึกษาแสดงให้เห็นว่าจำนวนไข่พยาธิลดลงอย่างมากหลังได้รับยาครั้งที่สอง โดยพบว่าค่าเฉลี่ยประสิทธิภาพของยา (overall efficacy) ด้วยวิธีป้องกันมีค่ามากกว่าวิธีผสมยาในอาหารคือ ร้อยละ 94.7 และ 83.1 ตามลำดับ และไม่พบผลข้างเคียงของยา ดังนั้นโปรแกรมการให้ยาและขนาดของยาที่ใช้ในการศึกษานี้ให้ผลดีในการถ่ายพยาธิไส้เดือนในนกกมาคอร์ดขนาดใหญ่

**คำสำคัญ:** พยาธิไส้เดือน ประสิทธิภาพ เฟนเบนดาโซล นกกมาคอร์ด

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