Albendazole: a review of anthelmintic efficacy and safety in humans

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SUMMARY

This comprehensive review briefly describes the history and pharmacology of albendazole as an anthelminthic drug and presents detailed summaries of the efficacy and safety of albendazole's use as an anthelminthic in humans. Cure rates and % egg reduction rates are presented from studies published through March 1998 both for the recommended single dose of 400 mg for hookworm (separately for *Necator americanus* and *Ancylostoma duodenale* when possible), *Ascaris lumbricoides*, *Trichuris trichiura*, and *Enterobius vermicularis* and, in separate tables, for doses other than a single dose of 400 mg. Overall cure rates are also presented separately for studies involving only children 2–15 years. Similar tables are also provided for the recommended dose of 400 mg per day for 3 days in *Strongyloides stercoralis*, *Taenia* spp. and *Hymenolepis nana* infections and separately for other dose regimens. The remarkable safety record involving more than several hundred million patient exposures over a 20 year period is also documented, both with data on adverse experiences occurring in clinical trials and with those in the published literature and/or spontaneously reported to the company. The incidence of side effects reported in the published literature is very low, with only gastrointestinal side effects occurring with an overall frequency of just >1%. Albendazole's unique broad-spectrum activity is exemplified in the overall cure rates calculated from studies employing the recommended doses for hookworm (78% in 68 studies: 92% for *A. duodenale* in 23 studies and 75% for *N. americanus* in 30 studies), *A. lumbricoides* (95% in 64 studies), *T. trichiura* (48% in 57 studies), *E. vermicularis* (98% in 27 studies), *S. stercoralis* (62% in 19 studies), *H. nana* (68% in 11 studies), and *Taenia* spp. (85% in 7 studies). The facts that albendazole is safe and easy to administer, both in treatment of individuals and in treatment of whole communities where it has been given by paramedical and nonmedical personnel, have enabled its use to improve general community health, including the improved nutrition and development of children.

Key words: Albendazole, anthelmintic efficacy in humans, anthelmintics in children, anthelmintic safety, *Ancylostoma duodenale*, *Necator americanus*, *Ascaris lumbricoides*, *Trichuris trichiura*, *Strongyloides stercoralis*, *Enterobius vermicularis*, *Taenia saginata*, *Taenia solium*, *Hymenolepis nana*.

INTRODUCTION

Benzimidazoles were originally developed as plant fungicides and later as veterinary anthelminthics. The first benzimidazole to be developed and licensed for human use was thiabendazole in 1962. Since then 4 other benzimidazoles (mebendazole, flubendazole, albendazole, triclabendazole) have been licensed for human use in various parts of the world. All are benzimidazole carbamates and show a broad spectrum of activity against helminth parasites. This paper reviews the activity of albendazole against the common intestinal helminth parasites of humans.

GENERAL SPECTRUM OF ACTIVITY

Albendazole has been shown to have activity either *in vitro* or *in vivo* in animal models and in humans principally against helminth species. Although the detailed mechanisms of action are unclear, experimental evidence from exposure of intestinal helminths of several different species to albendazole shows that the parasites suffer from metabolic disruption at a number of different sites, most of which are involved in energy production in the parasite (Lacey, 1988). This is in contrast to non-benzimidazole anthelminthics which act on the parasite neuromuscular pathways and paralyse them. For benzimidazoles, it is believed that the final common pathway of metabolic disruption is inhibition of beta tubulin polymerase causing disruption of cytoplasmic microtubule formation (Lacey, 1988). Experimental evidence is available to show that albendazole not only kills the adult stages of gut-dwelling helminths, but it also kills or sterilises eggs (Maisonneuve *et al*. 1985) and larvae (Cline *et al*. 1984).

HELMINTHS

In general, although animals may be intermediate hosts for human parasites, cross species infections with adult helminths are rare. Even species considered to be virtually identical (conspecific) in the past, such as *Ascaris lumbricoides* of humans and *A. suum* of pigs, have recently been shown to be distinct, without cross infection under natural conditions. Therefore studies of drug efficacy in animal models of infection with human species of helminth cannot be assumed to predict precisely the efficacy that will be found in humans, although they may provide

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valuable preliminary information about mode of action, efficacy, and safety (see Boes & Helwigh, this volume). It is also impossible to effectively maintain adult helminths *in vitro* to test the efficacy of drugs. Thus efficacy data for anthelminthics against the helminth species of humans are available only from studies in humans.

Albendazole had been shown to be effective against a wide range of helminth species in domestic animals and subsequently, during its development for human use, it was shown to be active against the major intestinal nematodes and three cestode species infecting humans. Its relative failure to be effective in most trematode infections such as *Fasciola hepatica* is ascribed to the differing kinetics of albendazole and the active metabolite albendazole sulphoxide in humans compared to ruminant species such as the sheep (the plasma half life in ruminants is some 5 to 10 fold longer than in humans).

An extensive search using commercial publication databases and citations within individual studies has identified, as far as possible, all clinical studies and case reports published up to March 1998 that referred to the clinical use of albendazole in the treatment of intestinal helminthiasis in humans. From the published papers, data on efficacy have been extracted and tabulated in detail. In all cases, the cure rate (proportion of subjects treated in whom disappearance of ova and/or parasites was observed after treatment) has been tabulated. Where the egg reduction rate (the reduction in egg count in a measured quantity of faeces following treatment in those not cured) was available, this has also been recorded. These methods of recording the efficacy of drugs against intestinal helminth infections are now considered to be standard by the World Health Organisation (WHO, 1999). Although the actual methods may vary to some extent between studies, particularly with regard to sensitivity, it is generally considered that the results from a sufficient number of studies will provide a fairly accurate measure of efficacy. Certain tests (for example the Kato-Katz semiquantitative test) have been established as the standard for sentinel studies of drug resistance (WHO, 1999).

Separate analyses have been made for the following helminth species: *Ancylostoma duodenale* (hookworm), *Necator americanus* (hookworm), *Trichuris trichiura* (whipworm), *Ascaris lumbricoides* (large roundworm), *Enterobius vermicularis* (pinworm), *Strongyloides stercoralis* (threadworm), *Hymenolepis nana* (dwarf tapeworm), *Taenia saginata* and *T. solium* (beef tapeworm and pork tapeworm). Since, in the course of drug development, different regimens have been investigated, analyses have examined the currently recommended dose regimen separately from other regimens used. The details of individual study results are included in the appendix tables.

In general all studies report using standard methodology (essentially standard WHO protocols). Following identification (and, if appropriate, quantitation) of the infecting helminth species using direct microscopy of stools together with concentration or staining techniques, patients were treated with albendazole. In a limited number of cases, the studies were comparative against other anthelminthics. For nematode species follow up was at 7 days and normally at either 14 or 21 days post-treatment. For tapeworms follow up 2 or 3 months post-treatment was also performed. If quantitation methods were used initially, positive samples in follow up were also quantitated, usually using the Kato-Katz method, although a few studies used other methods. Specifically for *E. vermicularis* the Scotch Tape (Graham's) test was used, while for *Strongyloides stercoralis* Baermann's concentration method was used. Data are presented for cure rates (those with a positive test [for ova] pre-treatment and no ova present at one or more tests post-treatment), and where quantitative data are supplied, as the Egg Reduction Rate (ERR – usually calculated as the reduction in egg count per gram of faeces (epg) post-treatment in those who still have eggs present). Within a study, the ERR is normally presented as the percent reduction in the geometric means pre and post-treatment [((initial epg − final epg) ÷ initial epg) × 100 %].

RESULTS

Hookworm (*Appendix Tables 1 and 2*)

Sixty-eight studies report treatment results for the two hookworm species in 6272 subjects using a single dose of 400 mg albendazole. Overall a mean cure rate of 77·7 % and an egg reduction rate of 87·8 % were found. Separation of the two species (where the information was provided) showed that efficacy in *Ancylostoma duodenale* infections (cure rate 538/586; 91·8 %) was better than for *Necator americanus* (cure rate 2606/3547; 75·0 %). This differential efficacy has been reported with other anthelminthic agents.

Twenty of the above studies report solely on 1699 children between 2 and 15 years of age, 1152 of whom were cured (67·8 %). Further examination of this lower efficacy in children shows that while efficacy is similar for *A. duodenale* infections (Adults: 91·7 %, 455/496; Children: 90·8 %, 69/76), there is an age differential with *N. americanus* infections, the cure rate being 80·9 % (1604/1983) in adults compared to only 67·0 % (1022/1525) in children. Two studies in children under 2 years of age are reported. Both used a single 200 mg dose of albendazole; the overall cure rate was 84·1 % (53/63). Hookworm (*N. americanus*) infection in such young children is uncommon and low intensities of infection are usually encountered. While complete cure was not

necessarily achieved, substantial reduction in egg count was observed. In older children and adults efficacy is much lower with a 200 mg dose.

In Table 2 data for doses other than that currently recommended are recorded. The data show that in general an increase in duration in dosing from 1 day to 3 days provides some increase in efficacy, particularly for *N. americanus* infections while increase in number of doses or total dose on one day has a less pronounced effect.

Trichuris trichiura (*Appendix Tables 3 and 4*)

Fifty-seven studies involving 4301 patients given a single 400 mg dose of albendazole for *Trichuris trichiura* infection are reported in Appendix Table 3. Twenty-one of these, with 1930 patients, involved only children. Overall 2050 patients (47·7 %) were cured at follow up, normally at 14 or 21 days or greater. The overall egg reduction rate in those not cured was 75·4 %. Of the children, 539/1930 (27·9 %) were cured by a single dose as compared with 1477/2371 (62·3 %) of adults. Table 4 lists the studies using doses other than the recommended dose regimen. There is some evidence that higher doses, and particularly longer dosing regimens produce increased efficacy. However, these benefits are not as pronounced as in some other infections, and intensity of infections is probably a more important determinant of efficacy than is dose regimen. The disparity between adults and children in efficacy is produced in this manner since the most intense and problematic infections are seen in the 5–15 year cohort.

Ascaris lumbricoides (*Appendix Tables 5 and 6*)

Sixty-four studies are reported which include 5127 patients who received a single 400 mg dose of albendazole for *Ascaris lumbricoides* infection (Table 5). There are 17 studies with 2118 children between 2 and 15 years included. Cures at 14 to 21 days or more were recorded in 4848 patients (94·6 %) with an egg reduction rate of 98·6 % in those not cured. In the paediatric group 2024 (95·6 %) were cured. With regimens other than 400 mg single dose, the effect of rising dose or longer duration of treatment is not pronounced because of the high degree of efficacy at the recommended dose, and the very high egg reduction rate. In children, particularly those under 2 years of age (Pamba *et al*. 1987), a single dose of 200 mg on one day produces good efficacy.

Enterobius vermicularis (*Appendix Tables 7 and 8*)

Twenty-seven studies record data on the treatment of *Enterobius vermicularis* in 903 patients. This infection is most commonly encountered in young children; adults are rarely affected and are thus less commonly investigated. Furthermore, standard coprological tests do not diagnose *E. vermicularis* effectively other than in massive infections, and the 'Scotch' tape test is used to examine the perianal skin for eggs and adult worms instead. Hence the number of studies and patients is somewhat limited despite the widespread and endemic nature of this infection. Cure was achieved in 883 patients (97·8 %) with a single 400 mg dose of albendazole.

Strongyloides stercoralis (*Appendix Tables 9 and 10*)

The recommended dose for *Strongyloides stercoralis* infection is 400 mg daily for 3 days. Nineteen studies, including 479 patients are reported at this dose; cures were seen in 298 (62·2 %) at 14–21 days post-treatment. Egg reduction rates are not normally recorded as diagnosis is dependent on the detection of larvae by a concentration method (Baermann's method) which is not necessarily quantitative. A number of other regimens have been tested, mostly with multiple day dosing. Although a single 400 mg dose appears effective (69·3 % cure), follow up in several of these studies was short and methods were generally not appropriate for the evaluation of strongyloidiasis.

Hymenolepis nana (*Appendix Tables 11 and 12*)

Hymenolepis nana is principally an infection of young children which is normally treated with anticestode drugs such as praziquantel. Unlike *Taenia* spp. infections, eggs rather than proglottids are detected in stools and disappear more rapidly after treatment, and therefore a prolonged follow up is less necessary. In all, 277 cases in 11 studies are reported, of whom 190 (69·5 %) were apparently cured by albendazole 400 mg daily for 3 days. Two studies report substantial egg reductions in those not cured. It is unclear from the reported studies whether complete cure was achieved as follow up was short. Shorter courses, particularly 400 mg single dose, do not appear to produce a significant cure rate.

Taenia saginata *and* T. solium (*Appendix Tables 13 and 14*)

Treatment with albendazole 400 mg for 3 days is reported from 7 studies with 131 patients, 111 (84·7 %) of whom were cured. However, only 3 studies report durations of follow up which are adequate (i.e. 2–3 months) to permit the demonstration of proglottids rather than eggs in the stools of patients not cured by the treatment. In these studies (Misra *et al*. 1985; Jagota, 1986; De Kaminsky, 1988) 91/109 (83·5 %) were cured. With single 400 mg doses a lower cure rate (64·8 %) was achieved overall. In the 3 studies with extended follow up, the cure rate was 68·2 %. In the single study using an 800 mg single dose, cure was achieved in 86·5 % but follow up was only for 1 month.

Table 1. Cure rates (CR) and egg reduction rates (ERR) in common intestinal helminthiases found in humans with recommended doses of albendazole: summary of studies published through March 1998

	Efficacy				
Species	No. of studies	Cure rate	CR (%)	CR range (%)	ERR (%)
Hookworm	68	4871/6272	77·7	100–33·3	87·8
Ancylostoma duodenale	23	538/586	91·8	100–75·0	—
Necator americanus	30	2606/3547	75·0	100–36·6	—
Trichuris trichiura	57	2050/4301	47·7	100–4·9*	75·4
Ascaris lumbricoides	64	4848/5127	94·6	100–66·9*	98·6
Enterobius vermicularis	27	883/903	97·8	100–40·0*	NA
Strongyloides stercoralis	19	298/479	62·2	100–16·7*	NA
Hymenolepis nana	11	190/377	68·5	100*–28·5*	NA
Taenia spp.	7	111/131	84·7	100*–75·7	NA

NA = not applicable.
* Small sample numbers.

Table 2. Adverse experiences occurring clinical trials of low dose albendazole treatment: the published literature through March 1998

	Current database (n = 22810)	
Adverse experience	Number of cases	Frequency (%)
Epigastric pain	88	0·386
Diarrhoea	80	0·351
Headache	78	0·342
Nausea	53	0·232
Abdominal pain	35	0·153
Dizziness	35	0·153
Vomiting	24	0·105
Lethargy	13	0·057
Constipation	13	0·057
Leucopenia	10	0·044
Pruritus	10	0·044
Fever	9	0·039
Cough	8	0·035
Raised liver enzymes	8	0·035
Rash	6	0·026
Anorexia	6	0·026
Urticaria	3	0·013
Allergic symptoms	3	0·013
Haematuria	2	0·009
Dry mouth	2	0·009
Proteinuria	2	0·009
Low red cell count	2	0·009
Insomnia	1	0·004
Anemia	1	0·004
Raised blood urea	1	0·004
Bone pain	1	0·004
Digestive trouble	1	0·004

Comparison studies – albendazole and mebendazole (*Appendix Table 15*)

Fourteen studies have been performed comparing albendazole and mebendazole. Albendazole was used in 12 of these studies at the recommended 400 mg single dose compared with mebendazole using either a single 500 mg dose or 200 mg daily for 3 days. Overall albendazole appears more effective for *A. lumbricoides* and hookworm, but the 3 day dosing with mebendazole is probably more effective for curing *T. trichiura* infections in individuals. The efficacy of albendazole was substantially better against *N. americanus* infections as suggested by Holzer & Frey (1987). Few studies have compared albendazole with pyrantel pamoate but two recent studies (Reynoldson *et al.* 1997; Sacko *et al.* 1999) are worthy of note as both, comparing albendazole at the standard dose versus pyrantel standard dose, show substantially better efficacy of albendazole against both species of hookworm. In both, the reason is considered to be pyrantel resistance due to excessive community use. The study of Beach *et al.* (1999) suggests that higher efficacy against *T. trichiura* is achieved using a combination of albendazole and ivermectin.

Effect of infection intensity on efficacy (*Appendix Table 16*)

Initial intensity of infection does not appear to affect albendazole's efficacy against *A. lumbricoides* or *A. duodenale*. In *N. americanus* infections there is some evidence that heavier infections are less likely to be cured. The effect of infection intensity is most pronounced in *T. trichiura* infection where a substantial reduction in cure rate is seen in the heavier infections, although egg reduction rates remain high.

Summary of efficacy results

The accumulated evidence in the published literature world-wide shows that albendazole is an effective anthelminthic in humans. The data from studies conducted using the currently recommended doses are summarised below in Table 1. To provide a measure of the range of results within the

Table 3. Adverse events with albendazole use: summary of the published literature and spontaneous reporting through March 1998

	Adverse events									
	Intestinal helminths		Hydatid		Cysticercosis		Spontaneous reporting	Fatalities		
Patient numbers (%)	22810	(%)	3282	(%)	899	(%)		121	(%)	
Body as a whole										
Body as a whole	31	0·14	54	1·65	14	1·56	45	40	33·06	
Metabolic					2	0·22	5	4	3·31	
Neoplasia							3	6	4·96	
Resistance mechanism			4	0·12			27	42	34·71	
Cardiovascular										
CV General							7	1	0·83	
Heart rate/rhythm			1	0·03			2	1	0·83	
Myocardium/valves							1			
Vascular							3			
Nervous system										
Central and peripheral NS	114	0·50	57	1·74	180	20·02	30	4	3·31	
Psychiatric					5	0·56	11	1	0·83	
Special senses										
Hearing							1			
Vision					5	0·56	4			
Other							1			
Gastrointestinal										
Gastrointestinal	294	1·29	220	6·70	72	8·01	39	4	3·31	
Liver/biliary	8	0·04	355	10·82	3	0·33	32	1	0·83	
Musculoskeletal	1	0·00	2	0·06			4			
Blood elements										
Platelets/clotting			4	0·12			5			
Red blood cells	3	0·01	8	0·24			6			
White cells/RES	10	0·04	31	0·94			15	1	0·83	
Respiratory	8	0·04	8	0·24			5	13	10·74	
Skin and appendages	19	0·08	68	2·07	9	1·00	38			
Urinary	5	0·02	1	0·03			5	2	1·65	
Female reproductive							9			
Uncodable	2	0·01	4	0·12	6	0·67		1	0·83	

populations studied, the upper and lower cure rates are given. For most parasites there is a pronounced 'skew' in the data produced by small studies and to some extent by the highly overdispersed nature of parasite intensity in some populations.

SAFETY

The incidence of side effects reported in the published literature on the use of albendazole for intestinal helminthiasis is very low, with only gastrointestinal side effects (all types of symptoms pooled) occurring with an overall frequency of just greater than 1%. The types of events observed in clinical trials are shown in Table 2. These symptoms are also commonly encountered in the communities where helminthiasis occurs; thus it is difficult to distinguish drug effects from the background symptomatology normally present. Only one study of appreciable size has examined the frequency of side effects compared to placebo; no significant differences were observed between albendazole and placebo in over 700 patients (Olds *et al*. 1999).

DISCUSSION

The evidence from published material indicates that albendazole is highly effective for the treatment of the common species of intestinal helminths seen in humans. It is effective in a single dose against *A. lumbricoides* and *E. vermicularis*, as are other anthelmintics, but it is also active against both species of hookworm, in contrast to mebendazole which is principally active only against one of the two species of human hookworm, *A. duodenale*. There is, however, some evidence to suggest that very heavy infections with *N. americanus* may require more than one dose to achieve complete cure. At low intensities of infection with *T. trichiura*, a single dose of albendazole is generally effective. However since this nematode infects the lower bowel and is relatively

resistant to all anthelminthics, dosing over 3 days may be required to cure heavier infections. Egg reduction rates even in heavy *Trichuris* infections are good (60–90 %) indicating that the majority of adult worms have been eliminated.

Three species have been shown to require multiple day dosing for their elimination (*Strongyloides stercoralis*, *Hymenolepis nana* and *Taenia* spp.) Efficacy in *S. stercoralis* infections is comparable to that reported for thiabendazole, the most commonly used treatment for the infection but known to be associated with significant side effects. Against cestodes albendazole has moderate activity, although most studies have not followed patients for long enough to ensure total cure. In cases of pure *Taenia* spp. infection, specific anticestode drugs such as praziquantel are preferred. However, where other helminth species co-exist, elimination of all may be achieved with 3 days dosing with albendazole.

Experience with albendazole in human use extends over almost 20 years, and it is remarkable how few adverse events have been reported (Table 3). Even under the more rigorous conditions of clinical trials, the frequency of side effects has been low and difficult to distinguish from either the background 'noise' in the population or from the symptoms of the infections themselves. Indeed, the number of patients involved is now sufficiently great to be expected to identify even rare events. At the doses used for the treatment of intestinal helminths, all reported events appear to be mild and self-limiting, and none has been serious or life-threatening. The same is true of spontaneous reports of side effects reported to SmithKline Beecham; there are very few reports of problems associated with low dose albendazole treatment of intestinal helminthiasis given the huge number of patients treated over the past 20 years. Most reports have resulted from the migration of *A. lumbricoides* (a rare event in the context of the numbers treated, and one that occurs during therapy with other anthelmintics), or from isolated cases of drug sensitivity (rashes and urticaria). It appears that most problems are associated with higher dose treatment for systemic infections where problems of drug–parasite interactions cause very specific syndromes such as abnormal liver function in echinococcosis (Gil-Grande *et al*. 1993; Teggi *et al*. 1995), or central nervous system symptoms in neurocysticercosis (Table 3). Fatalities have almost entirely been associated with long-term, high dose treatment in AIDS related infections, and have been due to the underlying disease rather than drug toxicity.

Over 20 years and several hundred million patient exposures, albendazole has been shown to be effective both for the treatment of individuals and, more recently, for the treatment of whole communities, where it has been given by paramedical and non-medical personnel. The latter development has only occurred because albendazole is recognized as both safe and easy to administer within the community. The benefits of this approach to treatment in terms of community health gains, along with improved nutrition and development in children, are now well accepted (Ottesen, Ismail & Horton, 1999; see also other papers in this volume).

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Appendix Table 1. Hookworm infection: cure rates (CR) and % egg reduction rates (ERR) with a single dose of 400 mg albendazole. Published studies through March 1999

Reference	Efficacy			
	Species	Cure rate	CR (%)	ERR (%)*
Albonico *et al*. 1994†	*N.a.*	595/1048	56·8	97·9
Ahmad *et al*. 1986†	*A.d.*	12/12	100	—
Ahmed *et al*. 1983	*A.d.*	1/1	100	—
Ai-Issa *et al*. 1985	*A.d.*	21/22	95·5	nd
Amato Neto *et al*. 1983	*N.a.*	16/29	55·2	nd
Barbieri *et al*. 1993†	NS	3/4	75·0	nd
Bartoloni *et al*. 1993†	NS	27/33	81·8	92·8
Bassily *et al*. 1984	*A.d.*	30/35	85·7	79·0
Bastidas, 1982†	NS	15/45	33·3	29·6
Beach *et al*. 1999	*N.a.*	12/12	100	100
Borderioux & Chevalier, 1982	NS	9/10	90·0	nd
Botey, 1988	*A.d.*	37/39	94·9	nd
Botey, 1988	*N.a.*	131/161	81·4	nd
Bunnag *et al*. 1984	NS	14/22	63·6	92·5
Bwibo & Pamba, 1984†	*N.a.*	30/34	88·2	93·3
Camillo-Coura *et al*. 1981	*N.a.*	4/5	80·0	nd
Chandiwana *et al*. 1983	NS	49/70	70·0	74·8
Carneiro da Cunha *et al*. 1993†	*A.d.*	6/8	75·0	nd
Chien *et al*. 1989†	*N.a.*	34/41	82·9	64·2
Chitchang *et al*. 1983	*N.a.*	42/119	36·3	93·2
Cline *et al*. 1984	*N.a.*	11/21	52·4	77·0
Cortes *et al*. 1982†	*A.d.*	2/2	100	—
Coulaud & Rossignol, 1984	*N.a.*	669/743	90·0	98·0
Farid *et al*. 1984	*A.d.*	30/35	85·7	nd
Gazder & Roy, 1987†	*A.d.*	1/1	100	—
Homeida & Musa, 1984	*A.d.*	6/7	85·7	nd
Ismail *et al*. 1991	*N.a.*	7/7	100	—
Jaogota, 1986	*A.d.*	130/141	92·2	85–95
Jongsuksuntikul *et al*. 1993	NS	43/51	84·3	96
Kleiner, 1990	*A.d.*	3/4	75·0	nd
Kleiner, 1990	*N.a.*	14/16	87·5	nd
Maisonneuve *et al*. 1984	*A.d.*	19/21	90·5	93·7
Maisonneuve *et al*. 1985	*N.a.*	4/4	100	—
Maisonneuve *et al*. 1985	*A.d.*	4/4	100	—
Mbendi *et al*. 1985	*A.d.*	75/81	92·6	nd
Misra *et al*. 1985†	*A.d.*	14/14	100	—
Morgan *et al*. 1983†	*N.a.*	23/27	85·2	95·0
Nahmias *et al*. 1989	*N.a.*	64/77	84·4	81·8
Norhayati *et al*. 1995†	*N.a.*	36/39	92·0	nd
Norhayati *et al*. 1997†	*N.a.*	27/29	93·7	96·6
Ochoa *et al*. 1989†	*N.a.*	47/47	100	—
Okelo, 1984	*N.a.*	10/14	71·4	nd
Olveda *et al*. 1983	NS	99/118	83·9	85·0
Ortega, 1982†	*N.a.*	9/11	81·8	nd
Ovedoff, 1984	NS	120/141	85·1	98·5
Ovedoff, 1984	NS	14/15	93·3	nd
Oyediran & Oyejide, 1982	*N.a.*	14/26	53·8	82·8
Phuvanandh *et al*. 1994	*N.a.*	113/138	81·8	nd
Prasad *et al*. 1985†	*A.d.*	34/39	87·2	90–95
Pugh *et al*. 1986†	*N.a.*	60/68	88·2	97·3
Raccurt *et al*. 1990*a*	*N.a.*	139/168	82·7	nd
Raccurt *et al*. 1990*b*	*N.a.*	102/121	84·3	84·1
Rahman, 1996†	*N.a.*	86/96	89·1	—
Ramalingam *et al*. 1983	NS	22/32	68·8	94·5
Reynoldson *et al*. 1997	*A.d.*	14/14	100	—
Rossignol & Maisonneuve, 1983	*A.d.*	42/26	91·3	92·6
Rossignol & Maisonneuve, 1983	*N.a.*	151/200	75·5	91·9
Sacko *et al*. 1999	*N.a.*	31/37	83·8	97·7
Saif, 1984	*A.d.*	24/24	100	—
Salazar Schettino & de Haro Ortega, 1981†	*N.a.*	1/1	100	—
Sinniah *et al*. 1990†	NS	16/16	100	—
Sitthicharconchai *et al*. 1984	NS	40/43	93·0	96·5
Stephenson *et al*. 1990†	*N.a.*	60/74	81·1	67·0
Udonsi, 1985	NS	1203/1413	85·1	nd
Upatham *et al*. 1989	NS	119/260	45·8	90·5
Urquiaga & Pavia, 1982	*A.d.*	0/1	0	nd
Viravan *et al*. 1982	NS	14/22	63·6	92·8
Zawde, 1987	*A.d.*	12/13	92·3	nd
Total cured/total treated, both species		4871/6272	77·7	
Total cured/total treated, *Ancylostoma duodenale*		538/586	91·8	
Total cured/total treated, *Necator americanus*		2606/3547	75·0	

* Egg reduction rate (in patients not cured). † Study involving children 2–15 years only.
‡ Children <2 years. *N.a.* = *Necator americanus*; *A.d.* = *Ancylostoma duodenale*.
NS = hookworm species not stated. nd = not done.

Appendix Table 2. Hookworm infection: cure rates (CR) and % egg reduction rates (ERR) with doses of albendazole other than a single dose of 400 mg. Published studies through March 1998

Dose	Efficacy				
	Species of hookworm	Cure rate	% Cured	ERR* (%)	Duration of follow-up (days)**
200 mg/day, 1 day		189/270	70·0	88·7	
200 mg/day, 2 days		2/2	100		14
200 mg/day, 3 days	*A.d.*	31/32	96·9	94·9	NS
200 mg/bd × 1 day		117/123	95·1		
400 mg/day × 3 days		183/185	98·9		
400 mg/day × 5 days	*N.a.*	135/136	98·6	99·9	14
400 mg bd × 1 day		31/32	96·9		17
400 mg bd × 3 days	*N.a.*	11/11	100		30
400 mg bd × 7 days	*N.a.*	15/15	100		30
400 mg tds × 1 day		12/12	100		
600 mg × 1 day		88/121	72·7		
800 mg × 1 day		56/76	73·7		
800 mg/day × 3 days	*N.a.*	11/11	100		180–270
2 mg/kg bd, day 1 and day 14	*N.a.*	6/7	85·7		NS
4 mg/kg/day, day 1 and day 14	*N.a.*	9/11	81·8		NS
10 mg/kg × 1 day		34/46	73·9		

* Egg reduction rate (in persons not cured).
** 21 days unless otherwise stated.
N.a. = *Necator americanus*; *A.d.* = *Ancylostoma duodenale*.
NS = Not stated.
References for studies tallied available from author.

Appendix Table 3. *T. trichiura*: cure rates (CR) and % egg reduction rates (ERR) with a single dose of 400 mg albendazole. Published studies through March 1998

Reference	Efficacy			
	Cure rate	CR (%)	ERR* (%)	Duration of follow-up (days)**
Ahmad *et al.* 1986†	1/1	100		
Ai Issa *et al.* 1985	2/2	100		14
Albonico *et al.* 1994†	120/1138	10·5	73·3	
Amato Neto *et al.* 1983	15/39	38·5		
Barbieri *et al.* 1993‡	8/19	42·1		
Bartoloni *et al.* 1993†	5/15	33·0	45·7	
Bastidas, 1982†	10/16	62·5	56·4	***
Beach *et al.* 1999	49/93	52·7	42·7	42
Biagi 1988	17/18	94·5		NS
Borderioux & Chevalier, 1982	11/59	18·6		
Botey, 1988	96/145	66·2		NS
Bundy *et al.* 1985†	7/9	77·8		30
Bwibo & Pamba, 1984	26/31	83·9	89·7	35
Camillo-Coura *et al.* 1981	8/14	51·1		
Camillo-Coura *et al.* 1984†	37/41	90·2		
Campos *et al.* 1983	18/30	60·0		
Carneiro da Cunha *et al.* 1993†	25/28	89·2		
Chandiwana *et al.* 1983	5/9	55·6	39·3	
Chen *et al.* 1984†	15/63	23·8	59·5	60
Chien *et al.* 1989†	2/41	4·9	52·3	28
Coulaud & Rossignol, 1984	301/430	70·0	99·0	17
Cruz, 1983†	9/26	34·6	80·6	20
Gazder & Roy, 1987†	11/12	91·7		
Hanjeet & Mathias, 1991	21/48	44		
Homeida & Musa, 1984	3/4	75·0		14
Ioli *et al.* 1987	6/6	100		
Ismail *et al.* 1991	27/85	31·8	87·2	
Jagota, 1986	57/63	90·5	87·5	
Jongsuksuntigul *et al.* 1993	14/43	67·4	87·0	

Appendix Table 3. (*cont.*)

Reference	Efficacy			
	Cure rate	CR (%)	ERR* (%)	Duration of follow-up (days)**
Kan, 1983†	11/33	33·3	87·8	28
Kleiner, 1990	10/14	71·4		
Maisonneuve *et al*. 1984	17/28	60·7	81·0	
Maisonneuve *et al*. 1985	10/10	100		90
Mbendi *et al*. 1985	283/291	97·3		7
Misra *et al*. 1985†	10/12	83·3	82·6	
Norhayati *et al*. 1997	6/110	5·5	49·1	28
Ochoa *et al*. 1989†	119/141	84·4	86·0	
Okelo, 1984	3/3	100		17
Ortega, 1982	97/220	44·1	82·0	
Olveda *et al*. 1983	26/31	83·9		
Ovedoff, 1984	68/119	57·1	80·7	
Ovedoff, 1984	20/29	68·9		
Oyediran & Oyejide, 1983†	11/29	37·9	69·3	
Phuvanandh *et al*. 1994	48/111	43·2		
Prasad *et al*. 1985†	2/2	100		14
Raccurt *et al*. 1990*b*	8/17	47·1	89·1	
Rahman, 1996†	80/96	83·4		
Ramalingam *et al*. 1983	6/22	27·3	39·2	
Rim *et al*. 1984	23/45	51·1	76·5	
Rossignol & Maisonneuve, 1983	113/192	58·9	85·9	
Saif, 1984	9/9	100		
Salazar Schettino & de Haro Ortega, 1981	2/4	50·0		
Sinniah *et al*. 1990	22/52	42·3	71·2	
Stephenson *et al*. 1990†	5/76	6·6	28·0	180
Upatham *et al*. 1989	12/19	63·2	59·4	30
Urquiaga & Pavia, 1982	12/19	63·2		
Vazquez *et al*. 1988†	19/22	86·4		16
Zawde, 1987	12/17	70·6		9–16
Total cured/total treated	2050/4301	47·7	75·4	

* Egg reduction rate (in persons not cured).
** 21 days unless other wise stated.
† Study involving children only (2–15 years).
‡ Children <2 years.

Appendix Table 4. The efficacy of doses of albendazole other than a single dose of 400 mg in *Trichuris trichiura* infection. Published studies through March 1998

Dose	Efficacy			
	Cure rate	(%)	ERR* (%)	Duration of follow-up (days)**
25 mg, day 1 and day 8	2/5	40·0		56
50 mg, day 1 and day 8	7/7	100		56
100 mg, day 1 and day 8	20/20	100		56
200 mg stat	48/191	25·1	75·3	
200 mg bd	102/316	32·3		
600 mg stat	141/276	51·1	84·6	
800 mg stat	85/116	73·3		
400 mg bd	20/37	54·1		17
400 mg/day, 2 days	113/115	98·2		
400 mg/day, 3 days	182/230	79·1		
400 mg/day, 5 days	81/91	89·0		14
400 mg tds	23/23	100		
800 mg/day, 3 days	3/3	100		180–270
10 mg/kg stat	30/48	62·5		

* Egg reduction rate [in patients not cured].
** 21 days unless otherwise specified.
References to studies tallied available from author.
stat = single dose, bd = two doses, tds = three doses.

Appendix Table 5. *Ascaris lumbricoides*: cure rates (CR) and % egg reduction rates (ERR) with a single dose of 400 mg albendazole. Published studies through March 1998

Reference	Efficacy			
	Cure rate	CR (%)	ERR (%)*	Duration of follow-up (days)**
Ahmad *et al*. 1986†	33/37	89·3		
Ai Issa *et al*. 1985	23/23	100		14
Albonico *et al*. 1994†	809/818	98·9	99·6	
Amato Neto *et al*. 1983	31/34	91·2		
Barbieri *et al*. 1993‡	42/46	95·0		
Bartoloni *et al*. 1993†	5/5	100	100	
Bassily *et al*. 1984	13/14	92·9	95·0	NS
Bastidas, 1982†	46/49	93·8	92·6	
Beach *et al*. 1999	61/62	98·4	NA	
Biagi, 1988	25/26	96·2		NS
Borderioux & Chevalier, 1982	42/44	95·0		
Botey, 1988	133/142	93·7	99·0	NS
Bwibo & Pamba, 1984†	36/40	90·0	93·2	35
Camillo-Coura *et al*. 1981	9/10	90·0		
Camillo-Coura *et al*. 1984†	16/18	88·9		
Campos *et al*. 1983	27/30	90·0		
Carneiro da Cunha *et al*. 1993†	95/90	95·0		
Chan *et al*. 1992*a*, *b*	86/86	100	100	
Chandiwana *et al*. 1983	33/34	97·1	25·0	
Chen *et al*. 1984†	46/46	100		60
Chien *et al*. 1989†	37/41	90·2	86·5	28
Cortes *et al*. 1982	26/27	96·3	92·0	
Coulaud & Rossignol, 1984	462/502	92·0	99·0	17
Cruz, 1983	23/26	88·5	99·8	20
Flores *et al*. 1990	57/60	95·0		
Farid *et al*. 1984	13/14	92·9		35
Gazder & Roy, 1987	41/43	95·3		
Hall & Nahar, 1994†	132/143	92·0		
Hanjeet & Mathias, 1991	35/36	97·0		
Homeida & Musa, 1984	3/3	100		14
Ioli *et al*. 1987	32/35	91·4		
Ismail *et al*. 1991	65/68	95·6	99·7	
Jagota, 1986	246/256	95·3	91·5	
Jongsuksuntigul *et al*. 1993	13/13	100	100	
Kleiner, 1990	50/53	94·3		
Maisonneuve *et al*. 1981	1/1	100		NS
Maisonneuve *et al*. 1984	132/147	89·8	96·0	
Maisonneuve *et al*. 1985	9/10	90·0	97·4	90
Mbendi *et al*. 1985	305/312	97·8		7
Misra *et al*. 1985†	54/56	96·4	97·9	
Norhayati *et al*. 1997	75/77	97·4	99·9	
Ochoa *et al*. 1989†	240/240	100		
Okelo, 1984	18/21	85·7		17
Olveda *et al*. 1983	237/263	90·1	99·0	
Ortega, 1982†	19/19	100		
Ovedoff, 1984	92/96	95·8	98·2	
Ovedoff, 1984	16/16	100		
Oyediran & Oyejide, 1982†	24/28	85·2	99·6	14
Phuvanandh *et al*. 1994	17/20	85·0		
Prasad *et al*. 1985†	68/74	91·9	87·5	14
Raccurt *et al*. 1990*b*	5/5	100		
Rahman, 1996	84/96	87·6		
Ramalingam *et al*. 1983	6/6	100		
Rim *et al*. 1984	32/35	91·4	98·5	30
Rossignol & Maisonneuve, 1983	185/198	93·4	99·3	
Saif, 1984	74/82	90·2		
Salazar Schettino & de Haro Ortega, 1981†	8/8	100		
Sinniah *et al*. 1990†	51/56	91·1	99	
Stephenson *et al*. 1990†	24/34	70·6	91·0	180
Tokmalaev *et al*. 1994	NS	100		
Upatham *et al*. 1989	74/78	94·9	99·3	30
Urquiaga & Pavia, 1982	12/18	66·7		
Vazquez *et al*. 1988†	75/81	92·6		16
Wang *et al*. 1987	39/41	95·1		10
Zawde, 1987	34/35	97·1		9–16
Total cured/total treated	4848/5127	94·6	98·6	

* Egg reduction rate, generally in patients not cured. ** 21 days unless otherwise stated.
† Study involving children 2–15 years only. ‡ Children <2 years.
NS = not stated. NA = not applicable.

Appendix Table 6. The efficacy of albendazole at doses other than 400 mg single dose in *A. lumbricoides* infections. Published studies through March 1998

Efficacy				
Dose	Cure rate	(%)	ERR (%)*	Duration of follow-up (days)**
200 mg stat	175/197	88·8	—	
200 mg bd	204/218	93·6	—	
200 mg/day, 3 days	12/12	100	—	NS
400 mg/day, 3 days	227/252	90·1	—	
400 mg/day, 5 days	107/109	98·2	—	14
400 mg bd	40/41	97·6	—	17
400 mg tds	15/20	75·0	—	
600 mg stat	47/57	82·5	—	
800 mg stat	11/11	100	—	
4 mg/kg/day, 1–5 days	5/5	100	—	NS
1·6 mg/kg/day, 3 days	3/3	100	—	NS
10 mg/kg stat	50/66	75·8	—	

* Egg reduction rate, generally in patients not cured.
** 21 days unless otherwise indicated.
References to studies tallied available from author.
stat = single dose, bd = two doses, tds = three doses.

Appendix Table 7. *Enterobius vermicularis*: cure rates (CR) and % egg reduction rates (ERR) with a single dose of 400 mg albendazole. Published studies through March 1998

Reference	Cure rate	CR (%)	Duration of follow-up (days)*
Ahmad *et al.* 1986†	1/1	100	
Ahmad *et al.* 1983	2/3	66·7	14
Ai Issa *et al.* 1985	14/14	100	14
Barbieri *et al.* 1993‡	16/16	100	
Biagi *et al.* 1988	21/21	100	NS
Camillo-Coura *et al.* 1984	2/2	100	
Chandiwana *et al.* 1983	20/20	100	
Chen *et al.* 1984†	80/80	100	60
Coulaud & Rossignol, 1984	141/141	100	17
Flores *et al.* 1990	87/88	98·9	
Gazder & Roy, 1987†	1/2	50	
Homeida & Musa, 1984	2/5	40	14
Ioli *et al.* 1987	24/24	100	
Jagota, 1986	25/25	100	
Kleiner, 1990	14/15	93·3	
Misra *et al.* 1985†	19/19	100	
Ochoa *et al.* 1989†	82/82	100	
Okelo, 1984	3/4	75	17
Olveda *et al.* 1983	23/23	100	
Ovedoff, 1984	55/55	100	
Raccurt *et al.* 1990*b*	77/77	100	
Rim *et al.* 1984	52/53	98·1	30
Saif, 1984	22/31	71·0	
Salazar Schettino & de Haro Ortega, 1981†	1/2	50·0	
Vazquez *et al.* 1988†	90/91	98·9	16
Zawde, 1987	2/2	100	9–16
Total cured/total treated	883/903	97·8	

* 21 days unless otherwise stated.
† Study involving children 2–15 years only.
‡ Children <2 years. NS = not stated.

Appendix Table 8. The efficacy of albendazole at doses other than 400 mg single dose in *E. vermicularis* infections. Published studies through March 1998

Dose/reference	Cure rate	%	Duration of follow-up (days)*
25 mg, day 1 and day 8	2/5	40·0	45
50 mg, day 1 and day 8	7/7	100	45
100 mg, day 1 and day 8	20/20	100	23
200 mg stat	6/7	85·7	
200 mg bd	72/72	100	60
400 mg tds	2/2	100	
400 mg/day, 3 days	2/2	100	17
600 mg stat	14/14	100	
10 mg/kg stat	29/29	100	7

* 21 days unless otherwise stated.
References to studies tallied available from author.
stat = single dose, bd = two doses, tds = three doses.

Appendix Table 9. *Strongyloides stercoralis* infections: efficacy of 400 mg albendazole per day for 3 days. Published studies through March 1998

	Efficacy		
Reference	Cure rate Cured/treated	Cure rate %	Duration of follow-up*
Ahmed *et al*. 1983	1/1	100	14 days
Amato Neto *et al*. 1985	9/32	28·1	
Barbieri *et al*. 1993‡	2/2	100	
Botero *et al*. 1988	1/6	16·7	NS
Camillo-Coura *et al*. 1981†	7/7	100	
Camillo-Coura *et al*. 1984	6/6	100	
Carneiro da Cuhna *et al*. 1993†	6/6	100	
Chitchang *et al*. 1984	34/42	81·0	
Cortes *et al*. 1982	3/4	75·0	
Datry *et al*. 1994	9/24	38	
Gazder & Roy, 1987	4/4	100	
Homeida & Musa, 1984	1/1	100	14 days
Kleiner, 1990	23/32	71·9	
Marti *et al*. 1996	67/149	45·0	
Mbendi *et al*. 1985	36/36	94·7	
Ochoa *et al*. 1989	33/38	86·8	
Okelo, 1984	4/6	66·7	17 days
Pamba *et al*. 1987‡	1/1	100	
Rossignol & Maisonneuve, 1983	41/54	75·9	
Vazquez *et al*. 1988	10/28	35·7	

* 21 days unless otherwise stated.
† Study involving children 2–15 years only.
‡ Children < 2 years.
NS = not stated.

Total	298/479	62·2

Appendix Table 10. The efficacy of dose regimens other than 400 mg albendazole daily for 3 days in *Strongyloides stercoralis* infections. Published studies through March 1998

Dose/reference	Cure rate	%	Duration of follow-up (days)*
200 mg bd, 3 days	35/54	64·8	
400 mg stat	61/88	69·3	
400 mg/day, 6 days	2/7	28·6	NS
400 mg bd, 3 days	4/4	100	30
400 mg bd, 7 days	5/5	100	
400 mg tds	39/50	78·0	
800 mg/day 3 days	86/113	76·1	
800 mg/day, 6 days	5/10	50·0	NS
4–30 mg/kg/day, 3–6 days	52/68	76·5	35–615
16 mg/kg/day, 3 days	8/9	88·9	35–615
10 mg/kg stat	1/3	33·3	

* 21 days unless otherwise stated.
NS = not stated.
References to studies tallied available from author.

Appendix Table 11. *Hymenolepis nana* infection: the efficacy of 400 mg albendazole per day for 3 days. Published studies through March 1998

	Efficacy			
Reference	Cure rate, Cured/treated	Cure rate %	ERR %*	Duration of follow-up (days)**
Ahmad *et al*. 1986†	20/33	60·6		
Ahmed *et al*. 1983	1/1			14
Cabello *et al*. 1988†	101/122	82·9		15
Camillo-Coura *et al*. 1981†	1/1			
Camillo-Coura *et al*. 1984†	16/31	51·6		
Cortes *et al*. 1982	2/7	28·5		
Homeida & Musa, 1984	2/2	100		14
Jagota, 1986	26/41	63·4	65–75	
Okelo, 1984	1/1			17
Prasad *et al*. 1985†	15/21	71·4	65–77	14
Rossignol & Maisonneuve, 1983	5/17	29·4		
Tokmalaev *et al*. 1994	NS	90		
Total cured/total treated	190/277	68·5		

* Egg reduction rate (generally in patients not cured).
** 21 days unless otherwise stated.
† Study involving children 2–15 years only.
NS = not stated.

Appendix Table 12. The efficacy of dose regimens of albendazole other than 400 mg/day for 3 days in *Hymenolepis nana* infections. Published studies through March 1998

	Efficacy			
Dose/reference	Cure rate	%	ERR (%)*	Duration of follow-up (days)**
200 mg stat	2/5	40·0		
200 mg bd, 3 days	0/4	0	2·4–85·7	
400 mg stat	28/92	30·4		
400 mg bd, 2 days	4/6	66·7		30
400 mg/day, 3 days (repeated at 10 days)	3/30	10		
400 mg/d × 5 days	14/21	67·0		
600 mg stat	1/1	100		

* Egg reduction rate in patients not cured.
** 21 days unless otherwise stated.
References to studies tallied available from author.
stat = single dose, bd = two doses.

Appendix Table 13. *Taenia saginata* and *Taenia solium*: the efficacy of 400 mg albendazole per day for 3 days. Published studies through March 1998

	Efficacy				
Reference	Species	Cure rate	CR (%)	ERR (%)*	Duration (days)**
Ahmad *et al*. 1986†	Sag	3/3	100		
Ahmad *et al*. 1983	Sag	1/1	100		14
De Kaminski, 1988	Sol > Sag	30/30	100		60
Homeida & Musa, 1984	Sag	1/1	100		14
Jagota, 1986	Mixed	56/74	75·7	75–90	90
Ioli *et al*. 1987	Mixed	7/8	87·5		
Misra *et al*. 1985	Sag > Sol	5/5	100		90
Okelo, 1984	Sag > Sol	7/9	77·8		17
Total cured/total treated		111/131	84·7		

* Egg reduction rate (generally in patients not cured).
** 21 days unless otherwise specified.
† Study involving children 2–15 years only.
Sag = *T. saginata*; Sol = *T. solium*.
Sol > Sag = *T. solium* predominant; Mixed = Ratio of Sag: Sol not stated.

Appendix Table 14. The efficacy of dose regimens of albendazole other than 400 mg/day for 3 days in *Taenia* spp. infections

		Efficacy			
Dose/reference	Species	Cure rate	%	ERR (%)*	Duration of follow-up (days)**
400 mg stat		107/165	64·8		
800 mg stat	Sag	32/45	86·5	55·4	28

* Egg reduction rate (generally in patients not cured).
** 21 days unless otherwise stated.
Sag = *Taenia saginata*.
References to studies available from author.
stat = single dose.

Appendix Table 15. Comparison of the efficacy of albendazole and mebendazole in infections with *A. lumbricoides*, hookworm, *T. trichiura* and *E. vermicularis*. Published studies through March 1998

Reference	Indication	Dose	Albendazole cure rate (%)	ERR (%)	Dose	Mebendazole cure rate (%)	ERR (%)
Albonico *et al*. 1994	*A. lumbricoides*	400 mg	98·9	99·6	500 mg	97·8	82·4
	Hookworm	stat	56·8	97·9	stat	22·4	99·3
	T. trichiura		10·5	73·3		14·2	81·6
Amato Neto *et al*. 1983	*A. lumbricoides*	400 mg	91·2		100 mg	90·0	
	Hookworm	stat	55·2		bd	44·0	
	T. trichiura		38·5		3 days	71·4	
Bartoloni *et al*. 1993	*A. lumbricoides*	400 mg	100	100	400 mg	100	100
	Hookworm	stat	81·8	92·8	stat	60·0	62·4
	T. trichiura		33·3	45·7		17·2	15·0
Cruz, 1983†	*A. lumbricoides*	400 mg	88·5	99·8	600 mg	87·5	99·8
	T. trichiura	stat	34·6	80·6	stat	100	—
Holzer & Frey, 1987	*A. lumbricoides*	600 mg	100		1 g	100	
	N. americanus	stat	95·0		stat	21·0	
	T. trichiura		90·0			93·0	
Ioli *et al*. 1987	*A. lumbricoides*	400 mg	91·4		100 mg	100	
	T. trichiura	stat	100		bd	0	
	E. vermicularis		100		3 days	95·8	
Ismail *et al*. 1991	*A. lumbricoides*	400 mg	95·6	99·7	500 mg	97·4	99
	N. americanus	stat	100	100	stat	90·0	100
	T. trichiura		31·8	87·2		36·2	79·5
Jongsuksuntigul *et al*. 1993	*A. lumbricoides*	400 mg	100	100	500 mg	100	100
	Hookworm	stat	84·3	96·0	stat	30·2	70·4
	T. trichiura		67·4	87·0		70·3	89·9
Kan, 1983*†	*T. trichiura*	200 mg	44·8	91·5	100 mg	61·9	83·0
		400 mg	33·3	87·8	200 mg	36·1	82·9
		600 mg	20·0	88·8	400 mg	14·0	86·1
		stat			600 mg	7·1	89·0
					100 mg bd 3 days	52·0	91·2
Phuvanandh *et al*. 1994	*A. lumbricoides*	400 mg stat	85·0	ND	200 × 3	100	ND
					600 mg	100	
	N. americanus		81·8		200 × 3	94·0	
					600 mg	26·0	
	T. trichiura		43·2		200 × 3	75·0	
					600 mg	51·0	
Pugh *et al*. 1986†	*N. americanus*	400 mg stat	88·2	97·3	100 mg bd 3 days	53·0	98·2
Sacko *et al*. 1999	*N. americanus*	400 mg stat	83·8	97·7	500 mg stat	51·4	68·5
Sinniah *et al*. 1990	*A. lumbricoides*	200 mg	91·1	98·8	200 mg	98·3	99·9
	T. trichiura	stat	19·1	76·8	stat	46·4	72·7
	A. lumbricoides	400 mg	91·1	99·2	400 mg	86·1	99·2
	Hookworm	stat	100	100	stat	8·3	88·9
	T. trichiura		42·3	71·2		37·1	86·5
Wang *et al*. 1987	*A. lumbricoides*	400 mg stat	95·1		200 mg stat	76·5	
					200 mg bd	81·0	
		200 mg bd	89·5		200 mg bd 3 days	100	

Cure rates (ERR) using flubendazole 200 mg stat, 500 mg stat, 600 mg stat, and 300 mg/day for 2 days were 47·6 (92·4), 17·3 (93·1), 18·8 (91·2) and 65·1 (94·5) respectively.
stat = single dose, bd = two doses.

Appendix Table 16. The relationship of the efficacy of albendazole therapy to intensity of infection with *N. americanus*, *A. duodenale*, *A. lumbricoides* and *T. trichiura*. Published studies through March 1998

Indication	Reference	Cure rate, %/ERR, % by intensity of infection		
		Light	Moderate	Heavy
N. americanus	Coulaud & Rossignol, 1984	91·3/71·8	70·0/66·3	67·0/64·0
	Maisonneuve *et al.* 1984	88·9/—	100/—	100/—
	Olveda *et al.* 1983	85·1/—	50·0/—	—/—
	Rossignol & Maisonneuve, 1983	75·1/89·3	80·0/98·9	67·7/98·9
A. duodenale	Rossignol & Maisonneuve, 1983	86·9/81·5	95·5/92·2	100/—
T. trichiura	Coulaud & Rossignol, 1984	73·0/81·2	46·1/71·2	—/—
	Gazder & Roy, 1987	100/—	75·0/—	—/—
	Rossignol & Maisonneuve, 1983	62·6/83·7	30·8/83·5	25·0/91·0
A. lumbricoides	Coulaud & Rossignol, 1984	96·3/38·4	84·9/80·2	100/—
	Gazder & Roy, 1987	100/—	94·1/—	100/—
	Maisonneuve *et al.* 1984	88·2/93·0	93·0/99·0	85·7/99·0
	Olveda *et al.* 1983	100/—	88·2/99·0	85·3/99·0
	Rossignol & Maisonneuve, 1983	96·9/99·9	90·9/94·8	92·3/99·9