
Effect of repeated mass chemotherapy for filariasis control on soil-transmitted helminth infections in Sri Lanka

N K Gunawardena¹, N D D M Amarasekera², A Pathmeswaran³ and N R de Silva¹

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Abstract

Background In July 2006 Sri Lanka completed 5 rounds of annual mass drug administration (MDA) with diethylcarbamazine citrate (DEC) and albendazole as part of its national programme for elimination of lymphatic filariasis (LF). Albendazole is highly effective against soil-transmitted helminths (STH). This study was carried out to assess the effect of repeated annual MDA on STH infections in the Western Province of Sri Lanka, an area co-endemic for LF and STH.

Methods Faecal samples were obtained (during August - September 2006), from grade 5 students in 17 schools in the Western Province that were included in a national survey of schoolchildren's health in 2003, and examined using the modified Kato-Katz technique. The prevalence and intensity of roundworm, whipworm and hookworm infections in 2003 and 2006 were compared.

Results Faecal samples from 255 children were examined in 2003; 448 were examined in 2006. Roundworm prevalence was marginally lower in 2006 (4.0%) than in 2003 (4.7%), as was hookworm (0.2% vs 0.4%), whereas whipworm prevalence was higher (13.8% vs 9.4%). These differences as well as that between the geometric mean egg counts were not statistically significant. Compliance with MDA in 2006, as reported by the schoolchildren examined, was only 59%.

Conclusions Four annual rounds of MDA with DEC and albendazole had virtually no effect on STH infections in the study area.

Introduction

The WHO Global Programme to Eliminate Lymphatic Filariasis aims to interrupt transmission of *Wuchereria bancrofti* with MDA programmes using a combination of a microfilaricide (DEC or ivermectin) and albendazole. It was expected that such programmes, in addition to eliminating LF, would also significantly reduce STH infections because of the inclusion of albendazole [1].

Mass or targeted chemotherapy with any one of 4 anthelmintics (including albendazole) is recommended by WHO for use in communities where the cumulative STH prevalence (infection with one or more STH) is over 50% or the cumulative percentage of moderately or heavily infected individuals is more than 10% [2]. In endemic communities where infection rates are lower (such as in Sri Lanka at present), extensive use of other control strategies is recommended, but there is little published data on the effect of mass chemotherapy in such settings.

Sri Lanka's MDA programme for elimination of LF started using an annual, two-drug regimen in the Western (WP), North-Western and Southern Provinces in 2002. A recent national survey of the health status of primary schoolchildren included examination for STH infections. The survey was carried out in the WP during May-June 2003, just before the second round of the MDA programme [3]. The specific objectives of this study were to establish the prevalence and intensity of STH infections among primary schoolchildren in the WP in 2006, after completion of 5 rounds of MDA with DEC and albendazole, and to compare the prevalence and intensity of STH infection in 2006 with that found in 2003.

Departments of ¹Parasitology, ²Physiology, and ³Public Health, Faculty of Medicine, University of Kelaniya, Ragama, Sri Lanka.

Correspondence: NKG, e-mail <gune1@yahoo.com>. Received 4 July, and revised version accepted 31 October 2007. Conflicts of interest: none declared.

Methods

Our study was confined to the WP, which is co-endemic for LF and STH. It covers 3633 km² and has an estimated population of 5.3 million. All 3 districts of the Province lie within the same ecological zone. In the 2003 survey, 17 schools were selected from among 1393 state-run schools in the Province as described previously [3]. Cumulative prevalence of STH infection among 255 children in grade 5 was 11.0% (28/255): 9.4% had whipworm, 4.7% had roundworm, and 0.4% had hookworm. All infections were of light or moderate intensity.

The same 17 schools were revisited during September-October 2006. In each school, one grade 5 class was randomly selected, and all children in the selected class were included in the survey. If a school had only one class in grade 5, all children in this class were included. Compliance in providing faecal samples was expected to be about 80%, giving a total sample size of about 500. This sample size would have 80% power in detecting a difference if cumulative prevalence rates had declined to 4% or below.

The study team visited each school at least 3 times. On the first visit the team distributed labelled containers with instructions to bring a faecal sample to school on the

following morning, with a signed form indicating parental consent. Faecal samples were collected at the second visit, transported the same morning to the laboratory and examined by the Kato-Katz technique as recommended by WHO [4]. Kato-Katz test kits were obtained from Vestergaard-Frandsen (India). According to the manufacturer's instructions, the egg count in each positive sample was multiplied by a factor of 24 to obtain the number of eggs per gram (epg) faeces. Intensity of infection was categorised using cut-off values recommended by WHO [2].

Data were recorded and analysed on SPSS version 10.0. The chi-square test was used to examine the statistical significance of observed changes in prevalence. Following standard practice, geometric mean egg counts were estimated as $\exp[\chi \log_e(c+1)/n] - 1$, where c was the egg count (epg faeces) for a particular individual and n was the number of individuals [5]. Geometric means were compared using Students t test.

Only children who brought a signed consent form were included in the study. All infected children were offered free anthelmintic treatment: mebendazole for nematode infections and praziquantel for cestode infections. Approval was obtained from the Ethics Committee, Faculty of Medicine, University of Kelaniya.

Table 1. Prevalence of STH infections by school

School ID	District	Number examined	Prevalence rates (%)			
			<i>Ascaris</i>	<i>Trichuris</i>	<i>Hookworm</i>	Any STH
10103023	Colombo	34	41.2	70.6	0	82.4
10101008	Colombo	28	7.1	21.4	0	25.0
10101006	Colombo	28	0	14.3	0	14.3
10103022	Colombo	23	0	13.0	0	13.0
10101011	Colombo	24	0	4.2	0	4.2
10104031	Colombo	25	0	0	0	0
10208069	Gampaha	23	0	8.7	4.3	13.0
10208066	Gampaha	14	0	0	0	0
10206055	Gampaha	26	0	0	0	0
10206050	Gampaha	30	0	0	0	0
10207062	Gampaha	32	0	0	0	0
10205043	Gampaha	30	0	0	0	0
10310089	Kalutara	33	3.0	54.5	0	54.5
10310085	Kalutara	26	7.7	26.9	0	26.9
10309078	Kalutara	16	6.3	6.3	0	6.3
10310091	Kalutara	32	0	0	0	0
10311097	Kalutara	27	0	0	0	0
Western Province		451	4.4	14.6	0.2	16.0

Results

Prevalence and intensity of infection in 2006

A total of 569 children were recruited, 451 returned faecal samples, giving a compliance rate of 79.3%. The cumulative prevalence of STH infection in the WP was 16.0%, with trichuriasis predominating (14.6%). The prevalence of ascariasis was 4.4% and hookworm 0.2% (table 1). Most whipworm infections (51/66, 77.3%) were of light intensity and the rest were of moderate intensity. Half the roundworm infections were of moderate intensity (10/20, 50%), and a few were heavy (2/20, 10%). The single hookworm infection was of light intensity.

Comparison of prevalence in 2003 and 2006

Roundworm prevalence was virtually unchanged: 4.7% (12/255) in 2003 vs 4.4% (20/451) in 2006 ($\chi^2 = 0.03$, $p = 0.86$). Whipworm prevalence was higher in 2006 [9.4% (24/255) vs 14.6% (66/451)], but the difference was barely statistically significant ($\chi^2 = 3.99$, $p = 0.05$). Only one hookworm infection each was seen in both 2003 and 2006 surveys. Overall, the cumulative prevalence of STH infections in the Western Province was higher in 2006 (16.0%, vs 11.0% in 2003), but the difference was not statistically significant ($\chi^2 = 3.32$, $p = 0.07$). As the figure shows, in 2003, 6 schools had children with one or more STH infection, but in 2006, nine schools had.

Comparison of infection intensity in 2003 and 2006

Whereas all 12 roundworm infections noted in 2003 were light or moderate infections, 2 children (of 20 with roundworm) had heavy infections in 2006. All whipworm infections noted in 2003 and 2006 were of light or moderate intensity, but the proportion of moderately heavy infections increased from 12.5% in 2003 to 22.7% in 2006. The hookworm infections noted in 2003 and 2006 were both of light intensity. Comparison of geometric mean egg counts in 2003 and 2006 indicated that the differences were not statistically significant (table 2).

Compliance with MDA in July 2006

Only 486 of 589 children registered in the 2006 survey provided information regarding compliance with MDA. Of these 486 children, 283 (58.2%) reported taking the DEC and albendazole combination in July 2006. Reported compliance rates showed wide variation between schools, ranging from 29.3% to 83.4%. Cumulative prevalence of STH infection was not significantly different between compliant and non-compliant children [17.8% (39/219) vs 19.4%, (30/155), $\chi^2 = 0.14$, $p = 0.704$]. Intensities of roundworm and whipworm infections were marginally lower among compliant children, but the differences were not statistically significant.

Table 2. Comparison of mean egg counts in 2003 and 2006

	Geometric mean egg counts		
	2003	2006	
	(n = 255)	(n = 451)	
Roundworm epg faeces	0.47	0.44	t = 0.149, d.f. = 704, p = 0.881
Whipworm epg faeces	0.73	1.31	t = -1.849, d.f. = 704, p = 0.053
Hookworm epg faeces	0.03	0.02	t = 0.317, d.f. = 704, p = 0.751

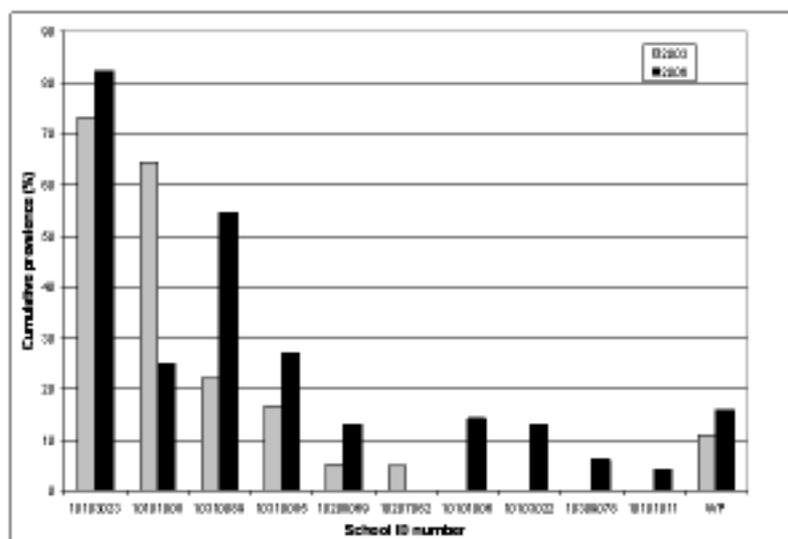


Figure. Cumulative prevalence of STH infection in schools with infected children in 2003 and 2006

Discussion

Two assumptions were made in this study. One is that prevalence among children attending primary schools in a given community is an accurate indicator of the prevalence of STH infections in that community at a given point in time. This relationship has already been clearly established, and WHO now recommends examination of stool samples from about 250 primary schoolchildren as sufficient for assessment of prevalence and intensity of STH infections in a given ecological zone [2]. The other assumption is that examination of children of the same age group, in the same schools, at two different points in time, will accurately reflect changes in prevalence of STH infections in the communities served by the schools. This assumption was made on the grounds that the type of community served by a given school generally remains constant, and that STH infections have relatively stable age-distribution patterns. Provided these two assumptions are valid, the results of this survey indicate that STH prevalence rates and infection intensities have remained virtually unchanged despite 4 rounds of MDA conducted between the first survey in 2003 and the second in 2006.

In a survey of 6 schools in Ragama (also in the WP), cumulative prevalence declined from 4.2% to 2.0% over a six month period that included the first round of MDA in the area [6]. Whipworm prevalence declined from 4.2% to 1.6% and mean egg counts also declined over this period. Although the reductions were not statistically significant (probably because so few children were infected), the trend was in the opposite direction to that observed in the present study. One critical difference between the two studies is that reported compliance with MDA was 85% in the 2002 Ragama study, whereas it was < 60% in the WP in 2006. An independent evaluation of the August 2004 MDA programme in the Colombo Municipality area also found that overall compliance was only 55% [7].

Reported drug compliance rates in this study may be underestimated because the follow up survey was conducted some months after the MDA programme. However, we think that it is unlikely that children would have forgotten taking the drugs because the chemotherapy regime involved swallowing 3 tablets of DEC and 2 large tablets of albendazole all at once. Moreover, the recall period was almost identical in both surveys: MDA was conducted at the end of July in both years with follow up surveys 2-3 months later.

These results suggest that inclusion of albendazole in MDA for LF does not reduce STH infections in areas of low endemicity and suboptimal coverage. An alternative strategy is probably necessary for further reduction in STH prevalence in Sri Lanka, such as targeted chemotherapy (target schools serving children from low

income families who are more likely to be infected), and change of anthelmintic regime (the 3-day course of mebendazole has greater efficacy against whipworm than single-dose albendazole or mebendazole).

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