

Evaluation of two years of mass chemotherapy against ascariasis in Hamadan, Islamic Republic of Iran

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Objective To evaluate the mass treatment of ascariasis in rural areas of Hamadan Province, Islamic Republic of Iran.

Methods A control programme in rural areas of Hamadan Province, which began in November 1997, involved giving all persons a single dose of 400 mg albendazole at intervals of three months. The efficacy of the treatment was evaluated by the formalin–ether concentration technique for stool examination and by the Stoll quantitative method.

Findings The average rate of infection with *Ascaris* before treatment was 53.3%, ranging from 40% in Hamadan district to 75% in Toysercan. Two areas, Malayer and Nahavand, were excluded from the programme because the infection rates were only 13% and 4%, respectively. After two years of mass treatment the infection rate had decreased to 6%. The proportion of positive cases excreting only unfertilized eggs increased to 32%. No side-effects of mass treatment were observed.

Conclusion Systematic mass treatment giving high coverage proved to be very effective in the control of ascariasis, notwithstanding a lack of other preventive measures.

Keywords Ascariasis/drug therapy; Albendazole/therapeutic use; *Ascaris lumbricoides*/pathogenicity; *Trichuris*/pathogenicity; *Giardia lamblia*/pathogenicity; *Hymenolepis*/pathogenicity; Treatment outcome; Iran (source: MeSH, NLM).

Mots clés Ascariadiase larvaire/chimiothérapie; Albendazole/usage thérapeutique; *Ascaris lumbricoides*/pathogénicité; *Trichuris*/pathogénicité; *Giardia lamblia*/pathogénicité; *Hymenolepis*/pathogénicité; Evaluation résultats traitement; Iran (source: MeSH, INSERM).

Palabras clave Ascariasis/quimioterapia; Albendazol/uso terapéutico; *Ascaris lumbricoides*/patogenicidad; *Trichuris*/patogenicidad; *Giardia lamblia*/patogenicidad; *Hymenolepis*/patogenicidad; Resultado del tratamiento; Irán (fuente: DeCS, BIREME).

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Introduction

The treatment of individuals with intestinal parasitic diseases can be expected to have only a limited effect on their transmission in the community as a whole. Consequently, community-oriented projects have an essential role in the prevention and control of such diseases (1).

Ascaris lumbricoides infection reflects socioeconomic status, environmental sanitary practices, health awareness and health education (2). Mass treatment against *Ascaris* spp. in developing countries, particularly those where ascariasis is highly endemic, has been reported to be highly effective in controlling this soil-transmitted helminth (2). This is especially true in communities where other interventions, e.g. health education, the improvement of environmental sanitation, and the provision of clean water and nutritional supplements, are not immediately feasible (3). In addition to certain sociological factors, parasitological factors have a great impact on such control. In tropical regions the rate of reinfection with *Ascaris* spp. after mass treatment is often remarkably high (4). The efficacy of control is clearly influenced by the drug used, its dosage rate, the intervals between successive doses, and the number of times the dose is repeated. The suggestion has been made that infections of soil-borne helminthic parasites might

be controlled by intensively repeating the administration of highly effective drugs (5, 6).

A. lumbricoides is the commonest intestinal parasite in Hamadan Province, Islamic Republic of Iran (7, 8). Its prevalence ranges from 40.4% in Hamadan district to 75.6% in the Toysercan area (9). A review of 56 cases of surgical complications caused by *Ascaris* infection indicated an incidence of nearly 3 cases per 1000 children under 10 years of age (Motahhari N., unpublished thesis, School of Medicine, Hamadan University of Medical Sciences, Hamadan, Islamic Republic of Iran). *A. lumbricoides* eggs were found in 79% of 259 samples of soil (100 g each) collected in 12 consecutive months from 19 public parks (M. Fallah, unpublished data, 1998). Children who spontaneously eliminate worms by vomiting are not rare, even among inhabitants of urban areas.

Cold conditions prevail in Hamadan Province in winter, the minimum temperature being -28°C and the mean 9°C . Farming is the principal occupation, and until recently most farmers used night soil as fertilizer because of its ready availability. Untreated sewage flowed into the rivers or was widely used in vegetable gardens. Such conditions provide a favourable environment for the development of *A. lumbricoides* infection.

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Materials and methods

The formalin–ether sedimentation method was used for pretreatment stool examinations of 10 750 individuals in order to determine the initial prevalence; the modified Stoll technique was employed for baseline egg counting (10). After the stool survey a mass chemotherapy programme was conducted in all rural areas of the province except for the towns of Malayer and Nahavand, where the infection rates were only 13% and 4%, respectively. A single dose of 400 mg albendazole was given to every person except children under 2 years of age and pregnant women. These groups were excluded in order to avoid possible side-effects (11, 12). The first treatment was given in November 1997 and further treatments were given at intervals of three months for two years. The programme was evaluated in December 1999, by which time eight treatments had been administered.

Results

The overall prevalence of intestinal helminths in the target localities before treatment was 56.5%, with the principal helminth parasites being *A. lumbricoides* (53.3%), *Trichuris trichiura* (4.5%), and *Hymenolepis nana* (2.2%) (see Table 1 and Table 2). The age group 2–5 years had a lower infection rate than other age groups. After two years the overall prevalence of ascariasis had fallen from 53.3% to 6%. The proportion of all positive individuals excreting only unfertilized *A. lumbricoides* eggs reached about 32%. A steep decline occurred in all rural areas, including the centre of the province (Table 3). Coverage ranged from 93% to 97% in different villages. The mean *A. lumbricoides* egg count per g of faeces was 9361 (range, 450–60 300). The mean, mode and median egg counts in different localities are indicated in Table 4. Among the positive cases, 57.1% had egg counts below 10 000 per g, 23.8% had counts from 10 001 to 30 000 per g, and 19.1% had counts above 30 000 per g. No reduction in the prevalence of intestinal protozoan parasites such as *Giardia lamblia* or in that of *H. nana* was observed.

Discussion

Evaluation of programmes during their execution is essential in order to determine whether satisfactory progress is being made and whether any adjustments are required (13, 14).

The existence of a source of *A. lumbricoides* is a significant factor leading to high incidence of infection in an area of endemicity. Poor personal hygiene and environmental sanitation, which can occur as a consequence of indiscriminate defecation by young children and the use of human excreta as fertilizer on farms and vegetable gardens, may result in infection (15).

Periodic treatment for the control of intestinal parasitic infections is highly effective and inexpensive (16). Nevertheless, it is desirable to make a careful study of the epidemiology of soil-transmitted helminths before undertaking large-scale control activities, especially with regard to periodic treatment schedules (17). The most effective approach has involved universal treatment at intervals of two months. However, excessively frequent drug administration should be avoided, while the high cost per individual and the very substantial manpower requirement for mass campaigns need to be taken into consideration. Ascariasis has been successfully controlled by treating at intervals of four or six months (12, 18, 19). We found that the prevalence of *Ascaris*

Table 1. Pre- and post-treatment prevalence of major intestinal parasites in the rural areas of Hamadan Province, Islamic Republic of Iran

Parasite	% of samples positive	
	Pre-treatment (n = 3098)	Post-treatment (n = 2667)
<i>Ascaris lumbricoides</i>	53.3	6
<i>Trichuris trichiura</i>	19.6	0.84
<i>Hymenolepis nana</i>	2.23	1.84
<i>Giardia lamblia</i>	6.42	6.45

Table 2. Pre-treatment prevalence of major intestinal parasites in different localities of Hamadan Province, Islamic Republic of Iran

Locality	n ^a	<i>Ascaris lumbricoides</i>	<i>Trichuris trichiura</i>	<i>Hymenolepis nana</i>	<i>Giardia lamblia</i>
		% +ve	% +ve	% +ve	% +ve
Hamadan city	325	40.9	0.3	3.38	8
Asadabad	1161	46.5	0.17	3.45	8.8
Bahar	220	56.3	0	1.8	5.45
Kabootar Ahang	378	40.4	0	1.3	3.7
Razan	317	55.2	0	0.6	1.58
Toysercan	97	75.6	19.6	1	5.74
Total	3098	53.3	4.51	2.23	6.42

^a No. of samples examined.

Table 3. Post-treatment prevalence of major intestinal parasites in different localities of Hamadan Province, Islamic Republic of Iran

Cities	n ^a	<i>Ascaris lumbricoides</i>	<i>Trichuris trichiura</i>	<i>Hymenolepis nana</i>	<i>Giardia lamblia</i>
		% +ve	% +ve	% +ve	% +ve
Hamadan	345	8.7	0	1.7	5.5
Asadabad	1053	5.4	0	2	3.45
Bahar	165	8.48	0	2.42	2.42
Kabootar Ahang	254	4.7	0	1.57	5.9
Razan	257	2.72	0	1.17	3.9
Toysercan	593	6.75	0.84	1.85	8.09
Total	2667	6	0.18	1.84	6.45

^a No. of samples examined.

spp. varied geographically in the study area: it was highest in the southern town of Toysercan and lowest, surprisingly, in the nearby towns of Malayer and Nahavand. In this region, especially in the Hamadan city area, people use all available open spaces for private vegetable gardens, and raw sewage is used for irrigation and sometimes as fertilizer.

There is an efficient and comprehensive network of health centres in the rural areas of the Islamic Republic of Iran.

Table 4. Post-treatment intensity of infection of *Ascaris lumbricoides* in different localities of Hamadan Province, Islamic Republic of Iran

Location	Eggs per g stool (epg)		
	Mean	Median	Mode
Hamadan city	18 493	15 800	35 850
Asadabad	—	—	—
Bahar	6459	4350	4400
Kabootar Ahang	19 877	16 600	16 200
Razan	7070	6900	6900
Toyserkan	8835	3025	1400
Total	9361	8550	2400

This played a key role in the success of the programme, and district health officers were focal points for the community-oriented project. Requests for anthelmintics, especially mebendazole, the main such drug on the local market, diminished dramatically after the implementation of the mass treatment programme.

Primary care workers have a basic role in ascariasis control because of their close links with communities. Their initiatives, educational work and efforts to improve commu-

nity sanitation and hygiene contribute significantly to the effectiveness of control activities (20). In order to evaluate the improvement of public health in depth and the impact at community level it is necessary to conduct nutritional assessment in some target age groups. The interruption of mass treatment can be expected allow a rapid increase in egg-positive rates because of rapid reinfection with *Ascaris* spp. (5).

It is considered that the present mass control programme should continue for at least three more years with six-monthly intervals between treatments and that further changes in the intensity of infection attributable to a decrease in the egg prevalence should be taken into account. It is worth noting that, although there were no significant reductions in *Giardia* spp. or *H. nana*, albendazole has been reported to be effective against these parasites (21–23).

The present study indicated that systematic mass treatment provided effective control of ascariasis even in the absence of other preventive measures. ■

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Conflicts of interest: none declared.

Résumé

Evaluation de deux années de chimiothérapie de masse contre l'ascaridiase dans la province de Hamadan (République islamique d'Iran)

Objectif Evaluer le traitement de masse de l'ascaridiase dans les zones rurales de la province de Hamadan (République islamique d'Iran).

Méthodes Un programme de lutte, commencé en novembre 1997 dans les zones rurales de la province de Hamadan, consistait à administrer à chaque habitant une dose unique de 400 mg d'albendazole tous les 3 mois. L'efficacité du traitement a été évaluée par examen des selles après concentration (méthode formol-éther) et par la méthode quantitative de Stoll.

Résultats Le taux moyen d'infection par *Ascaris* était de 53,3 % avant traitement, avec des valeurs allant de 40 % dans le district

de Hamadan à 75 % à Toyserkan. Deux zones, Malayer et Nahavand, ont été exclues du programme en raison de leur faible taux d'infection (13 % et 4 % respectivement). Après deux années de traitement de masse, le taux d'infection est tombé à 6 % et la proportion de cas positifs n'excrétant que des œufs non fécondés est passée à 32 %. Aucun effet secondaire n'a été observé.

Conclusion Un traitement de masse systématique avec un fort taux de couverture s'est révélé très efficace pour lutter contre l'ascaridiase, malgré l'absence d'autres mesures préventives.

Resumen

Evaluación de dos años de quimioterapia masiva contra la ascariasis en Hamadan, República Islámica del Irán

Objetivo Evaluar el tratamiento masivo de la ascariasis en zonas rurales de la provincia de Hamadan, en la República Islámica del Irán.

Métodos En noviembre de 1997 dio comienzo en zonas rurales de la mencionada provincia un programa de lucha en virtud del cual se administró a todas las personas una dosis única de 400 mg de albendazol a intervalos de tres meses. La eficacia del tratamiento se evaluó empleando la técnica de concentración con formalina-éter para examinar las heces y mediante el método cuantitativo de Stoll.

Resultados La tasa media de infección por *Ascaris* antes del tratamiento fue del 53,3%, entre el 40% del distrito de

Hamadan y el 75% de Toyserkan. Dos zonas — Malayer y Nahavand — quedaron excluidas del programa debido a que sus tasas de infección fueron sólo del 13% y el 4%, respectivamente. Al cabo de dos años de tratamiento masivo la tasa de infección había disminuido al 6%. La proporción de casos positivos que excretaban sólo huevos no fecundados aumentó al 32%. No se observaron efectos secundarios asociados al tratamiento masivo.

Conclusión El tratamiento masivo sistemático con alta cobertura fue una alternativa muy eficaz para combatir la ascariasis, pese a la falta de otras medidas preventivas.

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