

QUANTITATIVE ASSESSMENT OF *ASCARIS LUMBRICOIDES* INFECTION IN SCHOOL CHILDREN FROM A SLUM IN VISAKHAPATNAM, SOUTH INDIA

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Abstract. An epidemiological study was conducted on 217 school children aged between 7-13 years, from Relliveedhi a slum in Visakhapatnam, Andhra Pradesh, south India, during August 1993 to August 1994. The children belonged to a socioeconomically backward community - parental occupation being fishing or waged labor. Intensity and prevalence estimations for *Ascaris lumbricoides* were done indirectly by formalin-ethyl-acetate sedimentation technic and directly by worm expulsions following albendazole administration at a single oral dose of 400 mg/child. Prevalence rate was 73% while the intensity of infection ranged between low to moderate. Boys had severe infection than girls due to their outdoor activities and behavioral habits. Nine year old children had the highest prevalence rates. Mean *Ascaris* worm intensity was 2.2 (± 1.91) with an over-dispersed distribution of the parasite in the host population. Reinfection study over a period of nine month showed that the prevalence rates exceeded the pre-intervention level but the intensity of infection was very low. Dual species intensity correlation between *Ascaris* and *Trichuris* was consistently strong.

INTRODUCTION

Gastrointestinal nematode infections cause formidable public health problems in the tropics. The result of these infections leave a series of detrimental effect on the nutritional, cognitive and hematological parameters of the host, at times causing serious morbidity and occasional mortality (Savioli *et al.* 1992). An inverse relationship exists between the worm burden and severity of disease manifestations as depicted by community studies for ascariasis (Thein-Hlaing *et al.*, 1991), trichuriasis (Cooper *et al.*, 1992) and hookworm disease (Latham *et al.*, 1983).

Ascaris lumbricoides infection is of common occurrence in India among economically deprived sections of the society. Illiteracy, unhygienic and insanitary living conditions, neglect in immunization and primary health care facilities, polyparasitism since birth all contribute to an increased prevalence and incidence of intestinal nematode infections. Quantitative epidemiological studies on intestinal helminth infections are few from India (Elkins *et al.*, 1986; Haswell-Elkins *et al.*, 1987, Gnanamani *et al.*, 1993).

The present paper reports the incidence of ascariasis among school children from a slum inhabited by a fishing community, in Visakhapatnam

both prior to and following drug intervention.

MATERIALS AND METHODS

The study was conducted in a Municipal Primary School situated at Relliveedhi, a slum in Visakhapatnam. At the time of the present investigation 217 students, 112 boys and 105 girls (sex ratio 1:1.04), aged 7-13 years participated for the study. Prior to collection of stool sample, data concerning anthropometric, socio-economic, dietary and parental occupation were collected. Clinical examination of the children were also conducted.

Parasitological methods

Pre-treatment stool samples were collected from the children between August, 1993 to November, 1993 for the estimation of egg/gram (EPG) count (Hall, 1981). All infected children (n=177) were given a single oral dose of 400 mg/child of albendazole (Zentel, Smith Kline Beecham) in November, 1993. Worms were separately collected after thorough washing and stored in plastic containers marked with each child's identification number as provided in the beginning of the study. Single post-treatment stool samples were collected at regular monthly intervals till the end of the ninth month. Collection of samples was not possible at the sixth, seventh and eighth month as the school was closed for summer vacation.

Data analysis

From the data collected during study, preva-

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lence and intensity estimates for *Ascaris* infection was calculated. Chi-square test was employed to compare the prevalence between sexes, Z-tests for comparing the mean intensities. One-way ANOVA was used to determine the relationship between host age and intensity of infection. Kendall Tau's rank correlation was employed to measure dual species association between *Ascaris* and *Trichuris trichiura*. Data were analyzed using statgraphics ver 3.6. For all tests the probability level was fixed at 5% (Sokal and Rohlf, 1981). Prior to application of parametric tests data were log transformed (X+1).

RESULTS

Prevalence

The study showed 82% of the children were infected with one or more type of intestinal helminth. The overall prevalence of *Ascaris* infection according to egg positive stools collected prior to anthelmintic treatment (November, 1993) was 73%. Prevalence of infection was significantly higher in

boys compared to girls ($\chi^2=14.4$, $df=1$, $p<0.05$, Fig 1).

Intensity

The mean intensity (EPG) of infection was 3,413 (range 51-47,257). Sex-wise boys had intense infection compared to girls (Table 1). Age-wise no significant difference was noted (One-way ANOVA, $F1=0.15$, $v1=3$ and $v2=154$, $p>0.05$). 80% of the children had light infection while 20% harbored moderate ascariasis with no representatives in the heavy infection group. Dual species association between *Ascaris lumbricoides* and *Trichuris trichiura* showed a significant positive correlation both in the overall population and among different age classes (Table 1).

Prevalence and intensity based on worm counts

Prevalence based on worm count was higher (75%) compared to ova count. A total of 360 worms were expelled (mean burden 2.2 ± 1.91), with no significant difference between the sexes ($Z=0.0351$, $p>0.05$). The dispersion parameter k (parameter of

Table 1
Rank correlation showing *Ascaris lumbricoides* and *Trichuris trichiura* association for overall population and among different age classes.

Group	Boys	Girls	Total
Overall population	0.1860 ^a (94)	0.2489 ^a (64)	0.2053 ^a (158)
7 years	0.2945 ^a (23)	-	0.2444 ^a (31)
8 years	0.4001 ^b (25)	0.4362 ^a (17)	0.3975 ^b (42)
9 years	-0.0488 ^c (17)	0.0627 ^c (22)	0.0582 ^c (39)
10-13 years	0.3921 ^b (29)	-0.0223 ^c (17)	0.2339 ^a (46)

number in paranthesis indicates the number of individuals
^a $p < 0.05$; ^b $p < 0.0001$; ^c $p > 0.05$

Table 2
Mean intensity (EPG) of *Ascaris lumbricoides* following treatment.

	Months after anthelmintic treatment					
	1	2	3	4	5	9
Boys	0±0*	20±180	72±205	172±481	275±481	571±776
Girls	0±0	3±21	97±174	181±270	293±457	574±734
Total	0±0	13±137	83±193	175±323	283±472	574±734

* Mean±SD

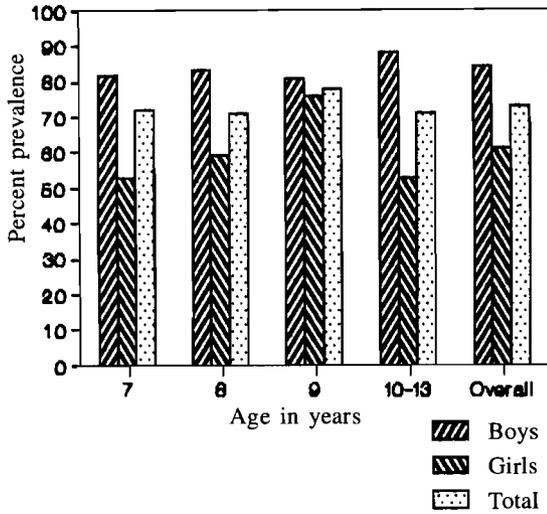


Fig 1—Prevalence of *Ascaris lumbricoides* in relation to age and sex of the study population (n=217).

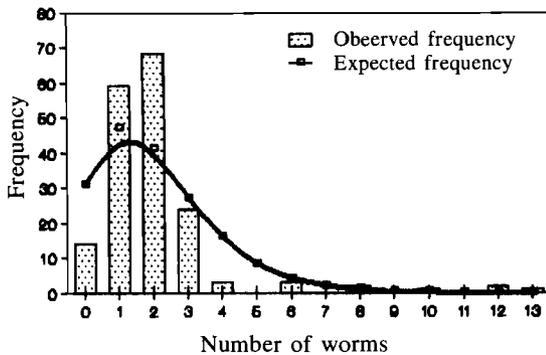


Fig 2—Frequency distribution of *Ascaris lumbricoides* worms among infected children (n=177).

the negative binomial distribution) was 5.38415 and the co-efficient of dispersion s^2/\bar{x} was 6.8262. Majority of the individuals (93%) harbored light worm burdens ranging from 1-3 worms while only a few (n=4) had more than 10 worms (Fig 2). 61% of the worms were expelled on day 2 compared to 39% on the first day following albendazole treatment.

Reinfection prevalence and intensity

One month post-treatment all children were egg negative indicating 100% efficacy of the drug. Reestablishment of infection was noticed from the second month. By the end of the ninth month the post-treatment prevalence (74%) had exceeded the pre-intervention level but the intensity of infection was significantly low ($Z=5.80456$ $p<0.05$, Table 2).

DISCUSSION

The results of the study showed high prevalence of ascariasis. A possible reason could be the individual or combined effects of a number of factors like humid tropical climate, insanitary conditions, unhygienic lifestyle, crowded living conditions, poor socio-economic status and inadequate health care facilities. Though the intensity of infection ranged from light to moderate, yet boys had intense infection compared to girls, in contrast to the findings of Elkins *et al* (1986). The probable reason for the difference could be due to their behavior and outdoor extra curricular activities since girls mostly stayed indoors. In conjunction with reduced mean egg intensity, worm burden per child was also low as reported by Cabrera (1984). The factors responsible for the low intensity of infection may be that exposure in the form of geophagy was not very prevalent among this study population. Interestingly, children reported the continuous use of herbal and plant products like castor oil and asfoetida, a common ingredient as a spice and flavoring agent, which have worm expulsion properties. Intensity of reinfection remained low even at the ninth month probably attributable to the general awareness developed among the parents and children during the study period. Significant positive correlation between *Ascaris lumbricoides* and *Trichuris trichiura* reflect the similar life-cycle patterns of the two parasites and the strong tendency exhibited by pre-school and school age children to acquire roundworm and whipworm infections (Elkin *et al*, 1988).

However, in developing countries the most important question remains the control of *Ascaris* and other intestinal helminths in a cost-effective manner either through selective or mass chemotherapy. Though selective chemotherapy is advocated (Keymer and Pagel, 1990; Holland *et al*, 1996) but there remains a proportion of the infected population not receiving anthelmintic treatment who serve as a potential reservoir in the cyclical transmission of ascariasis to others. Therefore control strategies need to be implemented covering health education, hygiene and chemotherapy with an aim to reduce morbidity and disease symptoms arising due to *Ascaris* and other intestinal nematodes.

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