GLOBAL JOURNAL OF PURE AND APPLIED SCIENCES VOL. 6 NO. 1 JANUARY 2000: 23-26
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EPIDEMIOLOGY OF ASCARIASIS IN SOME RURAL COMMUNITIES IN OGUN STATE, NIGERIA

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(Received 16 April 1999; Revision accepted 4 June 1999)

ABSTRACT

An epidemiological survey was carried out to determine the prevalence, intensity and reinfection rates of *Ascaris lumbricoides* in some rural communities in Ogun State, Nigeria. The study revealed a very high prevalence of infection (96 – 100%) in all the villages, but with rather low intensities. Both prevalence and intensity were not significantly affected by differences in age groups, sex, and household size ($p > 0.05$). In two of the four villages (Idi-Ori and Dega-Eruku) where intensity was also measured by direct worm expulsion, the mean worm burden were 2.5 and 2.9 respectively, with highly aggregated distribution (k = 0.38 and 0.18 respectively). The calculated monthly reinfection rate (X), obtained from the equation $Y = 1-(1-X)^N$ for the two villages were 3.8% in Idi-Ori and 2.3% in Dega-Eruku. The final equation $Y = 1-(1-X)^{11.8}$ indicates that the period required to attain the same pretreatment prevalence following a mass chemotherapy in these villages would be in the neighbourhood of 11-12 months.

KEY WORDS: *Ascaris lumbricoides*, epidemiology, re-infection, mass chemotherapy, Nigeria.

INTRODUCTION

The common roundworm, *Ascaris lumbricoides* is the most prevalent human intestinal helminth in the world with a global estimate of over 1 billion infected people (Crompton, 1989). The current prevalence of ascariasis in Nigeria ranges from 35% in some parts to 100% in others (Fasuyi, 1983; Alakija, 1986; Onadeko and Ladipo, 1989; Ogbe and Adu, 1990; Ndifom, 1991; Asaolu *et al*; 1992), with varying levels of intensity. These parasites are over-dispersed in the human hosts and aggregated in form, which could be described by the negative binomial (Anderson, 1986; Bundy *et al*; 1988; Holland *et al*; 1989; Ogbe and Odudu 1990; Mafiana *et al*; 1998). Understandably, a number of studies have concentrated on children, because they have been shown to have higher worm burdens and hence greater morbidity effects. However, understanding the age- prevalence, re-infection rates, together with familial aggregation pattern is of importance in epidemiology as well as in decision of primary targets in control (WHO,1981). Re-infection is considered a very important factor in any control strategy, whose rate is in turn dependent on the endemicity within a community (Morisha, 1972).

This study was therefore aimed at determining the prevalence and intensity of ascariasis in rural communities in Ogun State of Nigeria, the effect of household size on prevalence and intensity as well as the re-infection rates in these communities. The information obtained would contribute to the planning of effective control strategies against the infection.

MATERIALS AND METHODS

The study area is made up of Idi-Ori, Dega-Eruku, Ika-Ajibefun and Akiode villages near the city of Abeokuta, the capital of Ogun State, Nigeria. Located in the rainforest belt, the communities lie around latitude 7° 6'N and 3° 16" E and the inhabitants are predominantly farmers. The communities lack basic amenities like pipe- borne water, electricity, and refuse and sewage disposal systems. Both the domestic and peri-domestic areas are utilised for the disposal of refuse and sewage.

The purpose of the study was explained to the village chiefs, who in turn gave consent for the study to commence. An enumeration was made of all persons 1 year and above in each community, using the already existing Primary Health Care (PHC) numbers on each house. For each household, the name, age, sex and marital status of each person was recorded. In all, the total population of each village was as follows: Idi-Ori - 183 (having 29 clustered houses) Dega- Eruku- 115 (15 houses), Akiode - 32 (2 houses) and Ika Ajibefun - 21(3 houses).

Stool samples were collected from consenting households and examined under the microscope for *Ascaris* ova, using the quantitative Kato thick smear (Martin and Beaver, 1968).
The egg per gram (epg) of faeces was then calculated after adjusting for age and consistency (Nawalinski *et al*; 1978).

For direct intensity measurement, levamisole (levamex, manufactured by UNIBIOS Laboratory Ltd, India) was administered according to the manufacturer's prescription, to the villagers. Whole-day stool for each person was collected for 2 consecutive days. The number of worms voided was then recorded after sorting and measuring for length and weight.

Data were then analyzed for prevalence and intensity by age-group, sex, household size and, interactions between these parameters were analyzed by 2-way ANOVA. For the re-infection study; Idi-Ori and Dega Eruku (the two largest communities) were used. Subjects in Idi-Ori were re-treated 2 months after the initial treatment, while those in Dega-Eruku were re-treated 4 months after. In each case, all young worm positive cases were recorded, thereafter, the relationship between the young worm positive rate and monthly re-infection rate was established by applying the theoretical equation for time prevalence curve by Chai (1983) - $Y = 1-(1-X)^N$, where Y is prevalence, X is monthly re-infection rate, and N is time elapsed in months.

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Table 1. Prevalence and mean intensities of *Ascaris lumbricoides* in the communities.

Village	No. examined	%Infection	Mean intensity (epg)
Idi-Ori	104	100%	2878.04 ± 720.8
Dega-Eruka	80	97.0%	2251.43 ± 830.74
Akiode	21	96.0%	978.43 ± 879.24
Ika-Ajibefun	20	100%	3611.36 ± 224.56

Table 2: Age-Sex related Intensity (± SEM) of *Ascaris lumbricoides* infection

	Idi-Ori	Dega Eniku	Akiode	Ika-Ajibefun
Age class (years)				
1 - 10	2650.75 ± 371.1	1421.73 ± 660.17	1292.50 ± 791.54	1624.00 ± 1621.10
11 - 20	2815.94 ± 462.8	2536.95 ± 968.67	415. ± 119.41	4617.37 ± 1149.10
21 - 30	4126.00 ± 1484.3	3674.42 ± 923.18	320.25 ± 1187.31	1388.33 ± 1532.10
31 - 40	2343.50 ± 612.0	2359.00 ± 945.98	378.00 ± 1370.99	4634.00 ± 1625.10
41	2545.80 ± 813.0	1477.34 ± 708.68	860.00 ± 219.41	7140.00 ± 1876.50
>>	2460.80 ± 487.7	2039.13 ± 498.58	2604.00 ± 1370.99	2264.50 ± 1755.1
	F=0.31, p=0.0908	F=1.09, p=0.375	F=0.47, p=0.795	F=1.80, p=0.210
Sex				
Male	2795.44 ± 446.4	1846.08 ± 395.72	667.61 ± 560.20	3787.78 ± 807.50
Female	2852.17 ± 475.7	2656.78 ± 450.09	1289.25 ± 890.87	3434.96 ± 1013.40
	F=0.01, p=0.931	F=1.83, p=0.181	F=0.42, p=0.531	F=0.07, p=0.792
Age class*Sex	F= 0.40 p= 0.847	F=1.18 p=0.327	F=1.22 p= 0.362	F=1.35 p=0.329

The monthly reinfection rate was obtained using the known values of Y (young worm positive rate) and 'N' (2 or 4 months). The monthly re-infection rates in the two communities were thus obtained, while their mathematical mean was calculated for the entire study area.

RESULTS

The prevalence and intensity of Ascariasis in the villages are presented in table 1. Prevalence ranged from 96% to 100% while mean intensity (epg), though low, varied from village to village.

Table 2 shows the intensity of infection by age and sex, No significant difference was observed between the age-groups and sexes in all the villages ($p > 0.05$). Also, when the age groups were stratified by sex, no significant difference was found ($P > 0.05$).

The household sizes were in the range of 1-14 persons in Idi-Ori, 1-

Dega-Eruku where the intensity of infection was different between the age group, (children and adult, $P = 0.059$), no significant difference was observed among the different household sizes. Interactions between household size and age-group did not also show any significant difference ($p > 0.05$).

The prevalence of ascariasis by direct worm expulsion was 22.1% in Dega-Eruku, and 36.8% in Idi-Ori, with a mean worm burden of 2.9 and 2.5 respectively. The frequency distribution of the worms was over-dispersed in both communities but the negative binomial parameter, k, showed a more aggregated distribution in Dega-Eruku (0.18) than Idi-Ori (0.38). Adult worms were however longest and heaviest in the latter (35.30cm and 8.55g) than the former (31.50cm and 7.52g).

The young worm positive rates and re-infection rates for Idi-Ori and Dega-Eruku are shown in table 4. The correlation equation between prevalence and monthly re-infection rate was obtained by calculating the value 'N' in the equation $Y = 1-(1-X)^N$ after 2 and 4 months post treatment. The values obtained were 10.73 and 11.83 respectively. The mathematical mean of N was 11.28. The established equation between prevalence and monthly re-infection

the time needed for *A. lumbricoides* infection to attain equilibrium is approximately 11- 12 months after a one-time mass chemotherapy to all residents in these communities.

DISCUSSION

In spite of the high prevalence of ascariasis in the communities studied, intensity was low across all age-groups and sexes. Neither age nor sex was found to be an important factor with regard to both prevalence and intensity of infection, indicating a common pattern of behaviour and susceptibility in all the communities. This is however in contrast with studies of Asaolu *et al.* (1992) in some rural communities elsewhere in southern Nigeria where both prevalence and intensity peaked in the 5-14 year old, while it declined in the older age classes. The present study also supports results of previous investigations with respect to the low levels of worm intensity in Abeokuta area of Ogun State by Mafiana(1995) and Mafiana *et al.*(1998) where mean worm burden were respectively 1.82 and 5.50 as against those of Holland *et al.* (1989) which was 11.20 in Oyo State.

Forester *et al.* (1988), Haswell-Elkins *et al.* (1989) and Asaolu *et al.* (1992) reported that household size was significantly associated with mean worm burden, which we failed to prove in this study. This may be due to the fact that intensity was generally low throughout the communities and hence the difficulties in discriminating particular households. The reason for the low level intensity despite the high prevalence is not known, but could be due to genetic or nutritional or even immunological factors controlling the worm burden in these communities.

By means of chemotherapy and worm recovery, the current prevalence and monthly re-infection rates were determined in two of the communities, which were the largest of the four. Re-infection was assumed in persons harbouring young worms, which indicate new infections after previous treatments. The equation obtained was $Y = 1-(1-X)^{11.28}$. This indicates that, using a drug with the efficacy of levamisole for mass chemotherapy, the prevalence of infection observed in this study would be attained after about 11-12 months. Chai (1983) in his study obtained a lower equilibrium state of 7-8 months in Korean villages. Whereas prevalence was high in both studies, mean intensity was much lower in the present study. This may have impacted on the re-infection rate by increasing the time required to achieve pre-treatment prevalence. Chai (1983) also speculated that the period 7-8 months may be related to the average life span of the worm. However, Chandler and Reed (1981) reported the life span of *Ascaris* to be some where between 9-12 months, but up to 18 months by Brown and Nera (1983).

From the information obtained in this study that theoretically, it

Table 3: Intensity (± SEM) of *Ascaris lumbricoides* in relation to household size and age class.

	Idi-Ori	Dega Eruku	Akiode	Ika Ajibefun
Household size				
1 - 5	2920.30 ± 438.81	1411.25 ± 598.0	1012.00 ± 859.08	1597.75 ± 1649.20
6 - 10	2968.00 ± 520.78	2679.13 ± 473.71		3085.35 ± 795.6
> 10	3487.60 ± 855.09	1410.06 ± 391.98	1211.19 ± 522.82	
	F = 0.18	**F = 2.43**	**F = 0.04**	**F = 0.66**
	p = 0.835	**p = 0.096**	**p = 0.845**	**p = 0.428**
Age class				
1 - 15years	3174.30 ± 499.61	1284.21 ± 479.80	654.30 ± 839.41	3174.30 ± 499.61
> 15	3076.20 ± 530.54	2382.00 ± 312.05	827.83 ± 787.12	3076.20 ± 530.54
	F = 0.02, p=0.893	**F = 3.69, p=0.59**	**F = 0.07, p=0.799**	**F=1.85, p=0.191**
Household size* Age group	F = 1.73	F = 1.51	F = 1.93	F = 0.15
	p = 0.183	p = 0.228	p = 0.180	p = 0.706

Table 4: Monthly re-infection rates of *Ascaris lumbricoides* in the study area.

Village	No. Examined	Worm positive Cases (%)	Young worm postive cases (%)	Re-infection rate (%)	N
Idi-Ori	95	35 (36.8)	7(7.4	3.8	11.83
Dega-Eruku	68	15 (22.1)	6(8.8)	2.3	10.73

$\bar{X} = 11.28$

would take about 11-12 months to achieve pre-treatment prevalence, a control programme adopting a sustained six monthly mass chemotherapy would significantly reduce the prevalence of ascariasis in the communities studied. It is however necessary to point out that the observations of this study may not hold true for communities with very high intensity levels. Large-scale re-infection studies are therefore advocated in different parts of Nigeria in order to determine a nationally acceptable programme for mass chemotherapy.

ACKNOWLEDGMENT

We thank the Chiefs and people of Idi-Ori, Dega-Eruku, Ika-Ajibefun and Akiode communities for their co-operation during the study.

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