Helminthic reduction with albendazole among school children in riverine communities of Nigeria

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Abstract

The objective of this study is to report the prevalence and reduction in geohelminthic infection among Primary School children living in riverine communities of Delta State, Nigeria.

Stool samples from randomly selected Primary School pupils were obtained before and after treatment with a single 200 mg dose of albendazole. The Kato-Katz method was used in the processing of the stool specimens as well as the quantification of infection. Very brief information on hygienic practices and environmental sanitation practices were obtained from the children, Teachers, Health Officer, parents etc through questionnaires, in-depth interview and Focus Group Discussions.

In riverine communities of Warri North Local Government Area of Delta State, Nigeria, 697 (77%) of the school children studied were infected with intestinal helminthes. *Trichuris trichiura* infection occurred more (57%) followed by *Ascaris lumbricoides* (54%) and Hookworm (5%). Multiple helminthic infections were recorded, with *Ascaris-Trichuris* having the highest prevalence among the children. The low level of environmental sanitation, personal hygiene, absence of potable drinking water, and lack of awareness of the effect of nematode infection generally were identified as possible reasons for the high rate of infectivity. Post-treatment intervention with albendazole brought about reductions in the infectivity level of *Trichuris trichiura* to 25.4%, *Ascaris lumbricoides* (2.5%) and Hookworm (1.8%). Estimated rate of reduction was 95.6%, 64% and 56.1% for *Ascaris lumbricoides*, Hookworm and *Trichuris trichiura* respectively. All the teachers interviewed expressed their willingness to participate in regular de-worming programmes in their schools.

The 77% prevalence of intestinal geohelminthiasis before deworming the children with albendazole was reduced to 34% post-treatment. Regular deworming of members of this community will reduce infectivity with geohelminthes and thus the consequences especially in children. Though the relationship between hygienic and sanitation practices were not properly investigated, provision of toilet facilities, hand wash after using the toilet and before eating will be useful. In addition, the availability of potable water for utility purpose and mobilization with health education messages on the good hygienic practices will be useful. The willingness of the Primary School Teachers to participate in future deworming programmes is an impetus to the establishment of sustainable and regular deworming programme in the community.

Keywords: helminthiasis, deworming, *Ascaris.trichuris*, hookworm, chemotherapy, albendazole, control

Introduction

Intestinal parasites, notably the helminthes, are among the most common infection of school-age children where they cause morbidity in developing countries. The worldwide prevalence of these worms ranges from 1.0 to 1.5 x 10^9 (Watkins et al 1996) and they are of immense public health concern (Savioli et al 1992). Indeed, the World Health Organization (WHO) reported that more than 3 billion people are infected with intestinal parasites (WHO 1996).

The morbidity caused by helminths include: nutritional deficiency, intestinal obstruction, prostrating anaemia, chronic dysentery, rectal prolapse, respiratory complications, poor weight gain, retarded growth and mental retardation (Bundy 1994; Chan et al 1994). Paediatric intestinal obstruction due to ascariasis is reported to occur in 5% to 35% of all cases in a comparison of studies conducted throughout the tropics (Pawlowski and Davies 1989), while rectal prolapse due to Trichuriasis occurred in nearly 4% of children studied in the West Indies (Bundy and Cooper 1989). Clinical diseases associated with nematode infection are estimated at 3.5 million cases (WHO 1987).

The insidious effects of helminthiasis on nutritional status (Tomkins and Watson 1989; Nesheim, 1989), physical and intellectual development (Stephenson 1987; Cooper et al 1990; Nokes et al 1992) and non-specific symptomatic presentation as seen in *Trichuris colitis*, (Cooper et al 1986), and the magnitude of the burden of geohelminthiasis is grossly underestimated and therefore not given sufficient attention by Health Managers especially at the grass-root (rural) level in developing countries.

Studies in developing countries have shown that de-worming benefits the physical growth and fitness of children by partially reversing the effects of stunted growth (Thein-Hlaing et al 1991; Cooper et al 1992; Adams et al 1994), improves appetite (Stephenson et al 1993ab) and cognitive performance (Nokes et al 1992). In addition, the treatment of children could, in effect, lead to the reduction of infection in untreated adults, simply from a reduction in the number of transmission stages as observed in the field (Bundy 1990).

Reports on geohelminthic infections and control carried out in rural and landed communities abound but sufficient attention has not been given to riverine communities where land space is limited and a hand full of people live islands and on top of shallow waters. This study was conducted in remote, rural and riverine communities where health and environmental facilities and structure are poor, inadequate or altogether lacking. These communities reflect the situation of most remote communities in developing countries where the absence of regular and sustained intervention could be detrimental to the well being of growing children. In addition, we intend to draw attention to the infectivity of geohelminthes in these remote riverine communities and the subsequent reduction in prevalence and infectivity following intervention with albendazole; and to highlight the role School Teachers could play in School-based deworming programmes. We therefore report the reduction in the prevalence of geohelmithic infections using albendazole among school children in riverine communities located in Delta State, Nigeria.

Materials and methods

Study area and population

This study was carried out among primary school children living in riverine communities of Warri-North Local Government Area of Delta State, Nigeria. The communities are located on shallow portions of the Warri River with limited landmass, and are only accessible by boat. The study area covered three major zones, namely: Koko, Timi and Oboro zones. The zones are rural and lack basic infrastructures such as electricity and pipe-borne water, which is seen in semi-urban communities. Majority of the members of these communities engage in fishing and trading. The staffing of the Health Centers is inadequate as many individuals are not attracted to seek employment in these riverine communities. Sometimes, the rivers could be polluted as a result of oil spill from petroleum exploration with a concomitant limitation of the source of water for domestic purpose.

Selection of study participants

Nine-hundred and three (903) school children aged 4 – 16 years were randomly selected from 15 Primary Schools spread across three major zones: Koko, Timi and Oboro zones. A convenient sample method was employed in randomly selecting the 15 Primary Schools of the 42 after listing them according to their various zones and geographical spread. Five Primary Schools where then randomly selected from each zone. Essentially schools with odd numbers from the different areas within the three zones where selected. The same method was used in selecting the school children from the school register. With initial notification of the Ministry of Education on the purpose of the study that included intervention with albendazole, the children were given pre-labelled plastic universal containers for stool collection, after receiving assent from their parents/guardian. Personal hygiene and environmental sanitation information were obtained from the pupils. This was done directly with the children or in-directly through their teachers who were familiar with the local conditions. The Teachers only provided information for about 1% of the children who were too young to answer for themselves. Focus group discussions and in-depth interviews with key informants were conducted with Primary School teachers in the selected schools, Community Leaders, parents of the sampled children and a Public Health Officer.

Pre-treatment stool samples were obtained from the pupils and sent to the laboratory for parasitologic examination. Thereafter, the children were de-wormed with a single 200 mg dose of albendazole tablets, and stool samples were again collected, two weeks post-treatment. Albendazole administration was supervised to ensure compliance. After the collection of the pre-treatment samples from the children, the communities in the three zones were dewormed and post-treatment samples were collected only from the sampled population.

Processing and microscopic examination of faecal samples

Stool samples collected were preserved in formol-saline and transported to the Central Public Health Laboratory for processing and microscopic examination.

The pre- and post treatment stool samples were prepared and examined microscopically using the Kato-Katz quantitative technique for enumeration of worm burden (Martin et al 1968). In addition, the WHO (1987) criteria of estimating the intensity of worm burden based on egg per gram (epg) were applied in the calculation of intensity of infection.

Essentially, the faecal specimen was screened with the aid of a spatula and a screen to separate the faecal materials from debris. The screened faecal material was transferred into the hole in a template that was placed on a microscope slide and levelled to the surface. The template delivers approximately 41.7mg of faeces. A cellophane measuring 27mm that had been soaked in glycerol solution and malachite-green was placed over the specimen. With the faecal material evenly spread under the cellophane an additional drop of glycerol was added and left to stand for thirty hours before microscopic examination.

The obtained data were analysed using the EPI-INFO Statistical Package, Version 6.0. P-values < 0.05 were taken as significant.

Results

The mean age of the children (years) ± SD was 9.12±4.26 (range 4-16 years). This was made up of 580 males (64%) and 323 females (36%). Six hundred and ninety-seven of the 903 children examined (77%) were infected with helminthes which included *Ascaris lumbricoides*, hookworm, and *Trichuris trichiura*. Of the 697 children infected, 437 were males (63%) and 260 (37%) were females. Infectivity in both groups was 75% and 81% respectively for males and females ($p>0.05$).

In general, the worm burden in the pre-treatment examination was significantly reduced at the post-treatment evaluation (Table 1). Pre-treatment prevalence was 77% while post-treatment prevalence was 237 (34%). The estimated reduction rate was 95.6% for *Ascaris*, 64% for Hookworm and 56.1% for *Trichuris* ($p<0.05$). Dual and multiple rates of infections also differed at both the pre- and post-treatment evaluation (Table 1). *Ascaris-Trichuris* had the highest prevalence of 33.1% while multiple infections with *Trichuris-Ascaris-Hookworm* had the lowest prevalence at the pre-treatment evaluation. Furthermore, the intensity of worm using the WHO (1987) criteria for egg count per gram (epg) estimation showed that a significant proportion of the children (512 [73%]) had egg count of < 5,000 epg compared to those that had > 5,000 epg (185 [27%]). None of the 237 infected children had > 5,000 epg post-treatment.

Responses from administered questionnaires and interviews revealed that in the absence of pollution from oil spills, the main source of household drinking water in the communities was from the river. This same source of water and the bush at the bank of the river also serves as site for their waste disposal in most of the cases. The parents/guardians of 807 (89.7%) of the sampled children were fishermen. The wives and other family members process the harvested fish by drying them. The waterfront serves as fish market that is patronized by traders from distant cities. Generally, 360 (40%) of the sampled children live in homes with some kind of toilet facilities. Others use toilets located on canoes in the river and surrounding bush. Hand wash after using the toilet is practiced by 262 (29%) of the children sampled while 566 (63%) wash their hands before eating.

Mass community de-worming has never been conducted before and only less than 5% of the people had de-wormed themselves in the last four years. The community members were familiar with worms but do not recognize the types and their clinical effects. All the School Teachers involved in the collection of stool specimens in the various communities expressed their willingness to partake in the school health programme on regular de-worming of children in the schools and the community.

Discussion

This study is limited in several aspects especially as we did not investigate the risk factors of geohelminthiasis in this study area. A future study that would span both the rainy and dry seasons; and a detailed behavioural study are planned. Our current report highlights the reduction in the prevalence of geohelminthiasis following a single 200 mg dose of albendazole.

Warri-North Local Government Area of Delta State, Nigeria, consists of predominantly riverine communities that are only accessible by boat or canoe. The poor health infrastructure and the riverine nature of these remote communities were some of the reasons why this study was conducted. Only very few studies, including our earlier study (Oyewole et al 2002) had attempted to report geohelminthiasis in riverine communities.

The 77% prevalence of intestinal helminthes among the School Children in this study underscored the need for community deworming programmes. A study among children under the age of 12 years in an interior town of Guyana reported that the most common intestinal helminth parasite was hookworm (28.2%), followed by *A. lumbricoides* (18.8%) and then *Trichuris trichiura* (14.1%) (Lindo et al 2002). In our study *Trichuris trichiura* was the most common helminthic infection.

Intervention with a single 200 mg dose of Albendazole brought about a significant reduction in the prevalence of intestinal helminthic parasites among the children ($p<0.05$). When compared to our earlier study (Oyewole et al 2002), the reduction rate in the prevalence of *A. lumbricoides* was 94.4% against 95.6% obtained in this study; 90.2% against 64% for hookworm; and 56.1% against 49.7% for *Trichuris*. The general prevalence of intestinal helminthiasis of 77% in this study is lower than the 94% reported in our previous study reported in 2002 (Oyewole et al 2002 while the existing health, environmental sanitation and hygiene situation were the same. We did not compare the burden of the intestinal worm, as this was not our focus in this study. A recent evaluation of prevalence and risk factors for protozoan and nematode infections among children in an Ecuadorian community showed that one of the risk factors for *A. lumbricoides* infections in children in Santa Ana community was length of time since last antiparasitic treatment (Rinne et al 2005). The authors of the Ecuadorian study reported that infection rates for these parasites were higher for children who had not been recently treated, emphasizing the importance of laboratory diagnosis and treatment of children as vital part of helminthiasis control programme. Ironically, the same Ecuadorian study reported no association between the presence of a latrine or toilet system and the prevalence of parasitic infections. They also found that the source of drinking water was not related to the risk of any infection (Rinne et al 2005). Association between intestinal parasitoses and the absence of toilet facilities and the source of drinking water has been reported in previous studies (Manun'ebo et al 1994; Olsen et al 2001). Our study, however, did not fully study the association between the prevalence of geohelminthes and the source of drinking water and the toilet systems but noted the absence of toilet facilities in the homes of some of the sampled children, defecation around the river areas that were proximal to areas where fish and other food materials are prepared.

The poor perception about the clinical significance of intestinal geohelminthiasis and therefore not recognized as important, especially in children, attest to the insidious nature of the infections (Nesheim 1989; Tomkins and Watson 1989). It is worth mentioning that geohelminthiases are non-specific and only few people present in Health Posts with complaints. A prospective study on *Trichuris colitis* showed that only 2% of cases observed in the community had self-presented to the local health services (Cooper et al 1986). Inadequate food intake and repeated infections have been recognized as two crucial factors contributing to the poor health and nutritional status of children in communities who cannot meet the basic needs for food, housing, clean water supplies, and good sanitary systems with good environmental and health care. It has therefore been generally assumed that the nutritional status of children reflects indirectly the integrative effects of the quality of life of the whole community (Shetty et al 1994).

In the light of shortage of health personnel, the willingness of the school teachers to be involved in regular de-worming of the children can be exploited by the Ministry of Health to partner with the schools. With minimum supervision, de-worming of the students can be carried out while also opening the channel for the control of other parasitic diseases such as onchocerciasis and schistosomiasis. School-based delivery of anthelminthics have been established and evaluated in Ghana and Tanzania (Brook et al 2001). In this study, 96% of the teachers in Ghana and 98% in Tanzania were positive about their role in the programme including administration of anthelminthic drugs, and parents and children fully accepted the roles that they were expected to play.

The reduction of the prevalence of geohelminthic infection following chemotherapeutic intervention with albendazole is likely to have a positive health out-come on the general health of the children if regular mass deworming programme is instituted. In addition, a two dose 200mg regimen of albendazole is likely to eliminate the worms completely. Given the long time it takes for government to put the appropriate primary health care infrastructure in place with the right personnel, mass de-worming still stands as a feasible intervention in the control and prevention of geohelminthiasis in these riverine communities.

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References

Adams EJ., Stephenson LS, Latham MC, Kinoti SN (1994). Physical activity of growth of Kenyan School Children with hookworm, *Trichuris trichiura* and *Ascaris lumbricoides* infections are improved after treatment with albendazole. Journal of Nutrition 124: 1199 – 1206.

Brook S, Marriot H, Hall A, Adjei E, Allan E, C. Maier., Bundy DAP, Drake LJ, Coombes MD, Azene G, Landsdown RG, Wen ST, Dzodozmenyo M, Cobbinah J, Obro N, Kihamia CM, Issae W, Mwanri L, Mweta MR, Mwaikemwa A, Salimu M, Ntimbwa P, Kiwelu A, Turuka A, Knungu DR, Magingo A. (2001). Community perception of school-based delivery of anthelminths in Ghana and Tanzania. Tropical Medicine and International Health. 6(12): 1075-1083.

Bundy DAP, Cooper ES. (1989). *Trichuris* and trichuriasis in humans. Advances in Parasitology 28: 107 – 173.

Bundy DAP. (1990). New initiative in helminth control. Transactions of the Royal Society of Tropical Medicine and Hygiene 84: 467 – 468.

Bundy DAP. (1994). The global burden of intestinal nematode disease. Transactions of the Royal Society of Tropical Medicine and Hygiene 88: 259 – 261.

Chan MS, Medley GF, Jamison D, Bundy DAP. (1994). The evaluation of potential global morbidity attributable to intestinal nematode infections. Parasitology 109: 373-387.

Cooper ES, Bundy DAP, Henry FJ. (1986). Chronic dysentery, stunting, and whipworm infestation. Lancet ii: 280 – 281.

Cooper ES, Bundy DAP, MacDonald TT, Golden MHN. (1990). Growth suppression in the *Trichuris* dysentery syndrome. European Journal of Clinical Nutrition. 44*:* 285 – 291.

Cooper ES, Whyte-Alleng CAM, Finzi-Smith JS, MacDonald TT (1992). Intestinal nematode infections in children: the pathophysiological price paid. Parasitology 104:S91 – S103.

Lindo JF, Validum L, Ager, A, Campa, A, Cuardrado RR, Cummings R, Palmer CJ. (2002). Intestinal parasites among young children in the interior Guyana. West Indian Medical.Journal 15(1*)*: 25 – 27.

Manun'ebo MN, Haggerty PA, Kalengaie M, Ashworth A, Kirkwood, BR (1994). Influences of demographic, socio-economic and environmental variables on child hood diarrhea in rural area of Zaire. Journal of Tropical Medicine and Hygiene 97: 31-38.

Martin LK and Beaver PC. (1968). Evaluation of Kato thick-smear technique for quantitative diagnosis of helminth infection. American Journal of Tropical Hygiene 17: 382 - 391.

Nesheim MC (1989). Ascariasis and human nutrition. In Ascariasis and its Prevention and Control (ed. Crompton, DWT., Nesheim, MC and Powlowski, ZS), pp. 87 – 100. London: Taylor and Francis.

Nokes C, Grantham-McGregor SM, Sawyer AW, Cooper ES, Robinson S, Bundy DAP. (1992). Moderate to heavy infections of *Trichuris trichiura* affect cognitive function in Jamaican school children. Parasitology 104: 539 – 547.

Olsen A, Samuelsen H, Onyango-Ouma W. (2001). A study of risk factors for intestinal helminth infections using epidemiological and anthropological approaches. *J.* Bioscience*.* 33: 569 – 584.

Oyewole F, Ariyo F, Sanyaolu A, Oyibo WA, Faweya T, Monye P, Ukpong M, Okoro C. (2002). Intestinal helminthiasis and their control with albendazole among primary school children in riverine communities of Ondo State, Nigeria. Southeast Asian Journal of Tropical Medicine and Public Health. 33(2): 214 – 217.

Pawlowski ZS, Davies A. (1989). Morbidity and mortality in ascariasis. In: *Ascariasis and its prevention and Control*, Cropmton DWT, Nesheim MC and Pawlowski ZS (editors). London: Taylor and Francis.

Rinne S, Rodas EJ, Galer-Unti R, Glicman, N, Glickman LT. (2005). Prevalence and Risk factors for protozoan and nematode infect ions among children in an Ecuadorian highland community. Transactions of the Royal Society of Tropical Medicine and Hygiene. 99: 585 – 592.

Savioli, L, Bundy DAP, Tomkins AM. (1992). Intestinal parasitic infections: a soluble public health problem. Transactions of the Royal Society of Tropical Medicine and Hygiene. 86*: 353 – 354.*

Shetty PS, James WPT, Farro-Luzzi A. (1994). Malnutrition in the community: recent concepts. Transactions of the Royal Society of Tropical Medicine and Hygiene 88: 612 – 614.

Stephenson LS (1987). Impact of Helminthic Infections on Human Nutrition: Schistosomes and Soil Transmitted Helminths. New York: Taylor & Francis.

Stephenson LS, Latham MC, Kinoti SN, Kurz KM, Brigham H (1990). Improvements in physical fitness of Kenyan schoolboys infected with hookworm, *Trichuris trichiura* and *Ascaris lumbricoides* following a single dose of albendazole. Transactions of the Royal Society Tropical Medicine and Hygiene 84: 277 – 282.

Stephenson LS, Latham MC Adams EJ, Kinoti SN, Pertet A. (1993a). Weight gain of Kenyan schoolboys infected with hookworm, *Trichuris trichiura* and *Ascaris lumbricoides* is improved following once- or twice- yearly treatment with albendazole. Journal of Nutrition. 123: 656 – 665.

Stephenson, LS, Latham MC, Adams EJ, Kinoti SN, Pertet A. (1993b). Physical fitness, growth and appetite of Kenyan schoolboys infected with hookworm, *Trichuris trichiura* and *Ascaris lumbricoides* are improved four months after a single dose of albendazole. Journal of Nutrition. 123:1036 – 1046.

Thein-Hlaing H, Toe T, Lay-Kyn, M and Lwin, M (1991). A controlled chemotherapeutic intervention trial on the relationship between *Ascaris lumbricoides* infection and malnutrition in children. Transactions of the Royal Society of Tropical Medicine and Hygiene 85: 523 – 528.

Tomkins A, Watson F. (1989). Malnutrition and Infection: A Review. United Nations: ACC/SCN.

Watkins WE, Cruz JR, Pollit E. (1996). The effects of de-worming on indicators of school performance in Guatemala. Transactions of the Royal Society of Tropical Medicine and Hygiene 90: 156 – 161.

WHO (1987). *Prevention and Control of Intestinal Parasitic Infections*. Geneva. World Health Organization, Technical Report Series, No. 749.

WHO (1996). Fighting Disease, Fostering Development. World Health Organization, Geneva.