A review of intestinal helminthiasis in Nigeria and the need for school-based intervention

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Abstract

Nigeria is the most populous country in Africa. This huge population, coupled with the absence of basic social amenities, auspicious climatic environment, and weak public health infrastructure favour the transmission of soil-transmitted helminths (STHs). This paper reviews the prevalence of soil-transmitted helminthic infections in Nigeria and current control efforts.

An electronic search of PUBMED and other bibliographic databases and hand search of published literature was conducted, and all relevant articles were retrieved. After excluding duplicate studies, 48 articles and 5 reports were retained for this review.

Intestinal helminth infections (*Ascaris*, *Trichuris* and hookworm) in Nigeria remain as prevalent as they were in the 1970s. Majority of those affected are young children between the ages of 5 and 14 years living in rural areas and urban slums. Cultural, socio-economic and environmental factors are major contributors to the persistence of these infections.

Although the World Health Organization (WHO) recommends chemotherapy for *Ascaris*, *Trichuris* and hookworm infections targeted at school-age children as a feasible and cost-effective control strategy, there is no policy-backed approach for helminth control in Nigeria. This paper makes a case for regular school-based programs to deliver chemotherapy so as to reduce the burden of helminth infection in school-age children in Nigeria.

Keywords: Nigeria, intestinal helminthiasis, epidemiologic trends, school-based helminth control

Introduction

Parasitic worms are among the most common cause of chronic infection in humans; in developing countries it is more common to be infected than not (Awasthi et al 2003). Infection thrives and persists in communities in need of better housing, clean water, appropriate sanitation, better access to health care, education and increased personal earnings (Crompton 1999). This is typical of most rural communities and urban slums in Nigeria. Children growing up in these communities can expect to be infected soon after weaning, and to be infected and re-infected constantly for the rest of their life (Awasthi et al 2003). Helminth infection is a major cause of disease burden among children in developing countries (World Bank 1993), especially in sub-Saharan Africa. This high infestation mirrors severe shortage in health care, education, transport, and chronic poverty (Crompton 1999).

Following improvements in child survival, and the constant increase in the proportion of children living beyond the age of five in many developing countries, attention is now focused on the health of school-age children (Bundy and Guyatt 1995). At the same time, the increase in the level of school attendance in recent years in many developing countries has facilitated the delivery of school-based nutrition and health services, providing an excellent cost-effective opportunity for educational, economic and developmental gains (Del Rosso and Marek 1996).

In many developing countries, the only education children receive is in primary school, and this is the age when they are more frequently and more severely infected by helminths. These infections could thwart the efforts of a country to provide basic school education (PCD 1997); especially in a country like Nigeria where only 70% of school-aged children are enrolled in primary school (Ola and Oyeledun 1999).

There is a growing body of evidence that school-based health services such as treatment of schistosomiasis and intestinal nematode infections can be delivered at low cost (World Bank 1993; PCD 1997) and can contribute to improving children's general well-being, growth (Stephenson et al 1989; Stoltzfus et al 1998), nutritional status (Stephenson et al 1993; Beasley et al 2000), cognitive ability (Drake and Bundy 2001), and school attendance (Simeon et al 1995). This article is based on literature search and information from available data on soil transmitted helminths (STH) in Nigeria. It seeks to review current trend of infection, the cultural, socio-economic and environmental factors contributing to their prevalence and needed efforts for control.

Methods

Information for this review came from a comprehensive search of titles related to intestinal helminthiasis in Nigeria using PUBMED and other bibliographic databases conducted between January and April 2006, using the key words “Nigeria”, “intestinal helminthiasis”, “soil-transmitted helminths”, “epidemiologic trends”, “chemotherapy” and “school-based control”. The abstracts of relevant articles and full articles available on line were accessed. Full texts were then obtained from hand search of journals held in stock by the Lister Hill Library of the Health Sciences at the University of Alabama at Birmingham. Further searches were conducted based on links from the articles cited and was limited to publications from 1976 to 2006. Relevant websites such as that of the World Health Organization (WHO), United Nations Children Emergency Fund (UNICEF), were also searched. Information was also obtained from websites related to relevant agencies in Nigeria like the Federal Ministry of Health, Federal Ministry of Education and the National Population Commission.

Results

After excluding duplicate studies, 48 articles and 5 reports were retained for this review. Selected cited articles on prevalence studies were summarized in Table 1.

Table 1: Prevalence estimates of intestinal helminthic infections in Nigeria, 1976-2006

Author/Reference #	Geographical area	Sample size	Sample setting	Parasites	Prevalence (%)	Comments
Obiamiwe BA. 1977 (31)	Benin, Edo state	6,213	urban	Hookworm *Ascaris* *Trichuris*	16.9 19.5 5.9	Infection due to poor disposal of human excreta
Nwosu AB. 1981 (30)	Ovoko and Isienu, Enugu state	6,842	rural	Hookworm *Ascaris* *Trichuris*	71.1 20.6 7.9	Infection highest in children and during the raining season
Ejezie GC. 1981 (22)	Lagos, Lagos state	5,595	urban	Hookworm *Ascaris* *Trichuris*	29.5 74.2 75.8	Multiple infections observed. Infection due to inadequate health education
Ayanwale FO, et al. 1982 (10)	Ibadan, Oyo state	478	urban	Hookworm *Ascaris* *Trichuris*	46.0 70.0 4.0	Need to resuscitate the public sanitary inspector’s act advocated
Adeyeba OA. 1984 (3)	Iwo, Osun state	283	rural	Hookworm *Ascaris* *Trichuris*	18.4 39.9 21.9	Mixed infection observed, health education on personal hygiene
Arene FO. 1984 (6)	Okrika, Rivers state	396	rural	Hookworm *Ascaris* *Trichuris*	36.0 11.0 4.0	Infection highest in children 5-9 years old. Low public and personal hygiene
Alakija W. 1986 (5)	Iruekpen, Edo state	1,166	rural	Hookworm *Ascaris* *Trichuris*	9.2 10.8 1.7	Health education and provision of toilet facilities suggested
Adekunle LV, et al. 1986 (2)	Ibadan, Oyo state	1,273	urban	Hookworm *Ascaris* *Trichuris*	26.5 39.0 28.4	Intestinal parasites highly correlated with the occupation of parents
Reinthaler FF, et al. 1988 (36)	Abeokuta, Ogun state	479	urban	Hookworm *Ascaris* *Trichuris*	19.2 40.0 23.2	Children mostly affected
Akogun OB. 1989 (4)	Gumau, Bauchi state	1,037	rural	Hookworm *Ascaris* *Trichuris*	4.4 22.5 1.5	The prevalence of Ascaris has not changed in the past 52 years
Holland CV, et al. 1989 (26)	Ile-Ife, Osun state	766	urban	Hookworm *Ascaris* *Trichuris*	33.1 88.5 84.5	Intestinal helminthiasis are common infections in

						this area
Adedoyin MA, et al. 1990 (1)	Ilorin, Kwara state	907	urban	Hookworm *Ascaris* *Trichuris*	10.2 40.9 27.0	Egg load was higher among diarrheal than in non-diarrheal group
Obiamiwe BA, et al. 1991 (32)	Benin, Edo state	862	urban and rural	Hookworm *Ascaris* *Trichuris*	29.4 38.2 27.3	Infection occur more in children in the first two decades of life
Asaolu SO, et al. 1992 (8)	Ile-Ife, Oyo state	1,434	rural villages	Hookworm *Ascaris* *Trichuris*	52.4-63 61.5-72.2 65-74	Host age, sex, and household size were found to be significant factors for infection
Udonsi JK, et al. 1993 (48)	Port Harcourt, Rivers state	5,451	rural	Hookworm *Ascaris* *Trichuris*	31.4 49.3 40.7	Mass expulsion campaign using primary health care effective
Enekwechi LC, et al. 1994 (23)	Nimo, Anambra state	1,536	rural	Hookworm *Ascaris* *Trichuris*	13.0 20.8 15.3	Infection were more prevalent in children (10-12 years)
Arinola O, et al. 1995 (7)	Iroko, Oyo state	470	rural	Hookworm *Ascaris* *Trichuris*	14.8 49.4 15.8	Helminth infection is still rampant in Nigeria
Udonsi JK, et al. 1996 (49)	Port Harcourt, Rivers state	300	urban	Hookworm *Ascaris* *Trichuris*	42.7 54.0 43.7	Peak prevalence of Ascaris in those ≤9 years, others 15-19 years
Nwaorgu OC, et al. 1998 (29)	Ishielu Amagunze, Enugu state	704	rural	Hookworm *Ascaris* *Trichuris*	32.4 22.9 2.5	School-based helminth control recommended
Ozumba CC, et al. 2002 (35)	Enugu, Enugu state	13,385	urban	Hookworm *Ascaris* *Trichuris*	14.3 7.4 2.2	Helminth infections related to level of environmental sanitation, socio-economic status and water supply
Wagbatsoma VA, et al. 2005 (51)	Benin City, Edo state	207	urban	Hookworm *Ascaris* *Trichuris*	5.8 11.1 3.8%	Improvement in female education will reduce the incidence of communicable diseases in the family

Discussion

Epidemiology of soil-transmitted helminthic infections in Nigeria

Reported prevalence studies of soil transmitted helminths since the 1970s have indicated that the triad of *Ascaris lumbricoides*, *Trichuris trichiura*, and the hookworm species are common infections in Nigeria (Table 1). It has been reported that the prevalence of these parasites especially *Ascaris* has not changed in the past 50 years (Akogun 1989), and poly-parasitism with these nematodes is also a common occurrence (Ayanwale et al 1982; Arene 1984).

Most authors commented on the unhygienic and common practice of people defecating indiscriminately or dumping excrement at refuse depots, nearby bushes, underneath bridges, along bush tracks, motor highways, river banks and even on open fields in the 1980s (Nwosu 1981; Adeyeba and Dipeolu 1984). Unfortunately, the situation has not changed much, as there has been little success in the introduction of latrines to rural Nigeria (Holland and Asaolu 1990). Many houses lack lavatory facilities and public latrines are scarce (Nwosu 1981; Adeyeba and Dipeolu 1984). The drainage systems in most cities don't function effectively, and are often blocked by refuse which leads to widespread dispersal of ova and larvae of these helminths especially during the raining season (Obiamiwe 1977; Obiamiwe and Nmorsi 1991). Nwosu's findings indicated a high degree of contamination with human faeces in the rural environment (Nwosu 1981). In the urban environment a survey of faecal samples collected from playgrounds, markets, motor parks, residential and recreational areas revealed that 96.3% of the samples contained ova of *Ascaris lumbricoides* (Fashuyi 1983). These natural playgrounds have been reported as a major source of infection for children (Akogun 1989; Umeche 1989). Low level of education and poor socio-economic status of parents has been associated with helminthic infection in children (Nwosu 1981; Ayanwale et al 1982). In Nigeria, helminthic infections are still a disease of poverty, as there exist a strong correlation between parental socio-economic status and intestinal parasitosis in children. Adekunle et al (1986), found a higher prevalence of helminthic infections in children whose parents are unemployed or are petty traders, compared to children of professionals and middle class workers.

Some cultural practices favour spread of infection. The use of water for cleaning after defecation, and communal feeding from a common bowl in open street yard, a usual practice in some rural areas, may also account for a high prevalence of soil transmitted helminthes (Akogun 1989). Meals are often exposed to the wind, insects and domestic animals which may contaminate food with helminth ova while participants in the communal dinner are awaited. Majority of the country is warm and moist for most of the year creating a good environment for the parasites to develop all year round (Obiamiwe 1977; Ayanwale et al 1982; Reinthaler et al 1988).

The bulk of worm burden in most studies has been harboured by children 5-14 years old (Nwosu 1981; Adeyeba and Dipeolu 1984; Adekunle et al 1986; Udonsi and Ogan 1993; Arinola and Fawole 1995), but hookworm infection persists in older adults especially in farming communities (Arene 1984; Arinola and Fawole 1995). The preponderance of infection in school age children (5-14 year olds) makes this subgroup a good target for helminth control in the general population. In addition, schools provide a good opportunity for implementation (The Partnership for Child Development 1997).

The health consequences of helminthiasis in school-aged children

Many children in resource limited settings underachieve and never realize their full potential. The aetiology of this underachievement is complex (Drake and Bundy 2001), and a cause and effect relationship has been difficult to prove (de Silva 2003). However, there has been growing recognition of the specific deleterious effects of helminth infections upon both physical and intellectual development (Drake and Bundy 2001).

It is the intensity of infection that is the central determinant of the severity of morbidity (Cooper and Bundy 1988; Roche and Layrisse 1966), but clinical consequences of infection can manifest at much lower worm burdens than previously thought (Drake and Bundy 2001). Poly-parasitism significantly exacerbates morbidity (Ayanwale et al 1982; Adeyeba and Dipeolu 1984). In some species and regions, people with multiple infections are more common than those with either no infection or a single infection (Drake and Bundy 2001).

By far the most common effect on health is a subtle and insidious constraint on normal physical development, resulting in children failing to achieve their genetic potential for growth and suffering from the clinical consequences of iron deficiency anaemia and other nutritional consequences (Drake and Bundy 2001). Hookworm infestation has been recognized as an important cause of iron deficiency anaemia for decades (Roche and Layrisse 1966). Intense whipworm infection in children may result in Trichuris dysentery syndrome, the classical signs of which include growth retardation and anaemia (O'Lorcain and Holland 2000). Heavy burdens of both round worm and whip worm are associated with protein energy malnutrition (Stephenson et al 1993).

The global public health importance of hookworm disease, ascariasis and trichuriasis has been comprehensively reviewed (Cooper and Bundy 1988; Roche and Layrisse 1966; O'Lorcain and Holland 2000; Stephenson et al 2000; Crompton 2000). The disability-adjusted life-years (DALYs) lost to STHs is enormous in comparison with other infections (Chan 1997). A major reason such high DALY values were attributed to STHs stemmed from the linkage of hookworm to anaemia, ascariasis to growth stunting and trichuriasis to decreased school performance (Savioli et al 2004). By treating only school children in high prevalence communities, it is estimated that 70% of the total burden due to soil-transmitted helminthes can be prevented (Asaolu and Ofoezie 2003).

Our literature search did not reveal any documented study of the nutritional impact of helminthial infection in Nigerian children. However, a study from Kenya showed significant improvement in weight gain and skin fold thickness of children with round worm infestation after treatment, compared to an uninfected group (Stephenson et al 1993), suggesting that anti-helminthic treatment for ascariasis may result in a period of 'catch-up' growth in previously infected children.

There is abundance of evidence from Nigeria that shows that Ascaris is associated with a number of acute complications, including intestinal obstruction, appendicitis and peritonitis (Holland and Asaolu 1990). It is difficult however, to estimate mortality due to helminthiasis in a resource-poor setting like Nigeria, because of widespread self-medication (Ayanwale et al 1982; Akogun 1989; Holland and Asaolu 1990) and weak public health infrastructure. Many deaths still occur outside health facilities without post mortem examination and many cases of morbidity and mortality associated with helminthiasis go unreported (Holland and Asaolu 1990). Worldwide, mortality rates directly due to STH are estimated at 135,000 deaths annually (Savioli et al 2004).

Control strategies and need for school-based intervention

There is no evidence of countrywide control program for helminthiasis in Nigeria as school health services are rudimentary (Holland and Asaolu 1990; Ola and Oyeledun 1999) and currently funding for public health programs are skewed in favour of HIV/AIDS prevention. Researchers in parasite control had over time advocated for improved sanitation and health education to achieve an effective reduction of transmission and intensity (Adeyeba and Dipeolu 1984; Alakija 1986; Nwaorgu et al 1998; Smith et al 2001). Nwosu (1981) specifically emphasized the need to target the younger age groups for health education and behaviour modification in order to reduce environmental contamination with parasite infective stages. It has also been suggested that most heavily infected individuals in a community should be identified and treated over a period of years, especially during the dry season, when transmission conditions are least favourable (Nwosu 1981). These suggestions, if implemented at all, have not achieved much, as the prevalence of helminth infection still remain high across the country (Table 1).

Lately, targeted chemotherapy solely for high risk groups (school-age children) has been advocated and has been found to be highly effective in studies carried out at various sites in the country (Udonsi and Ogan 1993; Nwaorgu et al 1998; Holland et al 1996). Udonsi and Ogan (1993) reported the operational and clinical effectiveness of community-wide mass expulsion campaign using primary health care intervention, but the cost-effectiveness of the intervention was not assessed.

Helminth control using chemotherapy can be introduced at relatively low cost into established health care programs (World Bank 1993; de Silva 2003), and Drake (2001) has suggested school health services as the most feasible. School health programs offer the opportunity to deliver public health interventions to a great number of beneficiaries at a relatively low cost. School-based programs have therefore attracted growing interest by policy makers in developing countries and donor communities (Curtale et al 2003). There is a growing body of evidence that in many developing countries school-based health services such as treatment of intestinal nematode infections can be delivered at low cost (World Bank 1993; PCD 1997; de Silva 2003). For these reasons, de-worming has now become an essential component of school health programs in many developing countries (Savioli et al 1992). School-based programs also reach children who are not enrolled in school, usually the most affected group (Beasley et al 2000), and serve to transmit health education to the whole population.

Recent developments in global helminth control

In 2001, the World Health Assembly set a goal of attaining a minimum target of regular administration of chemotherapy to at least 75% and up to 100% of all school-age children at risk of morbidity by 2010 (WHO 2001). To achieve this global target, the WHO advocated a partnership for parasite control (PPC), involving organizations of the United Nations system, bilateral agencies, non-governmental organizations, and the private sector (PPC 2002). A consensus framework was developed, codenamed FRESH (Focusing Resources on Effective School Health, Hygiene and Nutrition Program) (PPC, 2002). School-based anti-helminth control is simple and inexpensive - costing as little as US$0.03 a dose (PPC 2002). The effectiveness of this approach has been demonstrated in many resource-constrained countries. In 2004, Cambodia became the first country to reach the WHO target by regularly providing antihelminthic drugs to 84% of its school-aged children (WHO 2004). Some countries in Africa like Burkina Faso, Cote d'Ivoire, Mali, Uganda, and Zambia among others are also implementing this program (PPC 2002).

Helminthic infections, neglected in the past, are now back on the public health agenda and their control will have a lasting impact on the health of children in endemic countries (WHO 2001). Nigerian children certainly stand to benefit from this renewed interest in helminthic infection control. It is particularly noteworthy that school-based helminth control programs have been shown to be practicable and well-received at the community level in Nigeria. Nwaorgu et al. (1998) in their study demonstrated that members of the community were willing to contribute to drug purchase and assist with the dissemination of health awareness messages thereby engendering a sense of ownership and ensuring sustainability.

Conclusion

Intestinal helminth infections are still highly prevalent among school-age children in Nigeria and a major cause of morbidity in this age group. Poor personal and environmental hygiene, poverty and favourable climatic conditions are major factors sustaining transmission, but there has not been any policy-backed effort at control. The effectiveness of school-based intervention using chemotherapy at six monthly intervals has been demonstrated to be cost-effective and feasible, in Nigeria and elsewhere. The time is ripe for policy makers in Nigeria to grab the opportunity that school-based programs offer and relieve Nigerian children of the burden of helminthial infection, so that they can achieve their maximum potential.

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