Height as a Substitute for Weight for Estimating Praziquantel Dosage

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Abstract

The study evaluated height and weight measurements of 750 school children from five rural communities in western Nigeria. The measurements were taken by 12 trained community members designated as distributors in determining treatment dose with praziquantel for these children. A very strong correlation value, $r = 0.97$, was obtained for the weight of treated children measured by the distributors and the research team. The distributors obtained a correlation coefficient value of $r = 0.87$ on weight and height measurements, showing that height can be used by community distributors in lieu of weight for correct dose determination.

Introduction

Schistosomiasis affects 200 million people worldwide; about 600 million are at risk of infection, and 4.5 million Disability Adjusted Life Years (DALYs) are lost annually (Morel 2000; WHO 2002).

Schistosomiasis is a public health problem in Nigeria (Cowper 1973; Adekolu-John and Abolarin 1986; Ejezie et al. 1989; Tayo et al. 1989; Mafiana and Adesanya 1994; Mafe et al. 1997). The National Control Programme has been in place for control of the disease since 1988. Despite much data on national disease prevalence, only the data from the 1991 national prevalence survey (Federal Ministry of Health [FMH] 1992) enables comparison of the disease status across the states, because it was based on a uniform methodology nationwide. Currently, there is an ongoing effort to provide a Geographical Information System map to guide disease control and monitoring of intervention (Mafe et al. 2000). The National Control Programme has, however, been supporting some states where schistosomiasis is endemic in controlling the disease through a search-and-treat effort aimed at school children (FMH 1999).

Although children aged 5–19 years are the ones most affected by schistosomiasis (Tayo et al. 1989; Mafiana and Adesanya 1994; Mafe et al. 1997), other groups within the community are also at risk of infection in an endemic area. These vulnerable persons need to be considered in a mass treatment exercise according to World Health Organization (WHO) advocacy (WHO, 2002).

Praziquantel is ideal for mass treatment of schistosomiasis because of its effectiveness against all species in humans, its ease of administration, single oral dose and safety. It has been shown to be easily managed by illiterate community members (Mafe et al. 1997, 2000, 2005). Praziquantel is administered at a dose of 40 or 60 mg/kg body weight, depending on the intensity of infection, and in accordance with the manufacturer's instructions.

Schistosomiasis primarily affects poverty-stricken individuals. There is a dearth of both health facilities and health workers in affected rural communities, and it is essential that drug distribution through a community-based approach be encouraged to ensure that treatment reaches these poor and affected communities.

Given the low literacy levels in most communities in which schistosomiasis is endemic in Nigeria, and that having, replacing and correctly using a weighing scale is unlikely, we need an alternate way of determining drug dosage. The use of height in lieu of weight has been evaluated in some African countries (Montresor et al. 2001, 2005) and found to be a good alternative to weight for praziquantel dose determination. There is therefore a need to adapt this device in schistosomiasis control in Nigeria.

This study evaluated the use of height in lieu of weight by community members trained as distributors in determining dosage of praziquantel for mass treatment in schistosomiasis control in rural communities of Nigeria. It was part of a larger study on identifying appropriate channels of distributing praziquantel to include communities at risk (Mafe et al. 2005).

Study Area

The study was carried out in five communities in which urinary schistosomiasis is endemic, namely Adepegba, Elere Adubi, Imala-Odo, Olapeleke and Imala, in Ogun State, Nigeria. These communities are located in Ewekoro, Odeda and Abeokuta South Local Government Areas of Ogun State, Nigeria. The national prevalence survey on schistosomiasis of 1991 classified Ogun State as hyper-endemic (FMH 1992). Reagent stick testing carried out among school-aged children of 5–19 years old in these communities showed high prevalence rates of 89%, 87.8%, 79.1%, 69.9% and 51.1% for Imala-Odo, Elere Adubi, Adepegba, Olapeleke and Imala, respectively (Mafe et al. 2005).

Methods

The research team is well known to the communities, having conducted previous studies on the disease in the area, with the co-operation of community members. Advocacy visits were made to mobilize the communities for mass treatment of all school-aged children, based on our previous studies.

Community members who were trained by the research team determined the census of the

communities. Two persons chosen by each community, based on ability to read and write and community acceptance, were trained as distributors by the research team. Training focused on the cause, transmission, prevention, treatment, dose determination, benefit of treatment, management of side reactions, drug inventory, exclusion criteria and record keeping. Distributors were taught to determine praziquantel dosage by weight, at 40 mg/kg body weight using a salter scale calibrated in kilograms according to the manufacturer's recommendation, and also to measure (using a dose pole calibrated in centimeters) the height of each treated child. Distributors were also taught to record the name, age, sex and number of tablets given to each child, and the occurrence and type of adverse reactions.

The research team visited the communities 2 weeks after the drug distribution had been completed, traced all the children treated by the distributors and measured their heights and weights using the same calibrated praziquantel dose pole and salter weighing scale. The height and weight measurements determined by the distributors were compared with those determined by the research team to evaluate the accuracy of measurement by the trained distributors and the dose determination.

The relationship between the heights and weights of these children as measured by the distributors was determined using the Pearson statistical test to obtain correlation coefficient values. The number of tablets the distributors administered to the children was compared with what would have been used had dosage been based on height. The data were entered and analyzed using Epi Info software Version 6.04 (Centre for Disease Control and Prevention, Atlanta, Georgia, USA).

The study received approval from the local Ethics Review Board of the Nigerian Institute of Medical Research, Yaba, Lagos, Nigeria.

Table 1. Weight and height measurements of school-aged children by community and sex

Community	Male				Female				Both			
	N	Weight Range (kg)	Height Range (cm)	*r*	*N*	Weight Range (kg)	Height Range (cm)	*r*	*N*	Weight Range (kg)	Height Range (cm)	*r*
Adepegba	25	13–46 (24.25)[a]	94–165.0 (122.60)[b]	0.90	20	15–31 (21.65)	94–199.0 (122.10)	0.08	45	13–46 (23.09)	94–199.0 (122.38)	0.50
Imala-Odo	98	14–75.0 (30.79)	94–179.0 (132.19)	0.94	98	14–65 (28.99)	99–175.0 (130.85)	0.90	196	14–75 (29.88)	94–179.0 (131.52)	0.92
Imala	233	15–53 (28.65)	96–167 (131.79)	0.94	210	15–58 (30.66)	95–198 (135.19)	0.86	443	15–58 (29.60)	95–198.0 (133.40)	0.89
Olapeleke/ Elere-Adubi	35	14–55 (31.17)	97–174 (134.22)	0.92	31	13–52 (25.50)	98–156 (124.87)	0.84	66	13–55 (28.50)	97–174 (129.83)	0.89
All	391	13–75 (29.13)	94–179 (131.52)	0.92	359	13–65 (29.26)	94–199 (132.39)	0.83	750	13–75 (26.0)	94–199.0 (131.93)	0.87

N = number in the population; *r* = coefficient value.
[a] mean weight, [b] mean height.

Results

A total of 750 children, 391 (52.1%) of whom were male and 359 (47.9%) were female, had their weights and heights measured and recorded, and were treated with praziquantel (Table 1). The mean weight and height with corresponding coefficient values are given for each study community. High correlation values were obtained for the communities studied. The poor coefficient value obtained for females for Adepegba is to be further investigated. A very strong correlation value of $r = 0.97$ was obtained for the weights of treated children measured by the distributors and the research team (Figure 1). Similarly, a coefficient value of $r = 0.97$ was obtained for the heights of the school-aged

children measured by the distributors and the research team during evaluation, indicating a strong relationship (Figure 2). A strong value of $r = 0.87$ (Figure 3) was also obtained for the distributors' measurements, indicating a good relationship between weight and height measurement for praziquantel dose determination. In all, 1146 tablets were used to treat the children based on weight measurement, while a total of 1267 tablets would have been needed if dosage had been based on height (Tables 2 and 3). Of 62 children whose ages ranged between 3 and 10 years, 82.3% were aged 5 to 7 years and received 1 tablet. The height measurements of these 62 children ranged between 94 and 109 cm. The WHO praziquantel dose pole (Montresor et al. 2005) is not calibrated to allow for administration of 1 tablet, the minimum being 1½ tablets, and similarly for 3½ tablets; hence the lack of records on these dosages as shown in Table 4. In this study, however, the pole has been calibrated to allow for 1 tablet. The proportion of those treated by tablet category differs for dosages based on height and weight ($p < .05$; $\chi_2 = 120.307$; df = 6).

Table 2. Dosage based on weight of children treated by the distributors and total number of tablets used

Number-of-Tablets Category							Number of Tablets
1	1½	2	2½	3	3½	4	
38	249	20	-	-	-	-	307
-	69	198	20	3	-	4	294
3	3	82	112.5	24	7	5	236.5
-	1.5	2	57.5	87	38.5	12.5	199
-	-	2	-	24	45.5	38	109.5
41	322.5	304	190	138	91	59.5	1146

Table 3. Estimated number of tablets that would have been used by school-aged children based on height measurement by researcher by height category if they had received tablets by height

Height Categories (cm)	Tablets Category	Number of Tablets That Would Have Been Used
94–109	1	62
110–125	1½	312
126–138	2	310
134–150	2½	255
151–160	3	204
161– 70	4	124
Total	**-**	**1267**

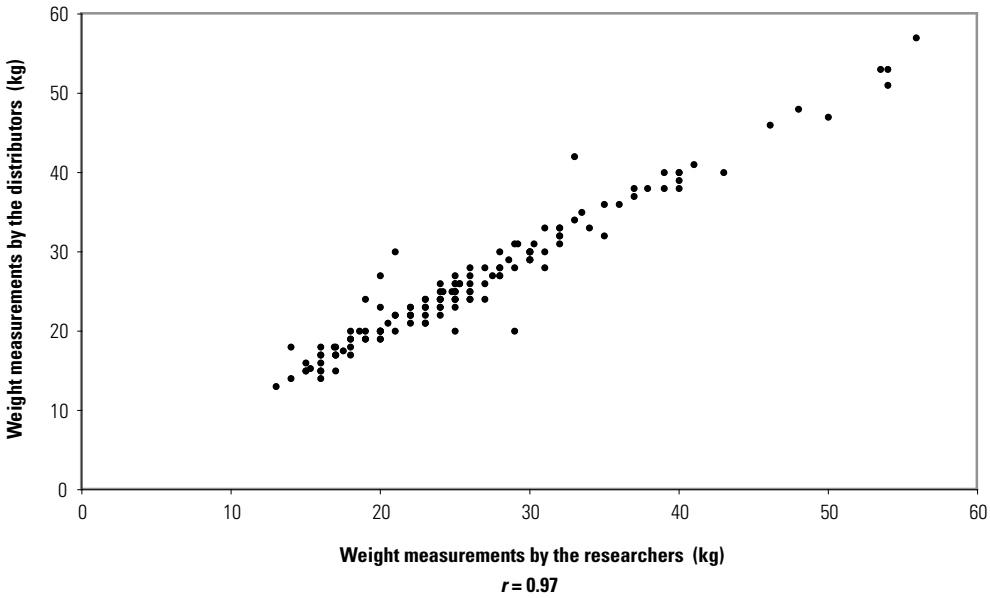
Discussion

The use of weight is the ideal means of dosage determination in drug administration; however, various factors militate against its use appropriately in largely rural communities with a high illiteracy level. This makes the use of height, measured with a calibrated device, a better alternative in such circumstances.

Table 4. Comparison of number of children treated by weight with estimated number of children that would have been treated by height

Number-of-Tablets Category	Number of Children Treated by Weight	Estimated Number of Children That Would Have Been Treated by Height
1	102	-
1½	261	214
2	172	155
2½	92	101
3	62	67
3½	36	-
4	25	27
Total	**750**	**750**

Figure 1. Relationship between measurements of weights of school-aged children by the researchers and distributors



Several means of determining drug dosage have been explored, such as use of mid-upper-arm circumference, estimation based on physical appearance, and age (Alexander et al. 1993; Shu and Okonkwo 2001; Idowu et al. 2003). Some of these, such as age, have been found unsuitable for dose determination (Idowu et al. 2003).

The distributors' measurements of height and weight of the treated individuals are highly reliable based on high correlation values obtained when compared with the research team's measurements during evaluation.

The use of height-measuring devices has been shown to be easily understood and used even by illiterate persons (WHO 1996; Hall et al. 1999; Idowu et al. 2003), and height is widely used globally in annual delivery of ivermectin in onchocerciasis control, for example, in the Ipogun

community, Southwestern Nigeria (Idowu et al. 2003). Hall et al. (1999) also reported height as a reasonably accurate estimate of weight in school children from Ghana, Tanzania and Malawi. The praziquantel dose pole has been adapted in this study to allow for dosage of praziquantel below 1½ tablets to children so qualified, which is within the manufacturer's dose recommendation.

Figure 2. Relationship between height measurements of school-aged children by the researchers and distributors

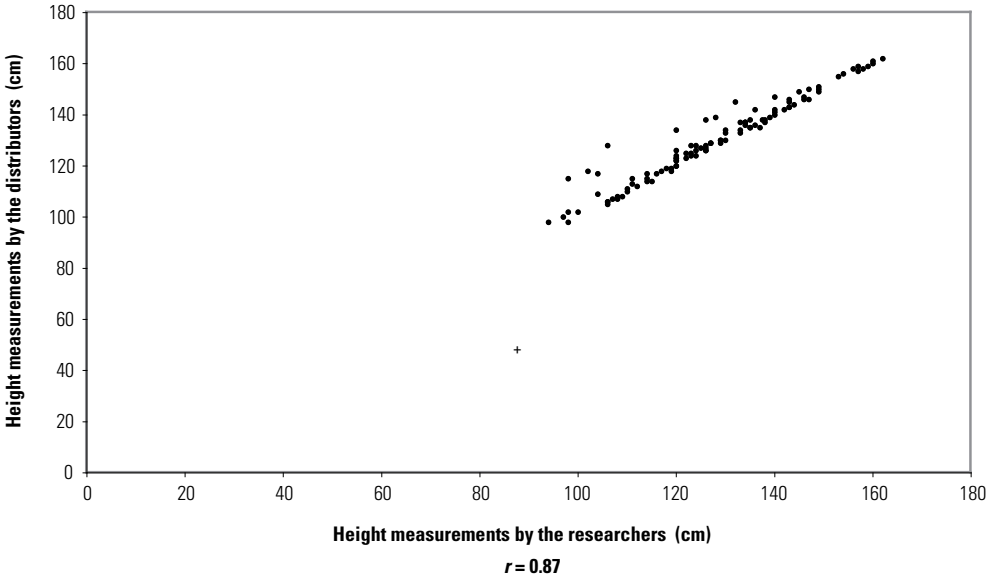
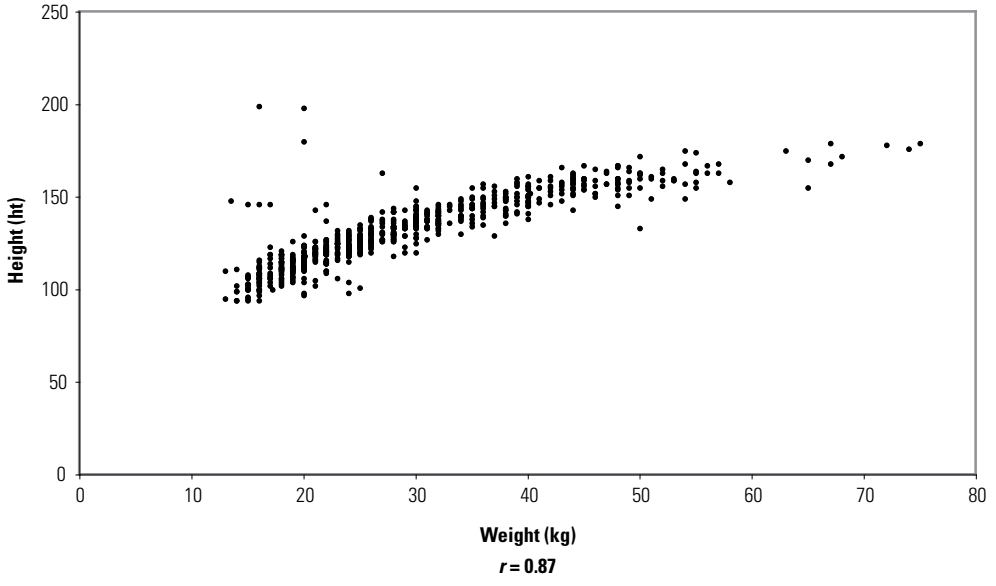


Figure 3. Relationship between weight and height measurements of school-aged children by distributors



We therefore recommend that the praziquantel dose pole be calibrated to administer 1 tablet to children whose height ranges from 94 to 109.9 cm. The use of height in praziquantel administration is user-friendly. The measuring device can be locally sourced, made and replaced. Given the use of a similar device in the delivery of ivermectin in onchocerciasis control programs, the use of height will allow for integration of community-directed health programs that will not only ensure that needy communities are served, but also minimize cost and enable capacity building.

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