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### SCHOOL BASED MASS DE-WORMING INITIATIVE IN SOUTH-WEST NIGERIA

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#### ABSTRACT

**Background:** The public health implications of helminthic infection in developing countries were generally agreed by many researchers to include poor growth and poor school performance among others. But the role of school based mass de-worming in combating the menace of helminthiasis remains controversial. Several studies have assessed the impacts of mass de-worming with conflicting results. This study was designed to evaluate the impact of antihelminthic mass chemotherapy on changes in growth indices and school absenteeism.

**Materials and methods:** Albendazole tablets were administered by school teachers to pupils after data and stool sample collection. Follow up data were collected 6 months later for impact assessment. Ponderal growth retardation was defined as BMI under 5-percentile.

**Results:** Overall helminth infection rate was 373/1442 (39%) of the pupils before the intervention. *Ascaris lumbricoides* (n=247; 25.8%) and hookworm (n=89; 9.3%) were the most common. At enrolment 19.6% of children with and 11.8% without helminth infections had BMI below the 5-percentile. These figures were reduced to 9.2% and 8.8% after de-worming respectively. No effect of de-worming was seen on longitudinal growth. The number of helminth infected children with >25% absenteeism reduced by 12.5%, while the reduction rate was 6.8% in the uninfected group.

**Discussion:** The difference in response to de-worming between infected and uninfected children strongly support the beneficial effect of de-worming on growth and school absenteeism. The intervention could be administered by school teachers without formal healthcare training, thus allowing integration of the programme into existing structures.

**Keywords:** Helminthes, Absenteeism, Preventive Chemotherapy.

### ÉCOLE EN FONCTION DE MASSE DES VERMIFUGES INITIATIVE DANS LE SUD-OUEST DU NIGÉRIA

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#### ABSTRAIT

Les implications de santé publique de l'infection à helminthe dans les pays en développement ont été généralement acceptées par de nombreux chercheurs d'inclure une croissance médiocre et mauvais résultats scolaires entre autres. Mais le rôle de l'école base massive des vermifuges dans la lutte contre la menace de l'helminthiase reste controversée. Plusieurs études ont évalué les effets de masse des vermifuges avec des résultats contradictoires. Cette étude visait à évaluer l'impact des antihelminthiques chimiothérapie massive sur l'évolution des indices de croissance et de l'absentéisme scolaire.

**Matériels et méthodes :** Albendazole comprimés ont été administrés par les enseignants de l'école aux élèves après prélèvement de données ou de selles. Suivi de données ont été recueillies à 6 mois plus tard pour l'évaluation de l'impact. Retard de croissance pondérale a été défini comme IMC sous 5 percentile.

**Résultats :** Dans l'ensemble le taux d'infection de helminthes était 373/1442 (39 %) des élèves avant l'intervention. *Ascaris lumbricoides* (n = 247 ; 25,8 %) et l'ankylostome (n = 89 ; 9,3 %) étaient les plus fréquentes. Lors de son inscription, 19,6 % des enfants atteints et 11,8 % sans helminthes infections avaient IMC inférieur au 5-centile. Ces chiffres ont été réduits à 9,2 % et 8,8 % après l'administration de vermifuges respectivement. Aucun effet de l'administration de vermifuge a été observé sur la

croissance longitudinale. Le nombre d'helminthes contaminés des enfants avec > 25 % l'absentéisme réduit de 13,9 %, tandis que le taux de réduction était de 7,2 % dans le groupe non infecté.

**Discussion :** La différence en réponse à des vermifuges entre enfants infectés et fortement appuyer l'effet bénéfique de déparasitage sur l'absentéisme de croissance et de l'école. L'intervention pourrait être administrée par des enseignants sans formation formelle de soins de santé, permettant ainsi l'intégration du programme dans les structures existantes.

**Mots clés:** Helminthes, absentéisme, chimiothérapie préventive.

## BACKGROUND

Despite the evidence indicating that school based mass deworming is one of the best ways to secure the future of children in developing countries, sustainability of the program as well as effective mass coverage continue to hinder the control of Soil Transmitted Helminths (STHs). (1) Chronic infections with intestinal helminths are important health factors that may influence school performance, reduce social competence and regular school attendance. Studies suggested that helminthiasis are associated with lower literacy levels by 13% and lower earnings later in life by 43%. (2) The total lost years of schooling due to worm associated absenteeism amount to over 200 million years, mostly in developing countries. (3) Also, IQ loss in poor countries associated with helminth infection is estimated as 3.75 points per worm infection. (4) The World Health Organization estimated that about 280 million children that are in need of deworming live in Sub-Saharan African Region where Nigeria is number one with 21%. (5) Despite the fact that antihelminthic drugs are not expensive, the cost of mass deworming is not sustainable. For instance data from the Partnership for Child Development (PCD) showed that the cost of school-based deworming was estimated to be around

50 US cent per child per year. But the actual cost of the antihelminthic tablet was 3 US cent per 400mg dose (albendazole) per child, (6) most of the cost is actually spent on training and other logistics. This means that if the cost of training and logistics could be eliminated, more money will be freed up to sustain the program. This was what motivated us to evaluate the effectiveness of a mass deworming program involving only school teachers without formal healthcare training.

## MATERIALS AND METHODS

**Study site and population:** This study was carried out at Ilero town, South-West of Nigeria. A previously

published research work from this community showed that open defecation was a common practice while tap water was also not available. (7) The town has about 7 public primary schools consisting of about 1442 pupils.

**Study design:** The study was designed as an effectiveness study with minimal influence of the research team. The study was carried out in the mid of the school year between April and Sep 2013. The aim of the study was explained to the children and their parents/guardians who also consented freely to participate in the study. The height in centimeter and weight in kilogram of each child was measured. The school attendance registers were checked to record the number of days that each child was absent during the school term. School absenteeism was evaluated in the 100 days the school was open prior to the intervention and 100 days after the intervention. Data from the primary 6 pupils were not included in analysis because they were not available for follow up, having graduated before the revisit period. Data from pre-school children below the age of 2 years were also excluded from analysis because they had no attendance register. We were therefore left with 957 pupils to work with. Though all the pupils in the community benefited from the deworming tablets

**Stool specimen collection:** The children were given wide mouth, screw cap plastic bottles with clear instruction on how to transfer feces into it in the school premises. Children that were deemed too young were assisted with trained personnel in specimen collection. Peanut sized stool samples were preserved with about 5mls of 5% formalin. The specimen was thoroughly mixed with the preservatives using applicator stick to ensure good preservation.

**Ethical approval and Drug administration:** The study was approved by the research and ethic committee of Federal teaching hospital, Abakaliki. Teachers were asked to administer 400 mg of chewable albendazole tablets to the pupils irrespective of their age at a cost of about 5 US cents per child.

The process was explained to the teachers a week before the program and they were encouraged to use their social contacts to sensitize the community.

**Laboratory analysis:** Preserved stool samples were centrifuged and examined by direct microscopy for ova of parasites by 2 independent microscopists, and

any discrepancy was resolved by having a third opinion.

**Data analysis:** Data of weight, height, age and sex were used to calculate weight for age, Body Mass Index (BMI) and height for age using WHO growth tables and software. Children were classified as reduced ponderal growth when BMI was less than 5 percentile (% ile) according to the WHO classification scale, those with BMI between 5 to 85 % ile were regarded as normal weight while those with BMI above 85%ile were classified as overweight. (8,9) Similarly, height for age was used as indicator for linear growth. The number of days of absenteeism before and after intervention were grouped into ranges from those who were absent for less than 5% through those who were absent for more than 25%. Because it was considered unethical to randomize children to treatment or placebo we used a different approach to document the effect of deworming. Thus, we divided the children into two arms for the data analysis, one consisting of children with detectable helminths and the other without helminths prior to treatment.

## RESULTS

We observed that the teachers complied reasonably with the deworming instructions given, and that the

community was effectively sensitized, judging by the consent and high acceptance rate from the pupils. We enlisted a total of 957 children (473 boys and 484 girls) with a median age of 8 years and in the range 2-16 years. Three hundred and seventy three (39%) of all the pupils in the community were infected with at least one helminth species. *Ascaris lumbricoides* (25.8%) and Hookworm (9.3%) were the commonest followed by mixed infection with the two parasites (1.8%), (table 1). The helminth positive children were almost twice as likely as the helminth negative children to be underweight prior to deworming (19.6% vs. 11.8%, Table 2, p=0.0001). Six months after deworming the prevalence of low underweighted pupils reduced to about 9% in both groups of children.

**TABLE 1: HELMINTHS DETECTED IN CHILDREN PRIOR TO DEWORMING**

Helminth	N (%)
Ascaris	247 (25.8)
Hookworm	89 (9.3)
Ascaris+Hookworm	17 (1.8)
Trichuristrichuria	6 (0.6)
Enterobius	5 (0.5)
Other mixed infections	9 (0.9)
Negative	584 (60.8)
<b>Total</b>	<b>957</b>

**TABLE 2: PREVALENCE OF ABNORMAL BMI BEFORE AND AFTER DEWORMING BY HELMINTH CARRIER STATUS.**

		BMI group, N (%)			Total
		Underweight	Normal weight	Overweight	
Before deworming <sup>1</sup>	Helminth Negative	69 (11.8)	479(82.2)	35(6.0)	583 (100) <sup>2</sup>
	Helminth Positive	73(19.6)	288(77.2)	12(3.2)	373 (100)
	<b>Total<sup>2</sup></b>	<b>142</b>	<b>767</b>	<b>47</b>	<b>956</b>
After deworming	Helminth Negative	51 (8.8)	475(81.8)	55(9.5)	581 (100)
	Helminth Positive	34(9.2)	296(80.4)	38(10.3)	368(100)
	<b>Total<sup>3</sup></b>	<b>85</b>	<b>771</b>	<b>93</b>	<b>949(100)<sup>4</sup></b>

<sup>1</sup>Significant difference between helminth negative and helminth positive children, p=0.0001; <sup>2</sup>Anthropometric measurements missing from 1 child; <sup>3</sup>Helminth status assessed prior to deworming; <sup>4</sup>Follow up was missing for 7 children

**ABLE 3: EFFECT OF DEWORMING ON SCHOOL ATTENDANCE**

	Number of pupils with more than 25% absenteeism		N, (%)
	Before deworming	After deworming	
Worm negative pupils	87 of 583(14.9)	47 of 581(8.1)	40(6.8)↓
Worm positive pupils	68 of 373(18.2)	21 of 368(5.7)	47(12.5)↓

↓= decrease in number

## DISCUSSION

The high prevalence of helminth infection seen in this community (39%) is a likely consequence of lack of potable water combined with the poor sewage disposal methods in this community, (report published elsewhere). (7) A survey of four primary schools in Kenya showed a similar prevalence ranging from 31% to 48.9%, (10) while 58.3% prevalence was also reported among Ethiopian children (11) in communities with similar challenges of water, sanitation and hygiene. A higher prevalence (68.2%) was once found in a similar study in Nigeria by Dada-Adegbola *et al* (12) while Kirwan *et al* reported 50% prevalence in a similar Nigerian study. (13)

Our data suggested a causal relationship between intestinal helminth infection and ponderal growth changes in the study population. Factors responsible for growth retardation of children in developing countries are complex and multifactorial. Apart from helminth infection, other factors attributable include undernutrition, low family income and large family size (14). This may explain why some studies found little or no effect of deworming intervention on weight gain.(15,16) However; other studies found deworming to significantly improve weigh gain. The study of Ethiopian children (17) also found an association between helminth infection and underweight among the school children, and the weight-for-age z-scores of the children significantly increased four weeks after treatment for helminth infection, with a single dose of albendazole. A clinical trial in India also showed that a single albendazole treatment of helminth infected school children lead to a significant weight gain.(17)

Studies evaluating the impact of deworming on school attendance have generated conflicting reports. For instance, the Kenyan study by Muguel and Kramin (18) showed that deworming improved school attendance. This was supported by another study in Jamaica which also showed that helminth infection

was associated with poor school attendance and deworming led to a significant improvement in absenteeism 6 months after treatment, a benefit that was more pronounced in infected children who were also stunted. (19) On the other hand, Davey *et al* (20) recently concluded that benefit of deworming on school attendance remains controversial. It is not

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unlikely that the initiation of our study could have sensitized the teachers to improve on school attendance record keeping which could be a confounding factor. Also as a predominantly farming community, seasonal variation in farming activities such as planting, weeding and harvesting could also interfere with school attendance, which we may not be able to account for. We therefore like to suggest that the deworming effect on absenteeism observed in our study needs cautious interpretation and should be subjected to further investigation that will take into consideration all possible variables.

By limiting our role during the deworming exercise to that of observership and data collection at few time points, the results of our study showed that school based mass deworming could be effectively carried out by the teachers without investing most of the donor funds in formal training. This in turn could free more funds for drug procurement and reduce donor fatigue which is a major obstacle to sustainability of mass deworming programs. Minimizing the interference of the research team also allows us to have a more realistic picture of the real life situation and the effectiveness of the program as opposed to efficacy studies, which require more control and follow up by the investigation team.

Studies that have employed community integrated approach in deworming programs reported that the approach is effective and feasible. (21-23) Also a study about community perception of school based deworming in Turkey showed that 87.4 % of the parents were aware of school health programs and 99% of them approved of teachers' role in providing health education and administering deworming tablets to pupils. (24) Our exercise cost about 5 US cent per 400mg dose of albendazole, indicating that about 2000 children could be effectively dewormed with just 100 USD. This suggested that deworming could be done effectively at minor expenses through interaction between public health promoters and the community. However, monitoring of large scale efforts of integrating deworming in existing facilities is important in order to detect obstacles to this approach. Our data support the usefulness of regular deworming and indicate that an effect will last at least 6 months. It seems possible to motivate schools to support the program at minimal cost. Further studies are needed to evaluate and monitor rolling out of this program.

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