



CROSS-SECTIONAL STUDY OF EFFICACY OF ALBENDAZOLE IN THE TREATMENT OF SOIL HELMINTHES INFECTED SCHOOL AGE CHILDREN IN PARTS OF ODEDA, OGUN STATE, NIGERIA

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ABSTRACT

This study assessed the efficacy and safety of albendazole (ALB) amongst soil-transmitted helminth (STH) infected school aged children (SAC) cross-section ally in Odeda Local Government Area (LGA), Ogun State, Nigeria. Consented 485 pupils between the ages of 5 – 16 years were examined for STH infections using the Kato-katz technique at baseline. All consented SAC were treated to a single dose (400mg) of ALB. Close-ended questionnaires on safety of ALB administered to SAC, 24 hours after ingestion. Stool samples were collected at 3-weeks post treatment to re-examine for Egg Reduction Rate (ERR) and Cure Rate (CR). The results were analyzed using SPSS version 20 with Chi-square set at $p = 0.05$ to compare relationship between demography factors and prevalence. Of the 485 pupils, an overall prevalence of 138(28.5%) were found to be infected with various species of STH infections. Though there was no significance, more males (29.1%) were infected than females (25.3%). The age group 11 – 13 years had the highest prevalence with 33% ($p > 0.05$). At 3-weeks post-treatment, only 1(0.2%) was still found to be infected with a single infection with *T. trichuria*. Adverse events reported by the pupils with most 24(4.9%) reported between 0 – 4 hours (Acute) and 16(3.3%) reported between 5 – 24 hours (Solicited). The ERR and CR was calculated to be 99.8% and 99.9% respectively. This study proved that ALB is still safe and efficacious in the control of soil transmitted helminthes and should be continued in the mass chemotherapy control amongst SAC and possible elimination.

Keywords: Safety, Efficacy, Albendazole, Soil-transmitted helminths, School Aged Children, Odeda.

INTRODUCTION

The most common intestinal helminths of human throughout Nigeria are *Ascaris lumbricoides*, *Trichuris trichiura*, *Ancylostoma duodenale* and *Necator americanus* (hookworm) (WHO, 2013). Since the adult stages of these helminthes reside in the intestines, they are called soil-transmitted helminths because their infections are specifically through coming in contact with the soil which are contaminated with fecal matter. Children between 5–14 years of age in developing countries are especially at risk of soil-transmitted helminth (STH) infections (WHO, 2017). Rarely do STH infections result to death; but they affect nutrition which results in anaemia, loss of appetite, intestinal damage and reduced absorption of vitamin A. Since STH infections occurs by the contamination of human food or water by agents such as flies from fecal matter which are common in tropical or subtropical nations thus, it is the commonest infection within such region (Awolaja and Morenikeji, 2009). In sub-Saharan Africa alone, above two-third of school aged children harbor polyparasitism STH infections (Zerdo *et al.*, 2016). The risk factors which influence STH transmission includes open bush defecation, walking barefooted on infected soil, geophagy and onychophagy, occupation of parents, sources of drinking water and poor personal hygiene (Ohiole *et al.*, 2017).

In Nigeria, various studies have been carried out to estimate the prevalence status of soil transmitted helminth infections in primary pupils ranging between 17.8% to 87% (Aniwada *et al.*, 2016; Azoro *et al.*, 2015; Ojurongbe *et al.*, 2014; Olopade *et al.*, 2018; Osazuwa *et al.*, 2011; Salawu and Ughele, 2015; Usip and Nwosu, 2013). Olopade *et al.*, (2018) observed that these parasitic infections contribute substantially to the problem of malnutrition and cognitive function which constitutes a major public health problem in Nigeria as a significant cause of morbidity among children. Soil-transmitted helminthes is a major public health problem in tropical countries affecting the physical growth and the cognitive levels in school aged children (WHO, 2013). This study provided more information on the prevalence of STH infections among primary school pupils in the study area and evaluated the efficacy of the antihelminthic drug (Albendazole) in combating STH amongst them.

MATERIALS AND METHOD

Study Area: Odeda LGA has its headquarter at Odeda is a place situated along Abeokuta- Ibadan Road, which is about 10 kilometres from Abeokuta (the State Capital) has an area of 1,560km² and a population of 113,342 (NPC, 2017). It has an extensive landmass mostly grass. The vegetation of the Local Government is mainly Orchard and of thick grasses as The Local Government enjoys a tropical climate, with double maxima of rainfall between April and July {short dry season in August} and from September to October.

The long dry season start from November. Thus, the land is suitable for agriculture and livestock rearing. The Local Government shares boundaries with Ibarapa and Iddo Local Government of Oyo State in the north and east, while Obafemi/ Owode Local Government to the south and west respectively.

Primary school pupils from six schools in Odeda Local Government Area (LGA) which included OLG Nursery and Primary School Alagbede, OLG Primary School Alabata, Odeda Local Government Primary school Mawuko, St John's Anglican primary school Bantun, African church primary school Rogun Rogun and All Saint's primary school Otere Ikereku were recruited into the study. The study area, predominantly agrarian communities and the government primary schools lacking water supply and toilet facilities are major risk factors in the transmission of soil transmitted helminthes.

Study Subjects and Consent: Ethical clearance was obtained from the Ethical Committee of State Hospital Ijaiye Abeokuta, Ogun State. A formal letter was also tendered to the Permanent Education Secretary of Odeda Local Government Area endorsed via the Head of Department of Pure and Applied Zoology, Federal University of Agriculture, Abeokuta to obtain formal permission to carry out the study. Informal Consent was also obtained from the parents of the pupils after sensitization before the commencement of the study. This study was carried out between June and September in 2017.

Exclusion criteria included; School children who were below 6 years and above 16 years, those with the age range who have been treated with any anti-helminthic drug in the last 6 months, those with medical conditions, pupils with no informed consent duly accented by parents/guardian, pupils with diarrhoeal specimens were not collected.

A total of 485 fecal samples were collected for analysis from a total number of consented 485 pupils within the age of 5 - 16 years Properly labelled universal sample bottles which were serially numbered were given out to pupils. They were instructed to carefully put a small quantity of fresh stool with a spatula (in order to prevent destruction of egg) in it. Each stool bottle was labeled appropriately to reflect participant's first name, family name and serial number for easy traceability. The stool samples which were collected within a 24h period were examined at the Parasitology unit laboratory of the Department of Pure and Applied Zoology, Federal University of Agriculture, Abeokuta for microscopic examination using Kato Katz kit technique (Mani *et al.*, 2004). The slides which have been marked with serial numbers in correlation with the pupil number are kept on the bench with the cellophane upwards at room temperature for 1 hour, followed by a microscope examination for helminthes eggs. For STH species identification, the World Health Organization standard diagnostic bench-aid was used. Each morphologically different

egg was counted using a tally hand counter. The intensity of each helminth observed was determined by multiplying the number of eggs of the species counted by 24 to obtain the number of eggs per gram of faeces (Epg).

Each pupil was administered with Albendazole (400mg) each after a snack and water had been ingested by each pupil. Follow up studies were carried out after three weeks and fecal samples were collected from 138 pupils that were positive from the baseline study. The samples were screened for the presence of helminthes eggs using Kato-Katz method. Data was analyzed using Statistical Package for Social Sciences (SPSS) Version 16.0. Frequency tables and cross tabulations were computed and appropriate statistical associations were made for the study variables. Chi-square test was used to compare prevalence with socio-demographic variables at 95% confidence interval in which p value less or equal to 0.05 was considered for significant. Egg Reduction Rate (ERR) and Cure Rate (CR) was calculated using Vercruyse *et al.*, (2011).

RESULTS AND DISCUSSION

Results showed that the recruited primary school pupils which comprised of 237 (51.1%) females and 248 (48.9%) males had a mean age of 9.48 ± 2.76 ; of which 138 (28.5%) were found to be infected with eggs belonging to STH (Table 1). The overall prevalence in the study-area was observed to be 28.5%. This was more than the 15.6% reported by Sam – Wobo *et al.*, (2012) within the same locality and lower than 48.9% , 46.3% and 75% reported by Simon-Oke *et al.*, (2014), Ojurongbe *et al.*, (2014) and Azoro *et al.*, (2015) respectively in primary school children in Ondo, Osun and Abia States, Nigeria. This variance could be as a result of poor awareness, sensitization and poor individual hygiene amongst the primary school pupils in their school and home environs as observed. According to Ogbaini-Emovon *et al.* (2014) and Olopade *et al.*, (2018), poor environmental and personal hygiene with respect to disposal of human faeces and hand washing after defecation and before eating are the driving forces of STH infection. Usip and Matthew (2015) also established that low standard of sanitation, hygiene and poor socio-economic conditions are pre-disposing factors to STH infections.

Though there was no significant difference ($p > 0.05$) between the prevalence of STH infection and sex, more males pupils 73 (29.1%) were infected than females 65 (27.8%) , this was similar with reports from Ojurongbe *et al.*, (2015) and Usip and Matthew (2015) unlike Simon-Oke *et al.*, (2014) who reported more females infected than the males. The high infection rate could be attributed to most of the males playing with the dirty environment. Age – group wise, it was observed that there was a steady increase in the prevalence from the age-group 5 – 7 years

with the age –group (11- 13) at the peak. This could have been as a result of increased number of contacts with contaminated sand through their activeness and adventurousness in extra-curricular activities (like playing of football) in their environs. Statistically, there was no significant relationship association between the socio-demographic of recruited pupils and the prevalence of STH amongst them with age ($p = 0.095$) and sex ($p = 0.133$) at baseline and age ($p = 0.511$) and sex ($p = 0.584$) at post-treatment (Table 1).

For multiple infections, polyparasitism (7.2%) was also observed among the positive infected pupils (Table 2). Double infection occurred with the highest involving *A. lumbricoides* and Hookworm (6.5%). The presence of *A. lumbricoides*, Hookworm and *T. trichuria* ovas (popularly referred to as the TRIAD) in this study was similar to reports by Salawu and Ughele (2015) in Osun State, Nigeria. The presence of these helminthes in the children indicates that the soil of the environment could be contaminated with fecal matter. The pre-dominance of *A. lumbricoides* and Hookworm occurring as multiple infection was similar to 6.58% and 5.3% reported by Adefioye *et al.*, (2011) and Azoro *et al.*, (2015) in Ilie, Osun and Isuochi, Abia both in Nigeria. These two parasites exhibit the same and their infective embryonated eggs can withstand extreme environmental factors for years until it finds a suitable host. Table 3 showed that the overall mean intensity for *A. lumbricoides* and Hookworm at baseline and 3 weeks post-treatment was (0.92 ± 2.17 ; 0.77 ± 2.01) and (0.00 ± 0.00 ; 0.00 ± 0.00) respectively. For *T. trichuria*, it was 0.018 ± 0.281 and after 3 weeks post-treatment reduced to 0.001 ± 0.03 . At 3-weeks post treatment, only one positive case was detected and it was *T. trichuria* as against no positive cases recorded for *Ascaris lumbricoides* and Hookworm. This was indicated in the overall intensity (0.001 ± 0.03). This indicated that a single dose of ALB 400mg was not enough to kill the *T. trichuria* eggs. This was similar to a helminthiasis study reported by Nkengazong *et al.*, (2010) in South-West Cameroon. According to Adegnika *et al.*, (2014), two doses of ALB recorded a higher cure rate of 67% against *T. trichuria* than a single dose of ALB (40%).

A total of 24(4.9%) pupils reported acute adverse events after ingestion of ALB while 16 (3.3%) pupils reported solicited adverse events after ingestion of ALB (Table 4). Effects complained of by primary school children in this study included abdominal pains, dizziness, stooling, headache, irritation and vomiting. These were similar to effects reported in Ndia, Kenya (Njomo *et al.*, 2000). Other incidences reported included cough and stomachache. According to Marriner *et al.*, (1986), Albendazole (ALB) has only limited solubility in water. After a 400-mg oral dose, ALB cannot be detected in plasma due to low absorbance of the drug from the intestines.

The metabolites are excreted mainly in the urine. Short abdominal pains, diarrhea, nausea, dizziness, and headache are some of the effects that occur occasionally after oral ingestion of ALB (Urbani and Albonico, 2003). As shown in Table 5, the overall Egg Reduction Rate (ERR) and Cure Rate (CR) at 3 weeks post treatment was calculated to be 99.8% and 99.9% respectively. At 3 weeks post-treatment, calculations showed that ALB was effective against *Ascaris lumbricoides* and Hookworm as both ERR AND CR was 100% respectively for species – specific

CONCLUSION

Since STH infections is linked to poor socio-economic factors which is associated with most African countries, continuous measures in controlling STH infections should be embarked on as the Government, the School and the Parents have a role

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to play in combating the illnesses. Mass deworming of school children with anti-helminthic drugs such as albendazole should be done at least thrice in a year by the government so as to avoid re-infections. General access to portable, clean water and good toilet facilities should be a top priority. Continuous mass awareness involving educational materials, drama sketches should be given to the parents or childgivers on the delirious implication of being infected with STH.

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Table 1: Demographic parameters of pupils recruited into the study and Prevalence of Soil Transmitted Helminthes among primary school pupils by sex and age before treatment and 3-weeks Post Treatment

| | Prevalence before treatment | | | | Prevalence 3 weeks Post-treatment | | | |
|------------|-----------------------------|-----------|-----------|-----------|-----------------------------------|-----------|-----------|-----------|
| | Positive | Negative | Total | p - value | Positive | Negative | Total | p - value |
| Sex | | | | | | | | |
| Male | 72(29.1) | 176(70.9) | 248(51) | 0.095 | 1(0.4) | 247(99.6) | 248(51.1) | 0.511 |
| Female | 65(25.3) | 172(66.9) | 257(53) | | 1(0) | 237(100) | 237(48.9) | |
| Total | 138(28.5) | 347(71.5) | 485(100) | | 1(0.2) | 484(99.8) | 485(100) | |
| Age-groups | | | | | | | | |
| 5 – 7 | 29(20.7) | 111(79.3) | 140(28.9) | 0.133 | 0(0) | 140(100) | 140(28.9) | 0.584 |
| 8 – 10 | 50(30.3) | 115(69.7) | 165(34) | | 1(0.6) | 164(99.4) | 165(34) | |
| 11 – 13 | 47(33) | 95(67) | 142(29.2) | | 0(0) | 141(100) | 142(29.2) | |
| 14 – 16 | 12(31.6) | 26(68.4) | 38(7.9) | | 0(0) | 38(100) | 38(7.9) | |
| Total | 138(28.5) | 347(71.5) | 485(100) | | 1(0.2) | 484(99.8) | 485(100) | |

Table 2: Prevalence of mixed infections among STH positive infected pupils

| Polyparasitism type (Double infection) | Number of pupils infected (Percentage) |
|--|--|
| Hookworm and <i>Ascaris lumbricoides</i> | 9(6.5) |
| <i>Ascaris lumbricoides</i> and <i>Trichuris trichuria</i> | 1(0.7) |
| Total | 10(7.2) |

Table 3: Baseline average and three weeks post treatment average parasite load of STH species observed amongst the school aged children.

| Average intensity of Soil transmitted species (Epg±SD) | <i>A. lumbricoides</i> | Hookworm | <i>T. trichuria</i> |
|--|------------------------|-------------|---------------------|
| Baseline average intensity (Epg±SD) | 0.92 ± 2.17 | 0.77 ± 2.01 | 0.018 ± 0.281 |
| Three weeks post treatment average intensity (Epg±SD) | 0.00 ± 0.00 | 0.00 ± 0.00 | 0.001 ± 0.03 |

Table 4: Frequency of primary school children who reported adverse and solicited events

| Adverse events | Acute adverse events (0 – 4 hours) Frequency (%) | Solicited adverse events (5– 24 hours) Frequency (%) |
|--------------------|---|---|
| Abdominal pains | 3(0.6) | 4(0.8) |
| Dizziness | 12(2.1) | 3(0.6) |
| Stooling | 0(0) | 8(1.6) |
| Irritation | 2(0.4) | 0(0) |
| Headache | 3(0.6) | 0(0) |
| Vomiting | 2(0.4) | 1(0.2) |
| No events observed | 461(95.1) | 469(96.7) |
| Total | 485(100) | 485(100) |

Table 5: Egg Reduction Rate(CR) and Cure Rate(CR) of Soil Transmitted Heminthes after three weeks post treatment

| Parasite species | Egg Reduction Rate (ERR) | Cure Rate(CR) |
|------------------------|--------------------------|---------------|
| <i>A. lumbricoides</i> | 100 | 100 |
| Hookworm | 100 | 100 |
| <i>T.trichuria</i> | 99.5 | 99.7 |
| Total | 99.8 | 99.9 |