MONITORING THE REINFECTION PERIOD OF SOIL TRANSMITTED HELMINTHS AFTER CHEMOTHERAPY IN IMO STATE, NIGERIA.

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ABSTRACT

This study is a follow up on an earlier study on the prevalence of soil transmitted helminths (STH) in school pupils in some schools in Imo state Nigeria conducted between April 2012 and August 2013. With ethical clearance from the University Ethics Committee, State Ministries of Health, and Education respectively, as well as informed consents from the parents/ guardians of these pupils, infected pupils were treated with two locally available anthelminthic drugs (Albendazole and Pyrantel pamoate) in order to determine the level of effectiveness of each drug as well as the re-infection period with any STH. The infected pupils were randomly grouped into three. One group was treated with Albendazole, another with Pyrantel pamoate while the third group was given some placebos. The treatments were followed up with repeated observations through collection of stool samples at intervals of two, six and twelve weeks post-treatment respectively. The stool samples were examined using the saline wet mount preparation and formal ether concentration technique. The parasite intensity was determined. Two weeks post treatment, a total of 137(76.5%) out of 179 pupils treated with either of the two anthelminthic drugs had 100% clearance of worm load while 42(23.5%) had significant reduction in their worm load. The group administered with placebos showed no reduction /cure in their worm infection. Six weeks post treatment observation showed a total clearance or absence of worm infection amongst the two anti- helminthic treated groups from all negative stool samples while the twelve weeks post treatment survey showed 19(25.00%) out of 76 pupils re-examined to be re-infected by one or two helminths with, Ascaris, 21.37% and Hookworm 5.28%. Z-test analysis shows that the proportion of the pupils infected by STH, (35.43%) is significantly greater than zero and re-infection status of pupils twelve weeks after treatment is not statistically significant, ($p<0.05$). From the above observations, it could be deduced that STHs could be monitored and eradicated through a well-planned and sustained programme of chemotherapy especially preventive chemotherapy.

KEY: ANTHELMINTHS CHEMOTHERAPY ERADICATION, MONITORING, REINFECTION ,

INTRODUCTION

Soil transmitted helminths infections are indeed the disease of the poor and the forgotten with **debilitating** effects often resulting in death of very poor persons especially school children and pregnant women.

The three most common STHs are the roundworms (*Ascaris lumbricoides*), the whipworms (*Trichuris trichiura*), and the hookworm species (*Ancylostoma duodenale* and *Necator americanus* (Hotez *et al* 2008). In some endemic areas, *Strongyloides stercoralis* may be the fourth important STH.

The spread and transmission of these helminths are influenced by poor personal and environmental hygiene, inadequate provision of essential amenities such as toilet facilities and clean water, soil qualities as well as climatic conditions of the area and consumption of contaminated foods, (WHO, 1987, Udensi, 1999, Tang, 2002, Nwoke, 2009 and Ogomaka *et al* 2012).

People especially children infected with STHs may suffer from anaemia, growth stunting, diminished physical fitness, and impaired cognitive development which represents a persistent drain on social and economic development of low-income countries, (Bethony, *et.al*, 2006 and King, 2010)).

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The current global strategy to control STH infections is preventive chemotherapy, that is, repeated large-scale or mass administration of anthelmintic drugs to at-risk populations, most importantly school-aged children (WHO, 2006 and WHO, 2010).

A shortcoming of this strategy is failure to prevent re-infection after effective deworming (Bethony, *et al*, 2006, Singer and De Castro, 2007, Ziegelbauer, *et al*, 2012). Hence, estimating the time frame during which re - infections occur is crucial to improving the effectiveness of this intervention.

STHs re - infections occur rapidly after treatment particularly for *Ascaris* and *Trichuris*, hence the need for frequent anti-helminthic drug administration to maximise the benefit of the preventive chemotherapy.

Frequent drug administration however, may be affected by gradual reduction in compliance overtime. Integrated control approach emphasizing health education and environmental sanitation are needed to interrupt transmission of STHs

WHO (1994) addressed the control of hookworm infections among girls /pregnant women and recommended that in an area where hookworm infections are endemic and where anaemia is prevalent, hookworm control using anti-helminthic treatment should be included in the strategies designed to improve their health, development and nutritional status.

WHO (1987) approved the use of four major drugs, Mebendazole, Albendazole, Levamisole and Pyrantel - pamoate for treatment and preventive strategies. These drugs are administered according to manufacturer's specifications with respect to body weight and age.

It is however not uncommon that despite the use of all these available drugs and other preventive strategies, re-infection of soil transmitted helminths still occurs among the treated groups.

It is against this backdrop that the researchers set out to investigate the time frame within which STHs infected and treated pupils are likely to get re-infected.

MATERIALS AND METHODS

Study Area: Owerri West lies in the western part of Imo state capital having the same geographical features with the rest of the state($5^0$10 and $5^0$67N and longitude 6^0 35and 7^0 28E)

It is these geographical characteristics/features coupled with economic, social and cultural factors that favour the survival, transmission and spread of these STHs in the study area.

Ethical Clearance /Consent: Ethical clearance as well as approval for the study were obtained from; Imo State University Ethics Committee, Ministries of Health and Education. Traditional Leaders of autonomous Communities, Headmasters and Headmistresses of schools used, parents and guardians of the pupils through the Parents Teachers Association group as well as from the pupils who participated in the study themselves.

Study Populations: All children who were presently in grades three and four constituted the study population.

A total of 745 pupils were used for the survey while only 264 STH positive pupils were involved in this monitoring study.

Collection of Specimen: Pupils were first educated on how to collect stool specimen with a model a day before the actual collection day.

Clean screw capped containers were distributed to the pupils for proper and prompt collection of specimen on the agreed day.

The collected specimens were taken to the diagnostic laboratory for analysis within three to four hours after collection.

Those specimens that were not examined within twenty four hours were stored in 10% formalin.

Method of Specimen Analysis: The stool specimens were examined using the saline wet mount preparation and formal ether concentration technique of Ukaga *et al* (2007). Enumeration of egg (intensity) was carried out using Mac-master Technique for egg counting according to Okolie (2006).

Administration of Drugs and Post Treatment Analysis:

Infected pupils were randomly grouped into three groups (1-3) of 85, 89 and 90 participants respectively.

Group 1 and 2 were administered with specific anthelminths according to prescriptions

Two weeks after the drug administration post- test stool samples were collected and examined to ascertain the efficacy of the drugs.

Follow up tests were also conducted six and twelve weeks after post-test to ascertain possible clearance of the infection and any re-infection of the disease among the pupils within the time frame.

By the twelfth week post treatment stool collection, only 76 pupils of the treatment group consented and gave their stool samples for the examination

RESULT

The result from the earlier prevalence study, showed that out of 745 pupils examined, 264(35.45%) were infected by soil transmitted helminths (*Ascaris*, hookworm and *Trichuris*), table1.

The 264 pupils who made up this present study population had a total of 179 pupils treated with the anthelminthic drugs used in this study.

Out of the 179 pupils treated with anthelminths, 137(76.5%) had their worm load cleared while 42 (23.5%) had their worm load reduced, (table 2).

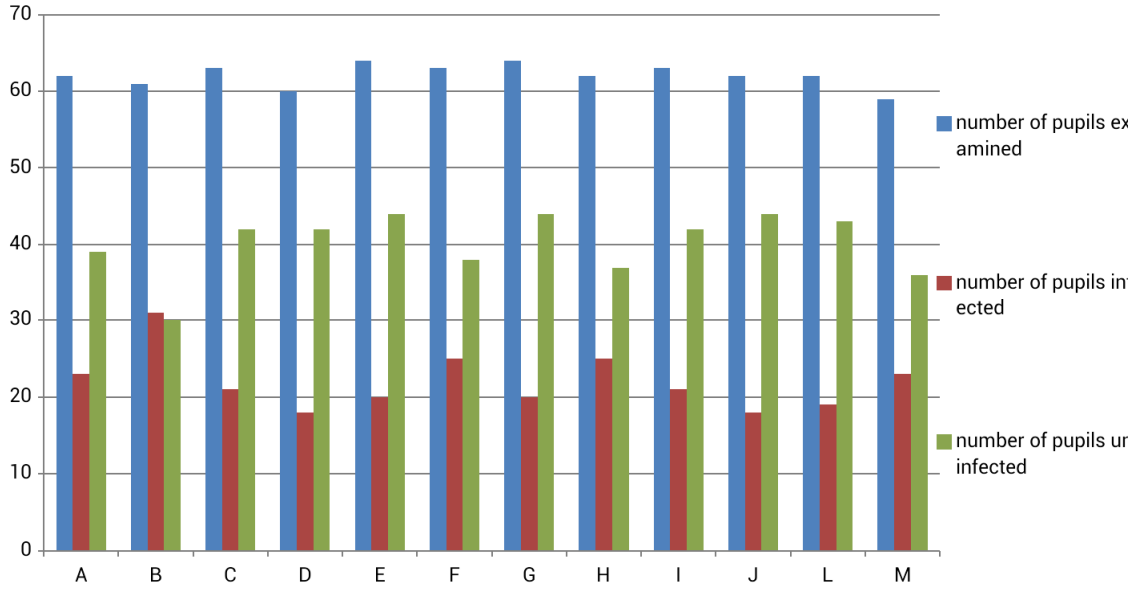
Egg count intensities decreased from 2122.5 to 41.2mec for drug A and from 2178.5 to 30.0 mec for drug B.

On the contrary there was no reduction among the untreated pupils rather their egg intensities increased from 1596.5 to 1988.2mec (table 3)

There was no re-infection amongst all the treated pupils six weeks after the treatment, (table 4). Infection status of the consenting 76 pupils re-examined twelve weeks after treatment shows that 19 (26,27%) pupils were re-infected while **53(73.33%) still had negative stool samples, (table 5)).**

There was no significant difference in the infection status of the pupils after twelve weeks post-test, ($p<0.05$). Of the re-infected number, 15 (21.37%) were infected by *Ascaris* while 4(5.37%) were infected by Hookworm (table 6).

CHART 1: INFECTION RATE OF STHS IN EACH OF THE TWELVE SCHOOLS SURVEYED.



The z-test analysis shows that the proportion of the pupils infected by STHs is significantly greater than zero. This means that greater majority is infected by the STHs in the area.Thus 35.43% of the population examined were infected by soil transmitted helminths

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TABLE 2: EFFICACIES OF THE ANTIHELMINTHS ON THE TREATED PUPILS.

ANTIHEHELMINTHS	NUMBER TREATED	NUMBER CURED/CLEARED	NUMBER REDUCED
Albendazole	89	67(75.3)	22(24.7)
Pyrental pamoate	90	70(77.8)	20(22.2)
A&B	179	137(76.5)	42(23.5)
PLACEBOS	85	0(0.00)	0(0.00)

KEY;

A Albendazole B Pyrantel pamoate

Result from the above table showed that Pyrental pamoate had the highest curative effect of 77.8%

Table, 3 Pre and post treatment worm intensities of the pupils in the three subgroups used for the examined.

SUB-SAMPLE	SUB-SAMPLE SIZE	PRE -- TREATMENT TOTAL EGG COUNT	MEAN EGG COUNT	POST-TREATMENT TOTAL EGG COUNT	MEAN-EGG COUNT
A	89	188900	2122.5	3700	41.2
B	90	196000	2178.5	2700	30.0
CONTROL	85	135700	2178.0	16900	1988.2
TOTAL	264	520600	1972	17540	2059.44

Table 3 showed that mean egg count after post treatment were lower in those treated with Pyrental pamoate(30.0) that among those treated with Albendazole (41.2) .

Table 4: Re-infection status of the pupils six weeks after treatment

SCHOOLS	NUMBER EXAMINED	NUMBER INFECTED
A	13	0(0.00)
B	11	0(0.00)
C	12	0(0.00)
D	9	0(0.00)
G	11	0(0.00)
I	15	0(0.00)
J	11	0(0.00)
TOTAL	82	0(0.00)

Table four showed that there were no eggs in the stool of the pupils after six weeks post treatment

Table 5: Infection status of the pupils twelve weeks after treatment.

SCHOOLS	NUMBER EXAMINED	NUMBER INFECTED (%)	NUMBER UNINFECTED (%)
A	13	3(23.08)	10(76.92)
B	11	4(36.36)	7(63.64)
C	12	2(16.67)	10(83.33)
D	9	3(33.33)	6(66.67)
G	7	3(42.86)	4(57.14)
I	14	2(14.29)	12(85.71)
J	10	2(20)	8(80)
TOTAL	76	19(26.67)	57(73.33)

Table 5 showed

Table 5 shows that only 19(26.67%) of the 76 treated pupils re-examined were reinfection after twelve weeks.

The chi-square analysis shows that reinfection twelve weeks after treatment differs significantly ($p<0.05$) since $X_{cal\ 4.8\ is\ less\ than}\ X_{tab12..6.}$

Table 6: Infection status in relation to the species of STHs after twelve weeks of treatment

SCHOOL	NUMBER EXAMINED	NUMBER INFECTED (%)	NUMBER INFECTED BY ASCARIS (%)	NUMBER INFECTED BY HOOKWORM (%)
A	13	3(23.08)	2(15.38)	1(7.38)
B	11	4(36.36)	2(18.18)	2(18.18)
C	12	2(16.67)	2(16.67)	-
D	9	3(33.33)	2(22.22)	1(11.11)
G	7	3(42.86)	3(42.86)	--
I	14	2(14.29)	2(14.29)	-
J	10	2(20)	2(20)	-
TOTAL	76	19(26.67)	15(21.37)	4(5.37)

Table 6 showed that only two species of STHs were identified after twelve weeks of post treatment, ***A.lumbricoides, 21.37% and Hookworm spp, 5.37%***

DISCUSSION

The result of the infection status of the pupils after post treatment survey gave an insight into the probable period of re-infection after administration of anthelminths.

The absence of infection six weeks after treatment could be reasoned out to imply that the anthelminths either killed or weakened the helminths thereby making them unable to reproduce within the first six weeks after the treatment.

This goes to agree with WHO,(1987) which states that the anthelminths on administration either binds to the acetylcholine receptor of the Nematodes causing a spastic paralysis followed by passive elimination of the parasite or binds to the Nematodes tubulin preventing the formation of microtubules and inhibit cell division.

This invariably leads to termination of the infection due to discontinuity in reproduction and egg productions

The infection observed twelve weeks after treatment, 19(26.67%) suggests that the helminths may have recovered from shock resulting from the effect of the drug and laid some eggs or that there was completely new infection within the time frame.

Considering the second option, if there were new infections after six weeks, the helminths did not begin to reproduce immediately, rather they would have passed through developmental stages until reproductive stage specific to each specie of the nematode is attended, (Udensi,1999).

This could be true since most adult stages are reached in about six weeks or more depending on the Helminths. For instance, *Ascaris lumbricoides* reaches maturity age from 8-12 weeks of infecting its host. Hookworm reaches its own maturity in 5-6 weeks while Trichuris trichuria matures in 8-12 weeks, (Ralph -Muller ,2002 and Udensi,1999)

The global strategy to control soil-transmitted helminth infections is 'preventive chemotherapy', which means large-scale administration of anthelmintic drugs to at-risk populations. However, because re-infection occurs after treatment, preventive chemotherapy must be repeated regularly to avoid obvious emergency.

.It is therefore evident from the above studies that re infection could occur in about three months after treatment and some species of helminths such as Ascaris and Hookworm are easily contacted because their infections have proven to be extremely difficult to eliminate or eradicate due to poverty and poor sanitation and other survival strategies as observedin the study area and this has manifested in their reinfections after treatment among other STHs.

However, the study showed that elimination of these helminths are feasible if treatment is followed up to a reasonable length of time coupled with proper personal and environmental hygiene through adequate provision of toilet facilities and potable water which will invariably breaks the transmission cycle.

RECOMMENDATION / CONCLUSION

Personal and collective environmental hygiene/sanitation should be fully addressed by the Government through adequate health education and sensitization on the danger of harbouring soil transmitted helminthes.

There should be adequate provision of essential amenities (good source of potable water, toilet facilities, and lighting system) as well as disposing points with good refuse bins.

These could go a long way to reducing the spread and transmission of STHs.

Laws prohibiting environmental contaminations through indiscriminate defecation, dumping of refuse and disposal of night soil without proper treatment should be promulgated.

Government should enforce routine community and personnel helminthic check followed by prompt administration of anthelminths to infected individual to avoid spreading of helminths and if this done there is hope of eliminating helminths in the near feature.

In conclusion, proper monitoring of reinfection of STHs after treatment is a good tool towards its eradication. This is could be possible once adequate environmental and personal hygiene and a well-planned and sustained programme of chemotherapy especially preventive chemotherapy are adopted by all and sundry.

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