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Comparative Evaluation of the Efficacy of Praziquantel (PZQ) and Niridazole/Ambilhar (N/A) in the Treatment of Urinary Schistosomiasis among School Children Examined in Idah and Ibaji Local Government Areas (LGAs) of Kogi State, Nigeria

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Abstract: The study was carried out among school children in: Government Day Secondary School and Local Government Education Authority (LGEA) Primary School, Ejule-Ojebe in Ibaji Local Government Area (LGA) and LGEA Primary School, Idah in Idah LGA, Nigeria. It was designed to validate the already established protocol of using Praziquantel (PZQ) as a drug of choice in the treatment of schistosomiasis and other helminths. The cure rate procured by PZQ (66.7%) was significantly higher than that of Niridazole/Ambilhar (N/A) (36.0%) ($p<0.05$). The validation of the efficacy of praziquantel was established in this study when it was observed in one of the subjects examined whose initial egg-count at week zero was 40 eggs/10 mL urine who failed to turn up for treatment (served as a 'control') had egg-excretion increased significantly up to 1,420 eggs/10 mL urine in the 20th week post-treatment when re-examined. Generally, the results showed that there was significant difference ($p<0.05$) in the percentage cure rate in children placed on PZQ-regimen in the three schools surveyed.

Key words: Cure rate, efficacy, niridazole/ambilhar, praziquantel, schistosomiasis

INTRODUCTION

Schistosomiasis is endemic in rural areas and especially among the inhabitants living along the Niger-Benue Basin of the two major Rivers in Nigeria (Ejima and Odaibo, 2010)

Most control programmes (using chemotherapy and other tools) are operating in 41% within schistosomiasis endemic countries and they are on national scale only in Brazil, Dominican Republic, Egypt, Iran, Iraq, Japan, Morocco, Puerto Rico, St. Lucia, Tunisia and Venezuela (Iarotski and Davis, 1981). It appears that a maximum of only 1-2% of all cases have been treated, the most frequently used drugs, being niridazole and hycanthone. While the former may produce adverse neuro-psychiatric effects, the latter may be associated with acute hepatic necrosis. These workers also observed that nearly 50% of endemic countries use more than three different methods of control simultaneously. According to WHO's estimates, Nigeria has the greatest national need for Praziquantel (PZQ) about 62 million tablets annually which is almost 15% of the total global need (Reich and Govindaraj, 2014). However, according to a report received from the Nigerian MOH and other informed sources, very little praziquantel is available in Nigeria-in either public or private sectors. The high cost of praziquantel and Nigeria's huge requirement for the drug has limited the country's ability to procure the drug from Bayer and from international agencies (despite the concessional prices offered by these agencies). The same holds true for a number of other Sub-Saharan countries such as Mozambique, Tanzania and Zaire (Reich and Govindaraj, 2014).

The early antimonial drugs such as nilodin (Miracil D) and hycanthone with their undesired side effects have diminished usefulness in mass treatment campaigns. In fact, the international consensus is that metrifonate is the most appropriate drug for *S. haematobium* infection, oxaminiquine for *S. mansoni* infection and praziquantel for double infections and *S. japonicum* (Davis and Wegner, 1979; Davis *et al*., 1979; Katz *et al*., 1979). Blair *et al*. (1949) found that Miracil D (Nilodin) appeared to be capable of curing 90% of urinary infections with *Schistosoma haematobium* provided that a total dosage was taken at least 60 mg kg^{-1} body-weight, spread over a period of 3-6 days. Alves (1949) reported by Maclean and Hay (1954) showed that of the total 75 Africans suffering urinary bilharziasis that were treated with Nilodin, only three failures were recorded. A few of the patients complained of toxic side effects which include nausea, vomiting, headache and dizziness but no major disturbance. Hence, Maclean and Hay (1954) chose this drug for the first mass treatment at Likoma, an Island on Lake Nyasa, East Africa.

Jordan and Randall (1962) who employed Lucanthone hydrochloride (10 mg kg^{-1} twice ×3 days; total dose = 60 mg kg^{-1} body weight uncoated tablets form) and TWSb (Astiban-3 injections of 0.5 g in 5 mL, given on 3 successive days to children of over 45 kg; 0.4 g to children between 35 and 45 kg body weight) in the treatment of *Schistosoma haematobium* concluded that neither drug is considered satisfactory for schistosomiasis control in E. Africa due to their undesired side-effects, including vomiting, abdominal pain, giddiness, headache and anorexia.

Forsyth (1967) using niridazole (ambilhar) to treat school children with *Schistosoma haematobium* infection in endemic area Zanzibar, E. Africa, revealed that the drug was effective when used in 5 days courses in which 20, 25 and 30 mg kg^{-1} body weight were given daily. The higher dosage regimens may be preferred. This worker reported that no side-effects attributable to ambilhar were observed; also, no apparent relationship between the levels of initial egg-count and cure rates in children of the same sex and comparable age. However, prevalence reduced from 42.1-15.5% and intensity also reduced in children who were still voiding eggs.

Oomen *et al.* (1975) used metrofonate (Bilacil) in the treatment of children infected with *Schistosoma haematobium* in Ruwan Sanyi, Northern Nigeria and recorded an overall reduction in egg output, 8 weeks after the final dose of the drug of 94.5% and cure rate of 43.6%. They recorded significant difference in cure rate of patients excreting pre-treatment egg-count of <1000/10 mL urine (58%) and those excreting pre-treatment egg-count of ≥1000/10 mL urine (15%) for Bilacil tablets (Bayer). The drug was reported to be excellently tolerated and its use on a large scale was recommended.

The study by Taddese and Zein (1988) in Ethiopia, testing the efficacy of different doses of oxaminiquine and praziquantel in the treatment of *Schistosoma mansoni* infection, revealed percentage mean egg-reduction of 72% 6th month post-treatment for the optimum dosage of praziquantel (40 mg kg^{-1} body weight, Kardaman *et al.*, 1983) and percentage mean egg-reduction of 73.3% for oxaminiquine (total dose of 60 mg kg^{-1}, WHO, 1985). Kardaman *et al.* (1983) observed that praziquantel was more effective and produced fewer side effects when administered as a split dose (2×20 mg kg^{-1}) than a single dose (1×40 mg kg^{-1}).

Chemotherapy is the major control method employed against schistosomes but due to the widespread use of schistosomacidal drugs, resistance which has appeared in natural populations of *Schistosoma mansoni* is likely to increase (McManus and Hope, 1993). WHO has spearheaded and recommended community-based chemotherapy for the control of helminthic infections in endemic communities. The control of schistosomiasis and intestinal nematodes employ single-dose chemotherapy as one of the major tools for morbidity control in endemic areas (Savioli *et al.*, 1999).

King *et al.* (2000) examined the long-term efficacy of praziquantel against *Schistosoma haematobium* infection in a school-based treatment programme in the Msambweni area of coast province, Kenya and their results indicated substantial year to year (1984-1992) variation in drug efficacy. However, the praziquantel-mediated reduction of mean *Schistosoma haematobium* egg-counts was consistently ≥83% for all years of observation by these workers. The responses to praziquantel varied significantly from a cure rate of 96% in 1990 to a cure rate of 65% in 1986 The level of praziquantel efficacy as recorded by these workers was within the previous range of *Schistosoma haematobium* cure rates, both in coast province and elsewhere in Africa.

Praziquantel-efficacy reported in other African countries is as follows: in Zimbabwe, Ghana, Kenya and Senegal, cure rate ranges from: 72; 67; 62-65 and 80-83%, respectively (Taylor *et al.*, 1988; Chan *et al.*, 1998; Olds *et al.*, 1999; Shaw *et al.*, 1999). Whereas the percentage cure rate recorded by McMahon and Kolstrup (1979) in Tanzania, Wilkins *et al.* (1987) in Gambia, Etard *et al.* (1990) in Mauritania and El Malatawy *et al.* (1992) in Egypt were 66-83, 57-93, 90-95 and 59-62%, respectively.

Renganathan and Cioli (1998) stated that if the treated patient has been recently exposed to infection (≤6 weeks ago) in an area with continuous rather than seasonal-transmission, apparent treatment failure may be observed when unaffected juvenile worms (Schistosomulae) reach maturity and pass eggs several weeks after praziquantel treatment.

Laurent *et al.* (1990) reported that annual reinfection rates for *S. haematobium* may be high in some areas such as Niger and post-treatment infection detected after a single round of therapy should not be immediately interpreted as evidence of praziquantel resistance. Nevertheless, failure of praziquantel treatments of various proportions have been reported (Herwaldt *et al.*, 1995; Liang *et al.*, 2000). It is necessary to be sure about the parasitological cure after treatment. Da Silva *et al.* (2005) examined 26 patients at minimum intervals of 1 week to evaluate the efficacy of praziquantel and observed that 7 days post-treatment, all the patients became negative to eggs in three samples of 24 h urine examination. Several other workers advocate the use of standard dose (40 mg kg^{-1} body-weight) as well as high dose (60 mg kg^{-1} body weight) of praziquantel in the treatment

of Schistosoma infections in areas of low praziquantel efficacy where schistosome strains resistance are anticipated (Bennett *et al*., 1997; Fallon *et al*., 1997; Pereira *et al*., 1998).

There are obvious differences in the chemical structures and inherent active ingredients in praziquantel (PZQ: Pyrozinoisoquinolinone) and Niridazole/Ambilhar (N/A: 5-Nitrothiazole) and their target and mode of action as well as their mechanism of selective toxicity (Gutteridge, 1982). The effects of N/A on energy metabolism of the parasite are uncertain but its effect on reduction of glycogen levels due to inhibition of glycogen phosphorylase is well established. The mechanism of selective toxicity of N/A is also uncertain but may discriminate between host and parasite enzymes. PZQ, on the other hand is known to have pronounced effects on neuromuscular system of the parasite, causing spastic paralysis in worms and the drug also inhibits fumarate reductase but its mechanism of selective toxicity is unknown (Gutteridge, 1982).

MATERIALS AND METHODS

Comparison between the efficacy of Praziquantel (PZQ) and Niridazole/Ambilhar (N/A) in the treatment of *S. Haematobium* infections in kogi state

The study cohorts: The subjects for the two drugs (PZQ and N/A) evaluation were enrolled from Government Day Secondary School, LGEA Primary School, Ejule-Ojebe, a village in Ibaji Local Government Area and LGEA Primary School, Ichekene in Idah Local Government Area. The purpose of the exercise was explained to all the participants with emphasis on compliance and informed consent was obtained from the subjects and their parents. Treatment and control of schistosomiasis infection depend largely upon the use of Praziquantel (PZQ) which is cheaper (Reich and Govindaraj, 1998; Doenhoff *et al*., 2000; Appleton and Mbaye, 2001; Hagan *et al*., 2004) easier to use and more widely available than other schistosomicides (Doenhoff *et al*., 2000; Hagan *et al*., 2004), thereby making chemotherapy the cornerstone of control (WHO, 1985). Niridazole or Ambilhar was however, commonly in use by the inhabitants of the present study area probably because of its relatively lower cost than PZQ. Hence, the rationale behind the comparative evaluation of the two drugs in the area.

Ethical consideration: Ethical clearance was obtained from Ethical Clearance Committee of Kogi State Ministry of Health (MOH/KSG/329/VOL.1/110) Lokoja, Nigeria. The study participants were involved in the study after obtaining their informed consent.

Procedure: The collection of urine samples and analysis were carried out using the parasitological procedure described by Jordan and Randall (1962), Adeoye and Ipeayeda (1994) and Cheesbrough (1999). Briefly, from each urine container, 10 mL of thoroughly mixed urine was collected in a graduated centrifuge tube and subjected to centrifugation at 1500-2000 rpm for 5 min (Cheesbrough, 1999).

The supernatant was decanted and the number of eggs present in 100 mL (100 μL) aliquot of the thoroughly mixed sediment was drawn in a pipette onto microscope slide and the eggs (usually with vertical spine) were systematically sought for and counted.

The number of eggs in 10 mL of each urine sample centrifuged was calculated from the mean result of three counts by proportionality. Throughout this research, 10 mL of urine was examined at least 3 times from each subject to confirm infection or no infection (Forsyth, 1967). Any leftover urine samples that could not be examined within the same day were preserved with boric acid powder (0.1 g/10 mL urine) for subsequent examinations.

All the fifty-one parasitologically positive subjects in the aforementioned three schools were enrolled for the treatment regimens. Prior to treatment, the weight of each subject was determined and recorded with the aid of weighing scales. The 51 subjects infected with varying intensity (GMI/10 mL urine) of *S. haematobium* infection were randomly assigned to two groups of equal ratio by allowing them to pick papers containing PZQ and N/A blind-folded. Those who picked PZQ and N/A were placed on PZQ-regimen and N/A-regimen, respectively.

Praziquantel (PZQ)-regimen: The subjects in PZQ-group were given praziquantel (Biltricide Bayer Lever Kusen, Germany) total dose 60 mg kg^{-1} body weight given as the split oral dose of 20 mg kg^{-1} each at an interval of 6 h (Taddese and Zein, 1988). The drugs were administered with the help of the trained nurses who jointly monitored each subject with researcher in case of contra-indication of the drugs.

Niridazole/Ambilhar-regimen: N/A group were given ambilhar, total dose of 100 mg kg^{-1} of body weight each given as five split doses of 20 mg kg^{-1} taken orally for 5 consecutive days (Forsyth, 1967). The drugs were administered with the assistance of the trained nurses. The choice of these two drugs, PZQ and N/A by the researcher for evaluation was informed by their minimal side-effects, proven efficacy and their most frequently acceptability by the subjects (Forsyth, 1967; Iarotski and Davis, 1981; Taddese and Zein, 1988; King *et al*., 2000).

The higher dosage of praziquantel (max. 60 mg kg^{-1} body weight) rather than the standard dosage (40 mg kg^{-1}, mostly used in the evaluation) in the present research was in accordance with the researches by Bennett *et al.* (1997), Fallon *et al.* (1997) and Pereira *et al.* (1998). Higher dosage of schedule of ambilhar was also preferably recommended by Forsyth (1967).

In order to assess and compare the efficacy of the two drug regimens, re-examination of urine sample obtained from each subject was conducted every 4 weeks (28 days) for four consecutive months post-treatment, between March and September, 2004 in accordance with the method adopted by Comen *et al.* (1975). Similarly, for possibility of re-infection of the treated or 'cured' subjects, urine samples were collected and examined 3 months after the initial treatment. The results of the monthly observations were scored as reinfection after 3 months post-treatment, for subjects whose status changed from egg-negative to egg-positive whereas in 'cured' subjects, status changed from egg-positive to egg-negative. In Ichekene LGEA Primary School, Idah, treatment of subjects was conducted between March and August, 2005 after their blood samples had been collected for serodiagnosis.

From the results of the urine re-examination, patients were considered 'cured' when no *S. haematobium* eggs could be identified in the several 10 mL centrifuged urine deposits from the same subject whereas those who still voided eggs in the deposits were considered 'non-cured'. Statistically, the percentage Egg-Reduction (ER %) and percentage Cure Rate (CR %) were computed and the significant difference between the cure rates of PZQ and N/A were assessed using Chi-square (χ^2).

Percentage Egg-Reduction (ER %) and percentage Cure Rate (CR %) were calculated using the equation (Taddase and Zein, 1988):

$$ER(\%) = \frac{\text{Pre-treatment egg count} - \text{Post-treatment egg count}}{\text{Pre-treatment egg count}} \times 100$$

The more usual method of computing ER % is by using the mean of individual percentage reductions (Reddy *et al*., 1975). This is given by the expression:

$$ER(\%) = \frac{\text{Mean of Pre-treatment egg count} - \text{Mean of Post-treatment egg count}}{\text{Mean of pre-treatment egg count}} \times 100$$

$$\text{Current Rate (CR\%)} = \frac{\text{Total No. of 'Cured' patient}}{\text{Total No. of treated subjects}} \times 100$$

RESULTS AND DISCUSSION

Effects of Praziquantel (PZQ) on egg-output in patients of urinary

Schistosomiasis: Table 1 presents the results of effects of Praziquantel (PZQ) administered to 26 subjects on egg-output in primary and post-primary schools in Ibaji and Idah LGAs. The results showed an impressive Egg-Reduction (ER) from overall mean egg output of 866.0 eggs/10 mL urine at week zero (pretreatment week) to 37.6 eggs/10 mL urine (95.7%) at the 16th week post-treatment. The overall Cure Rate (CR) with PZQ chemotherapy of 66.7% was recorded in this research. It has been observed in this study that the subject, serial number 12 with initial egg count of 40 eggs/10 mL urine who failed to turn up for treatment (who served as a control) had egg-excretion increased up to 1,420 eggs/10 mL urine in the 20th week post-treatment. The results also revealed that the percentage cure rate differed significantly among school children placed on

Table 1: Mean monthly changes in urinary egg count with 3 (split) oral doses of praziquantel (PZQ; 3×20 mg kg body wt., taken 3 times at interval of 4-6 h by school children in Ibaji and Idah LGA, Kogi State, between March, 2004 and August, 2005

		Week after beginning of treatment				
School/LGA	Egg parameteres	19/03/04 (0)	16/04/04 (4)	14/05/04 (8)	11/06/04 (12)	9/07/04 (16)
Govt. Day Sec. School,	Mean egg output	1,058.6 (n = 12)	91.6 (n = 9)	47.0 (n = 10)	91.1 (n = 11)	5.3 (n = 10)
Ejule-Ojebe, Ibaji	Egg reduction (%)	-	91.3	95.6	91.4	99.5
(n = 12)	Cure rate (%)	-	22.2	40.0	18.2	70.0
LGEA Prim. School,	Mean egg output	1,383.0 (n = 6)	901.3 (n = 4)	566.7 (n = 6)	26.3 (n = 4)	136.7 (n = 6)
Ejule-Ojebe, Ibaji	Egg reduction (%)	-	34.8	59.0	98.1	90.1
(n = 6)	Cure rate (%)	-	25.0	16.7	25.0	66.7
LGEA Prim. School,	Mean egg output	189.0 (n = 8)	5.8 (n = 6)	83.1 (n = 8)	19.4 (n = 8)	3.6 (n = 8)
Ichekene, Idah	Egg reduction (%)	-	96.9	56.0	89.7	98.1
(n = 8)	Cure rate (%)	-	33.3	50.0	75.0	62.5
(n = 26) Overall mean	Mean egg output	866.0 (n = 26)	235.2 (n = 19)	189.0 (n = 24)	54.9 (n = 23)	37.6 (n = 24)
egg output,	Egg reduction (%)	-	72.8	78.2	93.7	95.7
Egg reduction % and	Cure rate (%)	-	26.3	37.5	39.1	66.7
cure rate %						

PZQ, CR % = 66.7; N/A, CR% = 36.0: $\chi^2 = 13.8$; df = 3, ($p<0.05$); CR % between schools: ANOVA: $F_{cal} = 4.44$; df = 2/9 ($p<0.05$)

praziquantel regimen in the three schools studied. This was evident in the percentage cure rates at week 16 post-treatment during which cure rates of 70.0, 66.7 and 62.5% were recorded for the subjects in Government Day Secondary School and LGEA Primary School (both in Ejule-Ojebe, Ibaji LGA) and LGEA Primary School, Ichekene, Idah LGA, respectively ($p<0.05$) (Table 1).

Effects of Niridazole/Ambilhar (N/A) on egg-output in patients of urinary

Schistosomiasis: The effects of Nidazole/Ambilhar (N/A) on egg-output in 25 patients of urinary schistosomiasis in primary and post primary schools in Ibaji and Idah LGA are shown in Table 2. The results showed that there was reduction of mean egg-output from 231.9 eggs/10 mL urine recorded at week zero (pre-treatment week) to 22.2 eggs (90.4%) at 16 week post-treatment. At week 16 post-treatment, an overall cure rate of 36.0% was recorded for N/A regimen. The results revealed that there was no difference statistically ($p>0.05$) in cure rates among the school children in the three schools studied (Table 2). The egg-excretion observed in some patients on praziquantel and niridazole regimens during a follow-up urine examination in the 20th week post-treatment could hardly be interpreted as a result of drug failure or reinfection.

This is because neither the most efficacious anti-schistosomacidal drug (e.g., praziquantel) nor niridazole which is widely used has been known to procure 100% cure. Besides, for one to establish cases of reinfection with *S. haematobium* the subjects need to be treated and re-examined annually for several years (King *et al*., 2000).

Table 3 shows the overall summary of effects of praziquantel and niridazole on egg-output in fifty-one patients of *S. haematobium* infection treated in Ibaji and Idah LGAs. The results showed gradual reduction in egg-count from week zero (pre-treatment week) up to the 16 week in both regimens. The mean egg-count of 866.0 eggs/10 mL urine at week zero reduced to 37.6 eggs/10 mL urine at week 16, giving percentage reduction at the 4th and 16th week of 72.8 and 95.7%, respectively for praziquantel regimen. Similarly, the mean egg-count of 231.9 recorded at week zero reduced to 22.2 eggs/10 mL urine at week 16, giving percentage reduction at the 4th and 16th week of 48.3 and 90.4%, respectively for niridazole/ambilhar (N/A) regimen (Table 3). The cure rate of PZQ (66.7%) was significantly higher than that of N/A (36.0%) ($p<0.05$).

Table 4 presents the effects of the initial high geometric mean intensity (pre-treatment or week zero) on final cure rate. For praziquantel regimen, there was no difference in cure rate for the initial egg-count <1000 eggs/10 mL urine and egg-count ≥1000 eggs/10 mL urine.

Table 2: Mean monthly changes in urinary egg count with oral doses of Niridazole/Ambilhar (N/A, 20 mg kg^{-1} of body wt., taken consecutively for 5 days) by school children in Ibaji and Idah LGA, Kogi State between March 2004 and August 2005

		Week after beginning of treatment (date weeks)				
School/LGA	Egg parameters	19/03/04 (0)	16/04/04 (4)	14/05/04 (8)	11/06/04 (12)	9/07/04 (16)
Govt. Day Sec. School,	Mean egg output	180.0 (n = 12)	129.7 (n = 11)	60.0 (n = 11)	40.5 (n = 12)	26.0 (n = 12)
Ejule-Ojebe, Ibaji	Egg reduction (%)	-	27.9	66.7	77.5	85.6
(n = 12)	Cure rate (%)	-	9.1	0	41.7	33.3
LGEA Prim. School,	Mean egg output	380.0 (n = 6)	149.5 (n = 4)	127.8 (n = 6)	65.0 (n = 6)	31.7 (n = 6)
Ejule-Ojebe, Ibaji	Egg reduction (%)	-	60.7	252.2	82.9	91.7
(n=6)	Cure rate (%)	-	0	0	16.7	33.3
LGEA Prim. School,	Mean egg output	193.9 (n = 7)	82.5 (n = 6)	13.9 (n = 7)	7.4 (n = 7)	7.4 (n = 7)
Ichekene, Idah	Egg reduction (%)	-	57.5	92.8	96.2	96.2
(n = 7)	Cure rate (%)	-	0	28.6	42.9	42.9
(n = 25) Overall mean	Mean egg output	231.9 (n = 25)	120.0 (n = 21)	63.5 (n = 24)	37.1 (n = 25)	22.2 (n = 25)
egg output, egg	Egg reduction (%)	-	48.3	72.6	84.0	90.4
reduction % and	Cure rate (%)	-	4.8	8.3	32.0	36.0
cure rate %						

F_{cal} ANOVA between schools: = 1.84; df = 2/3 ($p>0.05$)

Table 3: The overall summary of the effects of praziquantel/niridazole regimens on egg output

	No. of weeks after beginning of treatment (weeks)				
Praziquantel (PZQ) regimen	0	4	8	12	16
Total egg output	22,515	4,468	4,535	1,262	9.02
Mean Egg Count (EC)/10 mL urine	866.0 (n = 26)	235.2 (n = 19)	189.0 (n = 24)	54.9 (n = 23)	37.6 (n = 24)
Egg reduction compared with initial count (%)	-	72.8	78.2	93.7	95.7
Cure rate (CR %)	-	26.3	37.5	39.1	66.7
Niridazole regimen (N/A)					
Total egg output	5,797	2,520	1,524	928	554
Mean egg count (EC)/10 mL urine	231.9 (n = 25)	120.0 (n = 21)	63.5 (n = 24)	37.1 (n = 25)	22.2 (n = 25)
Egg reduction compared with initial count (%)	-	48.3	72.6	84.0	90.4
Cure rate (CR %)	-	4.8	8.3	32.0	36.0

Table 4: The effects of pretreatment urine egg intensity on final cure rate with praziquantel and niridazole

Praziquantel (PZQ) Regimen	No. of treated	No. of cured	No. of not cured	Cure rate (%)
Pretreatment egg count <1000/10 mL urine	18	12	6	66.7
Pretreatment egg count ≥1000/10 mL urine	6	4	2	66.7
Total (n)	24	16	8	66.7
Niridazole regimen (N/A)				
Pretreatment egg count <1000/10 mL urine	25	9	16	36.0
Pretreatment egg count ≥1000/10 mL urine	0	-	-	-
Total (n)	25	9	16	36.0

$\chi^2_{Cal} = 13.892$, df = 3, ($p<0.05$)

This could not be evaluated in niridazole/ambilhar regimen since none of the subjects in this group had egg count up to 1000 eggs/10 mL.

CONCLUSION

The study has validated the prospects of an already established protocol of using Praziquantel (PZQ) as the drug of choice in the treatment of schistosomiasis and even other related helminths' infections. The cure rate procured by PZQ (66.7%) was significantly higher than that of Niridazole/Ambilhar (N/A) (36.0%) ($p<0.05$). The validation of the efficacy of praziquantel was established in this study when it was observed in one of the subjects examined whose initial egg-count at week zero was 40 eggs/10 mL urine who failed to turn up for treatment (served as a 'control') had egg-excretion increased significantly up to 1,420 eggs/10 mL urine in the 20th week post-treatment when re-examined. Generally, the results showed that there was significant difference ($p<0.05$) in the percentage cure rate in children placed on PZQ-regimen in the three Schools surveyed.

RECOMMENDATIONS

It has been established that schistosomiasis ranks 2nd to malaria in terms of public health importance and that the disease is endemic in most rural areas in Nigeria where there is dire need of Praziquantel (PZQ) to curtail the menace. Researcher, therefore, strongly recommends that the Government of Nigeria harnesses its resources efficiently to procure PZQ for mass treatment in school children and rural populace. Besides, Government should also put in place the necessary and comprehensive enlightenment campaign on the aetiology of the disease so as to avoid contracting it in the first instance before seeking for treatment.

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