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Original Research Article

Parasitological assessment of efficacy of albendazole and ivermectin in the treatment of intestinal helminthiasis among pupils in Iba, Osun – State Nigeria

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Abstract

Soil transmitted helminths constitute major cause of morbidity and developmental challenges among children in Nigeria. 250 children were recruited between March and June 2015 and Questionnaire were administered. Stool samples were analysed with semi quantitative saline preparation and quantitative Katokatz methods. Weight and height were determined at pre intervention and post intervention stage. The body mass index (BMI) was calculated. The infected children were treated with single oral dose of 400mg/10kg albendazole and 3mg/15-25kg Ivermectin at pre intervention stage using World Health Organisation (WHO) guide. Stool were collected at three weeks of post intervention stage and analysed with Kato katzs technique. Drug efficacy was determined based on egg reduction rate. The overall prevalence was 33.6% (84/250). *Ascaris lumbricoides* single infection had 71(84.5%) while multiple infections of *Ascaris lumbricoides* with others are as follows; with Hookworm 7(8.3%), *Strongyloides stercoralis* 3(3.6%), *Taenia species* 1(1.2%), *Trichuris trichiuria* 2(2.4%). Prevalence of helminths in relation to sex showed that males 50(38.2%) were more infected than the females 34(28.6%). The difference was not statistically significant (p=0.120). BMI revealed that 40(16%) were seriously underweight with BMI below 16.5 while 60(24.0) were lightly underweight with BMI 17.0-18.9 according to WHO threshold. Efficacy of Albendazole and Ivermectin were determined in 73 infected children. 39(53.4%) and 34(46.6%) of the children that were lightly infected with geometric mean egg count of 4.4 egg/gram and 5.5egg/gram treated with albendazole and ivermectin respectively were parasitic free with 0.0 geometric mean egg count reduction rate. The cure rate at three week was 100%. Number of children with normal weight has increased from 35(47.9%) to 57 (68.5%) after drug administrations. The study revealed that albendazole and ivermectin improves nutritional status of helminths infected school children. However ivermectin known for the treatment of Onchocerciasis can be administered in the treatment of helminths infection in the absence of albendazole.

Keywords: Efficacy, Albendazole, Ivermectin, Helminths, Pupils

INTRODUCTION

In the vast majority of developing tropical and subtropical regions of the world, helminths infections particularly soil transmitted helminths (STHs) constitute major public health and developmental challenges. Among these

include hookworms (*Necator americanus, Ancylostoma duodenale*), *Strongyloides stercoralis,* round worm (*Ascaris lumbricoides*) whipworm (*Trichuris trichiura*) (Julie *et al.,* 2010).

WHO (2013) estimated that more than two billion of the world's population is infected with helminths. Young children under 5years of age are being exposed to mortality and morbidity as a result of helminths infection (AMREF, 2007), this accounts for poor background/poverty, poor sanitary conditions such as defecation and faecal contamination of water bodies and the spread is due to poor personal hygiene (Van *et al.,* 2009).

The burden of these helminths infections has been consistently underestimated in the past, but there is now a general consensus that helminths infections represent an important public health problem especially for children (Bethomy *et al.,* 2006).

Literature review have suggested that even a moderate intensity of infection results in delayed physical growth and impaired congnitive development, particularly among children of school-going age. The adverse health and nutritional impacts of severe worm infections on children often lead to iron deficiency, anaemia, protein energy malnutrition, stunting (a measure of chronic under nutrition), wasting (a measure of acute under nutrition), listlessness and abdominal pain and may negatively affect class-attentiveness, absenteeism as well as disability adjusted life years (DALYs) lost (WHO, 2013).

The effects of helminths infections in children are adverse and alarming and have detrimental effects on the survival, growth, general fitness and performance of school children. These infections are known to trigger immune responses in man, creating problems for the body's ability to fight disease, thus making affected individuals more prone to co-infection (Watkins *et al.,* 1997).

The role of malnutrition in helminths infection may be great with respect to parasite and its host. Dietary deficiencies are important factors governing susceptibility to certain helminths. Malnutrition interferes with antibody production decrease inflammation reaction and lowers resistance (Arora and Arora, 2010). Nutrition plays an important role in resistance to infection by parasite and in severity of the disease produced (Philip *et al.,* 2000). Nutrition diagnosis was based on weight for height, age for height, age for weight, arm to head circumference and clinical examination for Oedema, loss of subcutaneous tissue and diminished muscle mass; height - for-age was taken as the simplest satisfactory measures of nutritional status in an environment where chronic under nutrition is likely. The correlation between malnutrition, parasitoses and child development are complex and studies of these inter relationship will allow health agencies to maximize screening and intervention strategies for developing countries (Obelhelman *et al.,* 1988).

The availability of safe and relatively inexpensive drugs such as albendazole and Ivermectin has made control through chemotherapy a potentially affordable option even in resource poor countries (Julie *et al.,* 2010). Helminths are major cause of morbidity in children and infants. The scale of the problem has been neglected partly, because the disease rarely kills. There is low awareness by the populace on how to stem the tide of helminths infection and transmission. This study identified people who are at high risk of helminthiasis and the intensity of infections to serve as a baseline data to health planner in the local and state government. The aim is to study soil transmitted helminths and efficacy of some drugs on infected school age children who live and attend primary school in a rural community of Osun State, Nigeria.

MATERIALS AND METHOD

Ethical consideration

Approval to undertake the research was sought from the Ethical Committee, Ministry of Health, Osogbo, Osun State. Communication with Head of the schools was made through formal letter obtained from Department of Medical Microbiology and Parasitology, LAUTECH. After the purpose and objectives of the study were been explained, verbal consent was obtained from each study participants and written ascent was also obtained from each participant's parents or guardians.

Study area

Iba town is located at 35km away from the capital city, Osogbo with latitude of $7^0$58'09"N $4^0$42'1"E and longitude of 7.969051^{0}N 4.70388^0 above sea level and average temperature of 37^{0}C. It has 2 health centers and 4 primary schools. The area is predominantly rural and most residents live in the village as farmer. The area lacks basic amenities such as good roads, standard hospitals and adequate facilities for refuges and sewage disposal. There is 341 children in all the primary schools in which 250 were randomly selected, 131 males and 119 females were enlisted for the study.

Study population

A total of two hundred and fifty (250) children were studied, with the assistance of the head of schools. St. Peters primary school, Ansar-Deen primary school and Brook side primary school were selected. The age group studied was between of 3 – 15years.

Eligibility Criteria

Inclusion criteria

Children who have not received antihelminthic drug 3 weeks prior to the sample collection

Exclusion Criteria

Children who were sick or deformed and those who took antihelminthic drug recently were not included in the study.

Sample selection

Three schools were randomly selected using lottery method and the schools are situated in Iba. In each school, consents were sought by inviting parent to Parent Teacher Associations (PTA) meeting where the purpose and benefits of the study was explained to them. Pupils in were selected as recommended by W.H.O (2013)

Data collection

Data about the socio-demographic characteristics and other associated factors were collected using questionnaire. The study enrolled 250 primary school pupils aged three to fifteen years. The age of each child was determined based on school records and the weight and height were measured using a ruler and a weighing scale respectively (Chessbrough, 2000). Stool specimen was collected using clean, tightly corked, leak proof container.

Sample collection

All sample and other parametric indices were collected from the children with full cooperation and assistance of the staff and children. The subjects were given a stool container on the eve of the day of examination with specific instruction to collect in the morning. Other data collected included, Age, sex, Class, School, weight, height and arm-head circumference, after which body mass index were compared with WHO standard. The samples were treated promptly and the preservation of faecal samples for eggs count was done in 2% formalin.

Sample Analysis

Macroscopic Examination of Faecal Samples

All specimens were mainly examined for the consistency, colour, odour, presence of mucus and blood.

Microscopic Examination of Faecal Samples

Microscopic Examination was carried out on faecal sample collected using semi-quantitative wet–saline preparation, for the presence of egg/ ova or larval of parasite according to the method described by (Chessbrough, 2000).

Kato Katz Method

The faecal sample was pressed through a katokatz screen mesh (HelmR test kits, Belo Horizonte, Brazil) of size 200um**.** The sieved stool was transferred into 6mm diameter hole of the plastic template on a microscopic slide**.** The template was then removed and the remaining sample (app 42mg) was covered with the glycerol soaked cellophane strip of size 25 x 35mm and 50um thick**.** The prepared slide was microscopically examined and the eggs of each of the helminths species were recorded. The number of eggs per gram of faeces was calculated and used to estimate the infection intensities of the parasites based on the classification reported by WHO (2002)**.** The method is recommended for use because it is rapid and can be used to concentrate a wide range of fecal parasites from fresh or preserved faeces. The techniques, however requires the use of highly flammable ethyl acetate.

Weight and Height Determination

Weight and height were determined by Anthropometric measurement.

Weight

This was taken with the shoe removed, the children stood on Baermans weight balance uprightly and their weight were taken at appropriate balanced time and measured up to the accuracy.

Height

This is done without shoe to the nearest decimal against a wall nailed meter and the accurate height was obtained. The arm to head circumference were performed individually and the result was perfectly accurate with all the children studied.

Negative and positive sample were further examined with the use of concentration method as described by (Chessbrough, 2000).

Treatment and Follow-Up

Pre-Intervention Stage

All pupils recruited who provided stool specimen in the pre-treatment survey were included in the analysis of infection patterns at baseline, but only the children positive for helminths eggs were treated with either single oral dose of 400mg Albendazole and 3mg Ivermectin respectively using sequence of randomization code for drug administration, where Albendazole was labelled as 1 and Ivermectin was labelled as 0. Placebo (multi-vitamin was given to non-infected pupils as well. The drug was administered with a glass of water following the confirmation that the child ate at home or ate the food that was provided. Pupils were given biscuit and multi-vitamin tablets as incentives.

Post Intervention Stage

Stool samples of the infected children were collected on the third week to monitor post-intervention stage, using quantitative katokatz techniques as described by (W.H.O, 1999; 2000).

Data Analysis

Data was entered into Microsoft Excel spread sheet and exported to SPSS version 21 and NCSS 2000. The proportion of children infected with helminths was expressed as prevalence. P-value <0.05 were considered statistically significant. The intensity reduction rate was calculated as cure rate.

$$\left(\frac{\text{Geometric Mean Egg counts per gram of fecal after treatment}}{\text{Geometric Mean Egg counts per gram fecal before treatment}} \times 100\right)$$

RESULTS

Demographic distributions among pupils showed that the study examined 250 school children of age three to fifteen years in which 131 (52.4%) were males and 119(47.6) were females. Of these, age range ≤ 5years were 54 (21.6%), 6-10 years were 169(67.6%) and 10-15 years were 27 (10.8%) Table 1. The single and multiple infection patterns of the helminths are shown in Table 2. Five different species of helminths were reported in the survey namely; *Ascaris lumbricoides*, Hookworms, *Strongyloides stercoralis,* T*aenia species* and *Trichuris trichiura.* In all, 84 out of 250 stool samples collected were positive for one or two intestinal helminths therefore giving the overall prevalence of 33.6%. 71(28.4%) of the children were infected with only one helminth (*Ascaris lumbricoides*) while 13(5.2%) were infected with two different helminths namely *Ascaris lumbricoides and Hookworm* 7(2.8%), *Ascaris lumbricoides and Strongyloides stercoralis* 3(1.2%), *Ascaris lumbricoides* and T*aenia species* 1(0.4%), *Ascaris lumbricoides* and *Trichuris trichiura* 2 (0.8%). Table 3 shows that 50(38.2%) were positive out of 131males pupils examined while 34(28.6%) were positive out of 119 females pupils examined, although it was not statistically significant p> 0.05. Also age group 6-10years had the highest infection of 34.3%, followed by age group ≤ 5years with 33.3%. The least infection is in the age group 11-15years with 29.6%. The nutritional status of pupils as indicated by Body Mass Index (BMI) in Iba, Osun state during the epidemiological survey is shown in Table 4. The percentage of pupils with obese, overweight, normal, underweight, seriously underweight are 4(1.6%), 9(3.6%), 137(54.8%), 60(24.0%) and 40(16.0%) respectively according to WHO BMI range standard. Table 5 shows the relationship of the nutritional status with the age and sex of the pupils. The weight loss affect 100 (40.0%) of the children with a marked depreciation due to the rate of infection for sex and age, making them nutritional unstable. The weight loss increases along the age of the pupils but well pronounced in the age group 6-10 years old and therefore making the age group nutritionally unstable. Table 6 shows sequence of albendazole administration against helminths by age and sex where 39 pupils were given single oral dose of 400mg albendazole. Among these, 6 males and 3 females were treated in pupils in age group ≤5years. 13(33.3%) males and 14(35.9%) females of age 6 – 10years as well as 2(5.1%) males and 1(2.6%) female of age group 11 – 15years were also treated with albendazole. Table 7 shows sequence of ivermectin administration against helminths by age and sex where 34 children were given single oral dose of 3mg ivermectin. Of these, 2(5.9%) males and 2(5.9%) females were treated in age ≤5years. 16(47.1%) males and 11(32.4%) females of age 6-10years as well as 3(8.8%) males of age group 11 – 15years were also treated with ivermectin. Among 250 pupils age range three to fifteen years, 84(33.6%) were positive for helminthes, while 58 (34.3%) children of age group 6-10years were most infected and 8(29.6%) children of age group 11-15years were least infected, but the difference was not statistically significant (p = 0.28). There was no significant difference in the intensity of infection according to sex or age range in the study. The proportion of male 50(38.2%) that had light infection was greater than female 34(28.6%). But the difference was not statistically significant (P=0.120). The age group of 6-10years had the highest proportion 58(34.30%) of those with a light infection but the difference was also not statistically significant (p=0.208)

Table 1. Demographic distribution of pupils in Iba, Osun state

Demographic variables	Frequency
Age (Years)	**Number (%)**
<5	54 (21.6)
6-10	169 (67.6)
11-15	27 (10.8)
Sex	
Male	131 (52.4)
Female	119 (47.6)
Total	**250**

Table 2. Overall prevalence/ Distribution of Single and Multiple Helminths infection Among Pupils in Iba, Osun state

Distribution	Helminths	No. Positive (%)
Single Infection	*Ascaris lumbricoides (A.l.)*	71 (28.4)
Multiple Infection	*A. lumbricoides + Hookworm*	7 (2.8)
	A. lumbricoides + Strongyloides stercoralis	3 (1.2)
	A. lumbricoides + Taenia species	1 (0.4)
	A. lumbricoides + Trichuris trichiura	2 (0.8)
	Total	**84 (33.6)**

Table 3. Prevalence of Intestinal Helminths among pupils by Age and Sex in Iba, Osun state

	Male		Female		Total	
Age Group (Years)	**No Examined**	**No Positive (%)**	**No Examined**	**No Positive (%)**	**No Examined**	**No Positive (%)**
≤ 5	25	10(40.0)	29	8 (27.6)	54	18(33.3)
6 -10	87	33(37.9)	82	25 (30.5)	169	58(34.3)
11-15	19	7(42.1)	8	1(12.5)	27	8(29.6)
Total	131	50(38.2)	119	34(28.6)	250	84(33.6)
P. value		0.178		0.181		

Table 4. Nutritional Status of pupils as indicated by Body Mass Index (BMI) in Iba, Osun state.

Category	BMI Range (WHO Standard)	Frequency	(%)
Seriously underweight	Less than 16.49	40	16.0
Underweight	Between 17.0 – 18.9	60	24.0
Normal	19.0 – 24.9	137	54.8
Overweight	25 – 29.91	9	3.6
Obese	30 or more	4	1.6
TOTAL		250	

Table 5. Nutritional Status with the Age and Sex of the Pupils in Iba Osun state Nigeria.

	Male					Female				
Age	**SU**	**UW**	**NW**	**OW**	**OB**	**SU**	**UW**	**NW**	**OW**	**OB**
≤5	3	4	15	0	3	3	4	21	0	1
6-10	11	20	52	4	0	15	25	39	3	0
11-15	7	5	5	2	0	1	2	5	0	0
TOTAL	21	29	72	6	3	19	31	65	3	1

NOTE:

SU: Seriously underweight; UW: Underweight; NW: Normalweight

OW: Overweight; OB: Obese.

Table 6. Method of Albendazole Administration on Helminths among pupils by Age and Sex in Iba Osun state.

	Male		Female		Total	
N (39)	No of Positive (%)	No Treated	No of Positive (%)	No Treated	No of Positive (%)	No Treated
≤ 5	6(15.4)	6	3(7.7)	3	9(23.1)	9
6-10	13(33.3)	13	14(35.9)	14	27(69.2)	27
11-15	2(5.1)	2	1(2.6)	1	3(7.7)	3
P. value	0.856		0.856			

Table 7. Method of Ivermectin administration on Helminths among pupils by Age and Sex in Iba, Osun State

	Male		Female		Total	
N (34)	No of Positive (%)	No of Treated	No of Positive (%)	No of Treated	No of Positive (%)	No of Treated
≤ 5	2(5.9)	2	2(5.9)	2	4(11.8)	4
6-10	16(47.1)	16	11(32.4)	11	27(79.4)	27
11-15	3(8.8)	3	0(0.0)	0	3(8.8)	3
P. value	0.661		0.663			

Table 8. Mean Egg Count/Gram Faecal by Sex and Age of Infected Pupils in Iba, Osun state Nigeria

Sex	No. Examined 250	No. Positive %	No. Heavy	No. light	Geometric mean egg count/gram
Male	131	50(38.2)	0.(0.00)	50(38.2)	4.5
Female	119	34(28.6)	0.(0.00)	34(28.6)	4.5
P. value		0.120		0.120	0.240
Age					
≤5	54	18(33.3)	0(0.00)	18(33.3)	5.2
6-10	169	58(34.3)	0(0.00)	58(34.3)	4.7
11-15	27	8(29.6)	0(0.00)	8(29.6)	1.9
P. value		0.208		0.208	0.063

Table 9. Cure Rate, Geometric Mean Egg Counts and Intensity Reduction Rates over 21 Days after one (1) treatment with albendazole and Ivermectin in Iba, Osun state Nigeria

Egg Before Treatment			4 Weeks After Treatment With Albendazole			
	No of Subject	Gm Egg/g	No Cure	Cure Rate (%)	Gm Eggs/g	Egg Reduction Rate (%)
	39	4.4	39	100.0	0.0	100.0
			4 Weeks After Treatment With Ivermectin			
	34	5.4	34	100.0	0.0	100.0

Table 10. Nutrition status of the Infected Pupils Before and After Drug Administration in Iba, Osun state Nigeria.

N=73

Category	Frequency before drug (%)	Frequency after drug (%)
Seriously underweight	11(15.1)	4 (5.5)
Underweight	24(32.9)	4(5.5)
Normal	35(48.0)	57(78.1)
Overweight	2(2.7)	5(6.9)
Obese	1(1.4)	3 (4.1)

Table 8. Table 9 shows study compliance comparing efficacy of albendazole and ivermectin among pupils in which 84(33.6%) pupils were positive for helminths but 11(4.4%) were excluded because of inability to provide

specimen. For this reason, a total of 73 children were treated. Before treatment with albendazole, 39(53.4%) participants with (4.4 egg/gram geometric mean egg count) were lightly infected. At three weeks post treatment 39(53.4%) children were parasite free and egg reduction rate (ERR) was (100%). Similarly, 34(46.6%) pupils with (5.4 geometric mean egg/gram count) that were lightly infected and given ivermectin were helminths free after three weeks of post treatment with Egg Reduction Rate (ERR) of 100%. Nutritional status of the infected pupils before and after drug administration was shown in Table 10. The frequency of the pupils with weight loss was reduced from 35(58.0%) before drug to 4(5.5%) after drug indicating potency of administered drugs against helminths infection. The number of pupils with normal weight increased from 35(48.0%) to 57(78.1%) after drug administration.

DISCUSSION

The study provides a data on the intestinal helminths infection, nutritional status and comparative study on the assessment of efficacy of albendazole and ivermectin on the pupils infected with helminths. The overall prevalence of helminths was (33.6%), *Ascaris lumbricoides, Hookworm, Strongyloides stercoralis, Taenia spp.* and *Trichuris trichiura* were the commonest parasite among school children in this area, indicating prevalence of these helminths in southwestern Nigeria as reported by Adeyeba *et al*., (2002), Ephrem *et al.,* (2015) and Bolaji *et al*., (2017). Although several studies had been done on prevalence of helminths infection worldwide including West Africa and Nigeria but the overall prevalence of 33.6% intestinal helminths in this study agreed with 39.9% reported in South Ethiopia by (Wegayehu *et al.,* 2013) and 43.9% documented in south-west Nigeria by (Adeyeba *et al.,* 2002). However, the result is lower than overall 65% prevalence documented by (Agbolade *et al.,* 2004; Oyewole *et al.,* 2007).

The difference in prevalence could be attributed to timing and seasonal differences in conducting the survey, environmental conditions and other geographical factors in the study areas. The high prevalence may also be connected with poor sanitation practices in the study area and among the school children. The high percentage accounts for low or no deworming programme in the area or re-infection after a period of deworming. Since, prevalence rate in this study is ≥20% and <50%. Thus, the need for regular deworming programme as recommended by (WHO, 2012).

Multiple infection occurred in 13(5.2%) of the total examined pupils and those who had multiple intestinal parasitic infection of *Ascaris lumbricoides* and hookworm had 7(2.8), *Ascaris lumbricoides* and *Strongyloides stercoralis* had 3(1.2) which is in agreement with Bolaji *et al*., 2016 that reported 3.3% and 0.7% respectively . The level of double infections with intestinal parasites determined in the present study (5.2%) was much lower than what was reported from South-West Ethiopia portraying a double infection of 35.8% among urban communities (Meningistu *et al.,* 2007). This could be attributed to poor environmental condition and difference in the socio-demographic condition of the study population.

The most common human gastrointestinal parasite in the study area was *Ascaris lumbricoides* with prevalence of 28.4% in a single infection. This reflected environment contamination and unsanitary life style, which is dangerous owing to the fact that intestinal parasites have been shown to have a devastating effect on children mostly those of school age (Wegayehu *et al*., 2013). The highest prevalence and intensity of *A. lumbricoides* recorded in this study could indicate high level of unhygienic practices and the habit of defecating indiscriminately in open place among school children which eventually contaminate the environment. Intestinal parasites have been reported to have deleterious effects on school children (Ephrem *et al.,* 2015). *A. lumbricoides* in school children is associated with nutritional status and cognitive development with a consequence of under-developed skill and learning ability. Although the hookworm infection rate of 20.5% and 16.2% in studies conducted by Ijagbone and Olagunju (2006) and Osazuwa *et al.,* (2011) was higher than what is observed in this study.

In this study, the performance of albendazole and ivermectin was considered satisfactory since egg reduction rates (ERRs) after the third week of administration on helminths infected pupils was 100% respectively. Several studies have shown ivermectin to be efficacious against *Ascaris lumbricoides* (cure rates 78.4 – 100%) as reported by (WHO,2006) and (Julie *et al.,*2010). In this study, male (38.2%) children were more infected than female (28.6%) and the difference was not statistically significant (p=0.120). It is however important to affirm that more male was enlisted in the study than female, which is in accordance with the report of (Ukpai and Ugwu, 2003) but contrary to (Ijagbone and Olagunju, 2006). The prevalence rate was decreasing with increasing age group possibly due to change in attitude, habits and more awareness regarding personal hygiene among the older school children

It has been shown in the study that the weight and height of the children has been adversely affected by the helminths infection. This reveals presentation of low body mass index (BMI) among the children. In addition, light infection characterized by low number of eggs counted was common among the helminths, indicating chronic infection (WHO, 2013).

Therefore it was observed that nutritional status of the subjects have been affected by the number of egg counted thus, impede normal growth via weight loss, indicating worm antagonizing the children metabolism

and diminished appetite but gender is not significant risk factor for helminths intensity as reported from this study. However, the frequency of the infected children that were undernourished was reduced after drug administration with albendazole and Ivermectin. Thus, indicating efficacious of both drugs against helminths in light infection.

CONCLUSION

The result of the study has shown that helminths infections are prevalent among the school children in Iba, Ifelodun Local government area of Osun State. The implication of this observation is that intestinal parasites are still a major health problem in Nigeria.

In view of this considerable morbidity and the public health significance of these parasitic infection, couple with the fact that children are the future of any nation, it then becomes necessary as a matter of urgency to control these parasitic infection from the community. This study therefore suggested that only well-organized health education programme on prevailing health problem, on personal hygiene, community health, adequate portable water supply and basic education shall bring a long lasting solution to the ragging problems posed by helminths.

The community leaders, heads of school, the staff and even local government have a vital role to play in the rescue operation. Also, mass treatments of infected children through their school will reduce the intensity of infection. Periodic deworming of children should form part of child care in an area where malnutrition and helminths infection are common. Currently, the recommendations in control programs are solely based on the overall prevalence of STHS, with those drugs being administered once a year when the STH prevalence is $\geq$ 20% and < 50%, and twice a year when the prevalence is $\geq$ 50%. Although intermittent chemotherapy provides a useful tool to combat helminths infection.

Ivermectin efficacy cannot be underestimated as well as albendazole especially on the prevalence of intestinal helminths where there is occurrence of co-infection and could be administered for controlling light intensity of intestinal helminths. However, Ivermectin popularly known for the treatment of onchocerciasis could be administered as an alternative antihelminthic in the absence of albendazole. Enhanced nutrient status increased the likelihood of success of each of these approaches generally by maintaining the effectiveness.

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