ASSESSMENT OF THE IMPACT OF PERIODIC TREATMENT OF SOIL-TRANSMITTED HELMINTH INFECTIONS ON THE HEALTH STATUS OF PRIMARY SCHOOL CHILDREN IN MUHEZA DISTRICT

BY

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A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF PUBLIC HEALTH (MPH) OF THE MUHIMBILI UNIVERSITY COLLEGE OF HEALTH SCIENCES

UNIVERSITY OF DAR ES SALAAM

SEPTEMBER 2003

CERTIFICATION

The undersigned certifies that he has read and hereby recommends for acceptance by the University of Dar es Salaam a dissertation entitled :-

" Assessment of the Impact of Periodic Treatment of Soil-Transmitted Helminth (STH) Infections on the Health Status of Primary School Children in Muheza District", in partial fulfilment of the requirements for the degree of Master in Public Health (MPH).

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Date: 30th September 200

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ACKNOWLEDGEMENT

First and foremost I praise the Lord for enabling me to pursue this course successfully.

I am deeply greatful to all the staff members of the Departments of Parasitology and Medical Entomology, Epidemiology and Biostatistics, Behavioural Sciences, Microbiology and Immunology, and Community Health from whom the capability to do this work grew.

I am very much indebted to my supervisor Professor C.M. Kihamia who gave me excellent advice and constructive criticism from the initial development of the proposal to the final completion of this work. I am also obliged to Mrs. R. Mpembeni (Medical Statistician) for her assistance in clarifying some statistical issues during data analysis.

Thanks to Dr Asia Hussein for her valuable comments and advice on data pertaining to anthropometrical nutritional indices. I am also greatful to the National Coordinator of UKUMTA who supported this study by providing drugs and equipment, the Muheza District Medical Officer and the Muheza District Education Officer for allowing me to do this study in the district. I am also greatly obliged to all teachers and pupils who agreed to participate in the study. I extend my gratitude to the field laboratory technician Mr. Umoja Nyanda who examined stool specimens during data collection. My heartful regards go to the Muheza School Health Coordinators Mrs. Agness Mbwana and Mrs. Martha Kussaga who gave me excellent cooperation and assistance during the field work. I wish to express my sincere gratitude to the Ministry of Health / World Bank for

sponsoring my course at the University of Dar es Salaam. I am very much obliged to my parents, my brothers and sisters and my close relatives for their moral support.

Lastly, but not least I wish to extend my heartful gratitude to my wife Anna Tesha Mtoi, and my daughter Natasha for tolerating my long absence from home during the whole period of my academic pursuit and indeed, for their encouragement and moral support. Really I find it very difficult to mention by name every individual who contributed to the success of this work, but to all of them I say thanks.

DEDICATION

This work is dedicated to my beloved wife Anna and my daughter Natasha.

ABSTRACT

A cross-sectional study was carried out in mid-June 2003, in Muheza district. The main objective of the study was to assess the impact of periodic treatment of Soil-Transmitted Helminth (STH) infections on the health status of the school children in the district after four years of intervention of school-based deworming project. The main focus was on the reduction of the prevalence and intensity and improvement of the health status as well as knowledge on disease transmission and prevention and compare it with the data from the baseline survey done in 1996. A simple random sampling method was used to select four primary schools, whereby all pupils from class V to VII totaling 339 were investigated. Prevalence and intensity of STH (geohelminths) was assessed by stool examination using Kato-Katz technique. Nutritional status was measured for wasting, stunting and underweight by using Weighing scale and Stadiometer. Knowledge, attitude and practices regarding geohelminthiasis were explored by using semi-structured interviews using questionnaires.

The findings of the study are as follows:-

The overall prevalence dropped from 70% during the baseline to 47.1%, intensity of infection dropped from moderate during the baseline to light for hookworm, *Ascaris lumbricoides* and *Trchuris trichiura*. Children's understanding of STH improved and there was improvement of anthropometrical nutritional indices. Stunting dropped from 66% to 43.1%, underweight dropped from 50.5% to 26.5% and wasting dropped

significantly from 1.8% to 0.6%. Therefore it is recommended that more research should be carried out to determine the prevalence of STH and the worm burden among the school children in rural and urban areas in order to assist policy makers in rational planning for control of STH. Relevant authorities should upscale the deworming programme throughout the country by involving various sectors like the government, NGOs and the community in the control of Soil-Transmitted Helminthiasis.

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ABBREVIATIONS/ACRONYMS

AMREF – African Medical Research Foundation.

DALYs – Disability Adjusted Life Years

DDH - District Designated Hospital

IDA – Iron Deficiency Anaemia

NGO – Non Governmental Organization

STH – Soil-Transmitted Helminths

UKUMTA – Ushirikiano wa Kumwendeleza Mtoto Tanzania

UNICEF- United Nations Children's Fund

WHO – World Health Organization

CHAPTER ONE

1.0 Introduction

Soil-transmitted helminth (STH) (geohelminth) infections account for more than 40% of global burden of all tropical diseases (WHO, 1999). More than 2000 million people are affected worldwide, of whom more than 300 million suffer associated severe morbidity (Crompton, 1999). In terms of burden of disease in school-age population in developing countries, geohelminths rank the first among the causes of all communicable and non-communicable diseases with DALYs lost (in millions) (16.%) (World Bank, 1993). Parasitic helminth infection may cause or aggravate malnutrition and retard child development (Stephenson *et. al.,* 2000). Heavy infections limit full utilization of nutrients in the diet. However, antihelmintics may reverse growth and nutritional deficit caused by even modest worm infection (Drake *et. al.*, 2000). Studies from many countries show that treatment for hookworm infestation in particular may improve work productivity and health (Crompton and Stephenson, 1989) and those interventions to decrease protein energy malnutrion or iron deficiency anaemia (regard- less of cause) result in improved physical productivity (Spurr, 1983; Stephenson, 1987; Latham, 1989). Data from studies show that prevalence of stunting increased with age showing a higher proportion of stunted school-age children (Partnership for child Development, 1998). Studies have shown that school-based programmes aimed at improving health and nutritional status may have the potential to bring about catch-up growth in stunted school-age children (Stoltzfus *et. al.,* 1997, 1998). In developing countries, more than

480 million children attend primary school each year with enrollment varying between 68% and 98% of eligible children. (Bundy and Guyat, 1995). There is a growing body of evidence that in many developing countries school- based health services such as treatment of schistosomiasis and intestinal nematode infections can be delivered at low cost (World Bank , 1993; Partnership for child Development 1999) and can contribute to improving children's well being, growth (Stephenson *et. al.,* 1989; Stoltzfus *et. al.,* 1998), nutritional status (Stephenson *et al.,* 1993; Beasley *et. al.,* 1999), cognitive ability (Drake *et. al.,* 2000) and school attendance (Simeon *et. al.,* 1995). Community chemotherapy programmes are the only way in the short term to reduce drastically the prevalence and intensity of the intestinal helminthic infections in most endemic communities (Latham, 1984; Stephenson *et. al.,* 1989).

In recognition of the benefits to children of deworming, many countries in areas where helminth infections are prevalent are now advocating national policies for school-based helminth control. At present many school-based deworming programmes are small or at the pilot stage of implementation. The challenge is how to expand these programmes and take them to national scale. In 1994 a simple one-time survey in Tanga identified a small and inexpensive package of interventions which had a potential to improve children's health and education comprising; annual treatment for intestinal worms using albendazole given to all children; annual treatment for urinary schistosomiasis using praziquantel in schools where the infection is common; and participatory health education. In a study done by Kihamia *et. al.,* (1996) in collaboration with Tanzania Partnership for Child Development, *Ushirikiano wa Kumwendeleza Mtoto Tanzania*

(UKUMTA) in three districts in Tanga region (Tanga, Muheza and Korogwe) through the inter-sectoral school health programme, mass treatment was conducted by primary school teachers using albendazole and praziquantel. The survey was done over a period of two months between March and May 1996 in 21 schools in the Intervention Area and 20 schools in the Comparison Area.

Mass treatment with albendazole was provided free in all schools in the Intervention Area after the baseline survey had been completed, while mass treatment with praziquantel was given in schools in which the prevalence of infection with *S. haematobium* was estimated from the questionnaire to be greater than 50%. Faecal and urine samples were collected in May 1996 after treatment had been given to 413 children in 8 schools in order to assess the cure rates of infections after mass treatment. Results showed that the prevalence dropped from 65% to 9% for hookworm, from 54% to 4% for *S. haematobium*, from 17% to 1% for *A. lumbricordes* and from 10% to 6% for *T. trichiura*.

In a study of cost-effectiveness of mass drug therapy for intestinal helminthes, Evans and Guyat (1995) revealed that mass treatment is more cost-effective than selective treatment (treatment after individual screening) in high prevalence area and at observed prices. Mass treatment targeted at known high risk groups, such as school children for soil- transmitted helminth infections, can be more cost-effective than population-based mass treatment.

Control programmes are designed to reduce worm burden and keep it low. Children will become reinfected but repeated treatment will ensure that they have much less worms

for a longer period throughout the year. This will have a positive effect on their health. This will in turn help to give them the best chance of growing and learning. The infrastructure provided by the school system enhances the management and delivery aspect of control activities. Moreover school children can be effective change agents in their communities. This study was conducted in June 2003. The major objective of the study was to monitor the impact of repeated deworming on the prevalence and intensity of STH in children and compare with the baseline conducted in 1996 and to measure the nutritional status of the school children in Muheza district.

1.1 Statement of the problem

Soil-transmitted helminth infections are diseases of poverty and remain a public health problem in the tropics and subtropics because of poor sanitary conditions in these regions. According to WHO (1987) there are some 3.5 million cases usually of clinical diseases with nematode infections alone. Most of these infections have various public health consequences such as malnutrition especially among children. It is the school-aged child who is at the greatest risk of infection with one or more of the most common parasites (Hookworm, *Ascaris lumbricoides* and *Trichuris trichiura*) and at the same time is a major source of infection (Bundy, 1994). Although mortality from these infections may be relatively low, complications are not uncommon and many cases need hospital care (WHO, 1987). Frequently, physicians and public health authorities show little interest in them. The reason for this may be because of eradication and control of these diseases appears to be easy. It is also noted that medical care expenditure on

parasitic infections may consume a considerable proportion of the national health budget (WHO, 1981).

Good health is essential for learning and cognitive ability. Ensuring good health when children are of school age can boost attendance and educational achievement. School children are often thought of as naturally healthy, but studies have shown that in Africa more than half of the school children are stunted in height and anaemic and in many areas most school children are affected with worms, schistosomiasis and malaria parasites. These highly prevalent conditions are all associated with impaired cognitive ability.

Physical ill health caused by parasitic helminth infections negatively impacts on a child's mental function. There is a proven link between iron deficiency anaemia, stunting and cognitive development. In addition, although evidence is not yet conclusive, it is likely that geohelminths do impair cognitive development. However, this may occur only for those children with the heaviest parasitic loads or for those already vulnerable in other ways, such as from undernourishment (Drake *et. al.,* 2000). Highly prevalent nutrition and health conditions in school-age children are important determinants of educational outcomes which educational policy makers and planners cannot afford to overlook.

There are now more school-age children in developing countries than ever before, due to population growth and the success of child survival programmes. At the same time, there are more children in schools as access to basic education has increased in most of the developing world. However, millions of school-age children remain at risk due to

poor health and nutrition. In schools, learning that includes aptitudes, time-on-task, and school achievement (test achievement scores and grades attained as final outcome) have a lot of deficits.

1.2 Research question

Soil-transmitted helminthiasis is endemic in Muheza district, affecting majority of school children. A baseline survey conducted by UKUMTA in 1996 revealed a prevalence of 70%. The high prevalence of infection is associated with malnutrition, growth retardation and cognitive impairment. Geohelminth infections are related to poor sanitation and lack of awareness of the need for good personal hygiene among school-age children. In recognition of the above named factors and the public health importance of the disease, geohelminths control intervention programme was implemented in Muheza district in 1998. The research question here is to assess the impact of repeated deworming on prevalence, intensity of infection, and health status of school children after 5 years of continuous periodic mass treatment.

1.3 Research objectives

1.3.1 Broad objective

To assess the impact of repeated deworming on the health status of primary school children.

1.3.2 Specific objectives

1. To determine the prevalence of STH and compare it with that of the baseline.
2. To determine the intensity of STH in eggs per gm of faeces (epg) and compare it with that of the baseline.
3. To assess the children's knowledge, attitude and practice (KAP) on soil-transmitted helminthiasis.
4. To measure the nutritional status of the children by age, weight and height and compare it with that of the baseline.

1.4 Hypothesis

Repeated mass deworming with anthelmintics reduces both prevalence and intensity of STH infections and improves health status of school children.

1.5 Expected benefits

1. The results from the study are expected to enhance the existing knowledge on STH and mass treatment in rural and urban schools.
2. The results would assist in planning and up scaling of deworming programmes.
3. Children would benefit health wise from repeated mass treatment.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Situation of STH infections and public health importance

Soil-transmitted helminth infections are a serious public health problem. WHO (1999) estimates that more than one billion of the world's population is chronically infected with soil-transmitted helminths and 200 million are affected with schistosomes. STH infections are widely distributed in tropical and sub-tropical areas especially in poor populations. For example, most people in sub-Saharan African indigenous populations and in the rural and peri-urban slum areas of the American populations. Global prevalence and number of cases of STH infections in school-age children are estimated to be roundworm 35% (320 million); whipworm 25% (233 million); hookworm 26% (239 million) (Partnership for Child Development, 1997).

Exposure and susceptibility to worm infections are not uniform and, it is the school-age child who is most at risk from intense infections. As intensity of infection is directly related to morbidity, it is clear that it is the school-age child who is most at risk from disease. For girls and boys aged 5 to 14 years in developing countries, these worm infections accounts for an estimated 12 and 11 percent of the total disease burden respectively, and represent the single largest contributor to the disease burden of this age group (Bundy, 1988). A community survey in Jamaica showed, for example, that for intestinal nematodes, some 90% of the total worm population occurred in children between 5 and 15 years of age.

As children are more at risk at an age when they are both growing and learning goehelminth infection potentially threatens a child's overall physical and psychological development. Parasitic helminth infection may cause or aggravate malnutrition and retard child development (Stephenson, Latham and Ottessen, 2000). Helminths particularly hookworm infection has been shown to cause iron deficiency anaemia (IDA), reduce growth and may negatively affect cognition (Stoltzfus *et. al*, 1997). It is estimated that 210 million children suffer from IDA (Del Rosso and Marek, 1996). There is substantial evidence that IDA in children is associated with decreased physical and mental and development and impair immune function. Anthelminthics may reverse growth and nutritional deficit caused by even modest worm infection. Intervention studies have shown that infection with as few as ten roundworms is associated with deficit in growth of school-age children and that moderate whipworm infections can cause growth retardation and anaemia. In the case of more severe infection, children infected with *Trichuris* dysentery syndrome show "catch-up growth" after treatment of intense infection with the worm and other intervention studies have shown a positive impact on anthropometrical parameters and iron status of pre-school and school-age children with helminth infections (Drake *et. al*, 2000).

In Zanzibar a school-based deworming programme implemented on Pemba Islands by the Zanzibar Ministries of Health and Education twelve schools were randomly selected for evaluation and allocated to the control, twice-yearly or thrice-yearly treatment groups, with approximately 1,000 children in each group. Baseline, six month and

twelve month follow-up nutritional and parasitological surveys were conducted by the Centre for Human Nutrition of John Hopkins School of Public Health. Overall, 91% of children participated in the baseline survey and 85% of those children were assessed again at the twelve-month follow-up. Children were given thrice-yearly mebendazole and compared with children that received twice yearly mebendazole and in untreated children. The evaluation found that children younger than ten years gained 0.27kg more weight and 0.13cm more height in the twice yearly group, and 0.20kg more weight and 0.30cm more height in the thrice-yearly group, compared to the control group. Children younger than ten with higher heights for age at baseline had higher weight and height gain in response to deworming. In children ten and older overall programme effects on height or weight gains were not significant. But in this age range younger boys had significant improvements in height gain with thrice-yearly deworming, and children with higher heights-for-age had greater improvements in weight gain on deworming.

In conclusion, the evaluation provided evidence that the school-based deworming programme improved the growth of school children. The pre-test design of the evaluation, the comparison between randomly allocated programme and control schools and statistical adjustment for the differences in baseline characteristics among groups, enabled the evaluations to conclude that periodic anthelminthics treatment caused greater height and weight gains among children participating in the programme (Stoltzfus *et. al.,* 1998).

The high prevalence of infections and the development of effective and safe single-dose treatments for worms have led the WHO to recommend mass treatment through schools

where surveys show that the prevalence of intestinal helminths or schistosome infections exceeds 50% (WHO, 1998); albendazole or mebendazole for treating round worms *(Ascaris lumbricoides),* whipworm *(Trichuris trichiura)* and hookworm *(Necator americanus* and *Ancylostoma duodenale*) and praziquantel for treating schistosomes are the recommended drugs.

In addition, population dynamic theory has predicted that focusing treatment effort on this age group would significantly reduce transmission in the population as a whole (Bundy *et. al.,* 1990). Large-scale field studies have supported these conclusions. A school-based programme in Montserrat treated 95% of school children on a regular basis, which caused a decline in intensity of both treated children and untreated population outside the school (Bundy *et. al.,* 1990). In Kenya treating only school children had almost the same impact on *S. mansoni* reinfection rates in a comprehensive programme that sought to treat the entire population. Population dynamic models of these data suggest that these observations can only be satisfactorily explained by the assumption that school children are the major contributors to helminth transmission (Chan & Bundy, 1997).

2.2 The Disease

Soil-transmitted helminths (intestinal worms) are named so because their life cycle includes an obligatory residence in the human gastrointestinal tract (WHO, 1987). Infection by intestinal worms has been increasingly recognized as an important public health problem, particularly in developing countries, including Tanzania. Poor

environmental sanitation as reflected by absence of latrines and inadequate or unprotected water sources has been implicated to be a major reason (Eshuis and Manschot, 1978).

Soil-transmitted helminths are widely distributed in Tanzania (Macpherson *et. al.*, 1991). In the 1993 World Development Report, intestinal helminths rank first as the main cause of disease burden in children aged 5-14 years. Soil-transmitted nematodes (*Ascaris lumbricoides, Trichuris trichiura* and hookworm) cause morbidity in humans in different ways by: -

- Affecting nutritional equilibrium
- Inducing intestinal bleeding
- Inducing malabsorption of nutrients
- Reducing growth
- Causing surgical complications such as intestinal obstruction, rectal prolapse and abscesses
- Affecting cognitive development

Ascariasis and trichuriasis are most prevalent in highland regions (Kihamia, 1977) and hookworm in the coastal areas of Tanzania *Ascaris lumbricoides* is the largest nematode (roundworm) parasitizing the human intestine (adult females, 20 to 35cm, adult males, 15 to 30cm). Adult female may produce about 200,000 eggs per day, which are passed with the feaces in a period of about 300 days. Adult worm can live up to one year. As a

consequence a large number of eggs are discharged into the environment daily and leads to extensive soil pollution. Unfertilized eggs may be ingested but not infective. Fertile eggs embryonate and become infective after 18 days to several weeks. Soil pollution will occur when the wormy person defecates in open place, in bush areas, behind the house or around latrines and pollute the soil (Ismid *et. al.,* 1980). How can sanitary conditions be when 90 young children in a school are sharing one toilet? Or when 54% of the toilets are not functioning? Primary schools in some of the poorest countries have inadequate sanitation facilities, according to a pilot survey of 14 countries in 1995. The average number of users is often higher than 50 students per toilet in city schools. None of the 14 countries had increased the number of toilets by more than 8% since 1990, suggesting that they are barely managing to keep up with the rise in student populations. Somewhat better progress had been achieved in providing safe water in schools. Inadequate sanitation and water in schools jeopardize not only student's health but also their attendance. Girls, in particular are likely to be kept out of school if there are no sanitation facilities (UNICEF, 1997).

The number of eggs per gram of faeces gives measure of parasite load indirectly. Worm expulsion studies provide a direct assessment of the intensity (parasite load) of worms and the ability of anti helminthics to expel worms. A study done in Asia by Anderson and Schad in 1985 revealed that egg count method can act as indirect measure of worm burden and this differs from person to person. Counting the number of worms is the direct measure of infection.

The laboratory examination classifies each individual as infected or uninfected for each helminth species. Further the individual can be classified according to intensity of infections measured in terms of eggs per gram (epg) of faeces. With Kato-Katz technique, the epg value is obtained by multiplying the number of eggs counted on the slide by a multiplication factor that varies according to the size of the template used. WHO recommends the use of a template holding 41.7mg of faeces, which correspond to a multiplication factor of 24. The classes of intensity proposed for the classification of individuals infection based on the WHO reports (1987, 1993) are presented in Table 1of the appendix B.

Although infections may cause stunted growth, adult worms usually cause no acute symptoms. High worm burdens may cause abdominal pain and intestinal obstruction. Migrating adult worms may cause symptomatic occlusion of the biliary tract or oral expulsion. During the lung phase of larva migration, pulmonary symptoms can occur (cough, dyspnea, haemoptysis, and eosnophilic pneumonitis – Loefflers syndrome) (Manson-Bahr, 1987).

Hookworms (*Ancylostoma duodenale* and *Necator americanus*) are the second most common human helminth infection (after *Ascaris lumbricoides*). Iron deficiency anaemia (caused by blood loss at the site of intestinal attachment of the adult worms) is the most common symptom of hookworm infection and can be accompanied by cardiac complications. Gastrointestinal and nutritional / metabolic symptoms can also occur. In addition, local skin manifestations ("ground itch") can occur during penetration by the

filariform (L3) larvae and respiratory symptoms can be observed during pulmonary migration of larvae (Manson-Bahr, 1987). Trichuriasis (*Trichuris trichiura*) also called the human whipworm is the third most common round worm of humans. Most frequently the infections are asymptomatic. Heavy infections are associated with chronic dysentery and rectal prolapse. The indirect consequences of human helmith infections are the psychological problems and economic consequences due to hospitalization and cost of buying drugs.

2.3 Control Strategies

WHO advocates the integrated control of schistosomiasis and soil-transmitted helminths. Control strategies for both diseases have indeed common grounds. Schistosomiasis and soil-transmitted helminth infections are invariably more prevalent in the poorest sections of the populations in endemic areas of the least developed countries. In tropical Africa, rural populations bear the heaviest brunt of the common intestinal parasites (Nhonoli *et. al.,* 1974). In Tanzania about 80% of the population lives in the rural areas where people are engaged in agricultural activities.

The goal is to reduce morbidity from schistosomiasis and soil-transmitted helminth infections to levels such that these infections are not improving the developmental, functional and intellectual capacity of affected children. Highly effective, safe single-dose drugs can be dispensed through health services, school health programmes and community interventions directed at vulnerable groups. As these infections are endemic in poor communities, more permanent control will only be feasible where chemotherapy

is supplemented by improved water supplies and sanitation, strengthened by sanitation education. In the long term this type of permanent transmission control will only be possible with improved living conditions due to economic development. WHO control package includes:

- Ensuring the wide availability of single dose anthelminthic drugs (praziquantel and broad spectrum anthelminthics) in all health services in endemic areas.
- Ensuring good passive and, where appropriate, active case management in health services.
- Regularly treating at least 75% of all school-age children at risk of morbidity (in and out of school) by 2010.
- Regularly treating children at risk of morbidity through the IMCI (Integrated Management of Child hood Infections) strategy.
- Treating pregnant women at risk of iron-deficiency anaemia due to hookworm infection through women's health programmes.
- Improving the access to safe water and sanitation through intersectoral collaboration
- Improving hygiene behaviour by scaling up sanitation education, targeted at high-risk groups such as school-age children, women and special occupation groups.

2.4 Treatment

2.4.1 Broad spectrum anthelminthics

Broad-spectrum anthelmithics includes: Mebendazole, albendazole, diethylcarbamazine, ivermectin and praziquantel. Albendazole and mebendazole are effective across a broad spectrum while others (piperazine) are effective for one species in a single dose. A narrow spectrum drug may offer some cost advantage in certain area where a single helminth species is prevalent. However, additional costs are incurred in confirming the uniqueness of infection. For the majority of endemic areas a broad-spectrum drug is preferable, since whipworm infection is ubiquitous and can only effectively be treated by broad-spectrum anthelminthics.

2.4.2 Mass treatment interventions

Treatment of STH is commonly with albendazole or mebendazole. Mass treatment means that all persons are offered treatment regardless of the individual infection status. Mass delivery as common in school helminth control programmes in developing countries. If the estimated prevalence of infection for either schistosomiasis or STH in a school is greater than 50% the World Health Organization recommends that all children in the school should be treated (WHO, 1992). This strategy is called "mass treatment" Experience in Ghana and Tanzania shows that a small survey of intestinal parasite can be undertaken by examining the smears from 30 children in a small number of schools in each district, and if the overall prevalence of geohelminths is 50% or greater, it can be assumed that infections are wide spread and mass treatment is warranted (Hall *et. al.*,

1996). Targeting anthelminthic drugs at children of school age has been advocated as one of the most effective approaches to controlling helminth infection. The cost-effectiveness of programmes are said to be maximized when drugs for treating geohelminths and schistosomiasis are combined and co-administration is now recommended by WHO (Partnership for Child Development , 1996) .

2.5 Rationale of the study

The prevalence of STH among school children in Muheza district was 70% as it was indicated during the baseline survey carried out in 1996 by UKUMTA *(Ushirikiano wa kumwendeleza Mtoto Tanzania)*. Following the baseline survey mass annual treatment with Albendazole was provided in all schools since 1998.

To date no evaluation has been done. The overall objective of this study was therefore to assess the impact of periodic deworming that has been carried out by UKUMTA for the past five years on the health status of primary school children. The National School Health Programme, implemented by the Ministry of Health needs such information to improve the implementation of deworming programme throughout the country.

This study could lead to recommending country-wide up-scaling of such deworming programmes.

1996). Targeting anthelminthic drugs at children of school age has been advocated as one of the most effective approaches to controlling helminth infection. The cost-effectiveness of programmes are said to be maximized when drugs for treating geohelminths and schistosomiasis are combined and co-administration is now recommended by WHO (Partnership for Child Development , 1996) .

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CHAPTER THREE

3.0 METHODOLOGY

3.1. Study area

The study was conducted in Muheza district. This was selected because it is one of the intervention areas for the government-run school based health programme delivering anthelmintics drugs to primary school children in Tanzania. The prevalence of infection with the four most common species of parasitic worms was as follows: *S. haematobium* 60.4%, *A. lumbricoides* 19.8%, *T trichiura* 18.5% and Hookworm 71.2% (UKUMTA 1996). The mean egg counts for each parasitic infection were *S haematobium* 243egg/10ml of urine *A lumbricoides* 577epg, *T trichiura* 22epg and Hookworm 931epg (UKUMTA 1996). Intestinal worms rank fourth in terms of outpatient and in patient attendances with a total number of 26,876 (9.6%) reported cases (Annual Primary Heath Care report Muheza, 2002).

3.2 District Profile: -

Muheza is one of the seven districts of Tanga region with an area of 4,922km^2. It is the second largest district in the region next to Handeni. Administratively it consists of 6 divisions, 35 wards and 175 villages. The district total population according to 2002 Census is 284,074 and the growth rate is 1.5%. The average household size is 4.5. The district has an established network of health facilities, including 1 hospital (DDH), 4

health centers and 54 dispensaries. The district road network adds up to more than 10,000km with 1988km connecting the peripheral health facilities to the District Hospital. 9% (180km) of the latter are completely impassable during the rainy seasons. The district has a total of 151 primary and 12 secondary schools. 58% of the population has an access to clear water from deep wells, protected springs, or protected wells equipped with pumps. About 35% of the population has piped water, which may not be safe. The rest depend on shallow wells, rivers and other sources of water whose water in most cases is unreliable and unsafe.

The Muheza district lies at an altitude of 1200m above sea level, with the average of annual rainfall between 1000 – 1500mm and the temperatures ranging from 30 – 32oC. The district has 3 distinctive climatic belts namely coastal belt, mountainous and lowland plains. The resident tribes of Muheza are Wabondei, Wadigo/ Wasegeju, Wasambaa in low plains the coastal strip and the Eastern Usambara Highlands respectively. About 90% of the population engages in peasantry, fishing and hunting. The main food crops are Maize, Cassava, Banana, Rice, Yams, and Potatoes. Cash crops include sisal, tea, sugarcane, oranges, mangoes, coconuts, cardamons and cashew nuts.

3.3 Study design

A comparative cross – sectional evaluative study that involved four selected primary schools were carried out in Muheza district. Comparative data from the UKUMTA intervention studies were available.

3.4 Study population

The target population included schoolchildren in class V to VII because these were the ones who were enrolled in schools at the time baseline was done.

3.5 Sample size determination

The sample size was based on the prevalence rate of soil transmitted helminthiasis of 70% in Muheza (UKUMTA 1996). The sample size required was 323 subjects.

This was arrived at by using the following statistical formula (Armitage and Berry, 1987).

$\mathbf{N= Z^2Pq/E^2}$ $\mathbf{q = 1 - P}$

Therefore: $\mathbf{N = Z^2P (1 - P) / E^2}$

Whereby:

N = is the sample size

P= is the prevalence of the problem in Question.

E =is the marginal error on P.

Z = is the percentage point of normal distribution corresponding to a two sided Significant level.

Now taking **Z =1 .96; E = 0.05** and **P = 70%** by using Epi Info Calculation

$N = (1.96)^2 \times 0.7 \times (1 - 0.7) / (0.05)^2 = 3.8416 \times 0.21 / 0.0025 = 322.6944 = 323$

Add 5. % of none response so the actual size will be 339.

This figure was taken as a rough estimate of the sample size required for the purpose of the study in order to detect an estimate of the true prevalence rate.

3.6 Sampling

- Cluster sampling
- Intentional randomization

Since the target population was children of school age, the sampling unit was primary schools (clusters) randomly selected. Within each selected cluster, intentional randomizing of subjects was done. This means that subjects included in the study was those pupils in class V to VII who participated in the 1998 UKUMTA survey and deworming programme.

School selection was based on the reasonable accessibility by the field team.

3.7 Data collection

Data collection was done after the researcher has been introduced to the District Education Officer, the District Medical Officer, the District Executive Officer and the primary schools head teachers, teachers and children. Each selected primary school child selected was asked to participate in answering questions from the questionnaire. Each child was provided with a numbered plastic container and was asked to provide stool specimen for examination. The containers were numbered according to the same ID No used on both questionnaire and stool container. Stool containers were issued the day before and stool specimens were collected only in the morning before 9 o'clock so that there was ample time for parasite identification and worm load determination.

Principal Investigator measured weight/height with assistance of research assistants and schoolteachers. Stool specimens were examined by an experienced laboratory technologist from the department of Parasitology and Entomology of the Muhimbili University College of Health Sciences.

3.7.1 Study instruments

3.7.1.1 Stool examination

A wide mouthed, screw-capped stool container labeled with each subjects serial number was used to collect a faecal samples from each subject in the study. Each child was given a stool container by their teacher a day before the research team were due to arrive, and were instructed to defecate onto a piece of paper to prevent the stool being contaminated with sand, and asked to transfer to the bottle a piece stool about the size of the thumb using a stick.

Procedure: - The faecal subject from each subject was examined using semi-quantitative Kato-Katz technique for the eggs or larvae of intestinal worms (WHO 1991, 1994).

A small piece of faeces was placed on a clean piece of paper and a small square of nylon mesh was pressed on top of the stool was sieved through the screen and accumulated on top of the screen to collect some sieved faeces which was then pressed into a hole 9 mm in diameter in a 1 mm thick piece of plastic placed on the center of a microscope slide.

The spatula was passed over the template was recovered carefully from the slide so that a cylinder of the faeces was left on the slide. The faeces were covered with small square of hydrophilic cellophane which had been soaked in aqueous glycerol and methylene blue. The microscope slide was inverted and the faecal smear was pressed firmly against the cellophane on the hard surface to spread it evenly underneath the cellophane strip. The slide was left for about an hour to clear then examined under a microscope for eggs and larvae of intestinal worms. The number for eggs and larvae seen was multiplied by 24 to estimate their concentration in eggs/gram of faeces. If the eggs or larvae of any species of worm were seen the child was defined as infected.

With Kato-Katz technique the epg value is obtained by multiplying the number of eggs counted on the slide by a multiplication factor of 24 when the template holding 41.7mg of faeces is used (WHO 1987, 1993).

Equipment for Kato-Katz technique

Glass slides, cellophane, glycerin, malachite green, stoolspots (wide-mouthed), applicator sticks, nylon mesh, template, microscope, disinfectant and a form for recording results (see appendix B).

3.7.1.2. Nutritional status

Each child was weighed wearing as little clothing as possible, without shoes and with no objects in the pockets. The child stood barefooted at the centre of the balance platform of a Soehnle 7600 electronic scale (CMS weighing equipment, U.K) with feet placed together while relaxed but still. Weight was recorded to the nearest 0.1Kg.

Height was measured using a fixed portable stadiometer (CMS weighing equipment). Each child was positioned standing straight on the platform, barefooted, such that the Frankfurt plan is horizontal, with feet together, knees straight and heels, buttocks and shoulder/ blades in contact with vertical surface of the statiometer. Arms are let to hang loosely at the sides with palms facing the thighs. Height was recorded to an accuracy of 0.1cm.

3.7.1.3. Structured interview

Structured questionnaires were used to all children in the study. The major theme of the questionnaire focused on socio demographic characteristics of the children, knowledge on signs and symptoms of intestinal helminthiasis, mode of transmission and preventive measures of intestinal helminthiasis.

3.8. Data analysis and management

The following procedures were followed in data processing, entry and analysis. All the filled questionnaire were coded and doubled checked by the principal investigator. A questionnaire field for data entry was prepared in Epi Info programme version 6 for entering the coded data. Analysis was done using the Epi Info programme version 6. Descriptive statistical analysis was done and presented in frequency distribution tables and cross tabulation. Chi-square tests were employed to test for association between selected variables. P-value of 0.05 or less was considered to be significant.

3.9. Ethical issues

Ethical clearance was sought from the Muhimbili University College of Health Science Ethical Committee. Permission to conduct the study in the district was obtained from the Muheza Municipality. The aim of the study was explained to the teachers and children. Treatment was given free of charge to all children identified to be infected with STH.

3.10. Limitation of the study

Cross-sectional or prevalence studies are carried out at certain point in time and in a given population or a geographical area. They depend on a single examination of a cross-section of the population in which sick and healthy, or exposed and unexposed are not distinguished until results are examined. Information is collected through a survey by means of questionnaires, and/or laboratory or physical examination of the individual members of the study population. The prevalence of a risk factor or a disease is expressed as the proportion of the affected individuals in the study population in a given geographical area and at a given point in time. An important limitation of cross-sectional studies is their inability to sort out cause and effect relationships since both are found in a study population at the same time (Kapiga *et. al.,* 1998). The method of choosing 4 primary schools has a bias, because 4 primary schools can not represent the characteristics of all the primary schools in Muheza district, because they vary from one school to another. A potential problem of the questionnaire and an alternative

explanation for the nature of health knowledge to be assessed in this study may be the difference in closed and opened-ended questions. In response to answers where there are only two options, children are more likely to provide correct answers than in response to open- ended questions, where they have to specify answers by themselves.

Anthropometry as an indicator of nutritional and health status has its limitation especially during adolescence. There are no well defined criteria or cut- off values that relate to specific risks or aspects of health in the individual. Most available data have considered anthropometric dimensions as continuously distributed variables, so that associations with health can be documented, but have seldom been analyzed to provide the optimum cut-offs necessary for development of anthropometric indicators (WHO,1995).

Despite all these problems the researcher managed to get useful information, reflecting the actual situation and magnitude of the problem in the area. In general, the result can be used in Muheza district as a whole, as well as other areas in the country. This is because most of our schools have similar conditions as the studied schools and school children had the same habit.

CHAPTER FOUR

4. 0 RESULTS

In order to evaluate the impact of repeated deworming on the health status of the schoolchildren in Muheza district, it was necessary to examine children from class V to VII who received treatment and health education during the baseline survey and treatment done by UKUMTA in 1996. The evaluation focused on the prevalence and intensity of soil-transmitted helminths, assessment of the Knowledge, Attitude and Practice (KAP) and anthropometric nutritional indices with regard to stunting, underweight and wasting five years post intervention. The results from the selected schools represent the schools in Muheza district, as previous studies (UKUMTA, 1996) showed that Soil Transmitted Helminth (STH) infections are a common problem in most schools in Muheza district.

4.1 Schools selected

Four primary schools were selected in Muheza district, on the basis of being included in the baseline survey and being reasonably accessible. The distribution of the study population in the selected schools is shown in Table 1.

Table 1: The distribution of the schoolchildren in relation to the selected schools.

District	School	Number of children
Muheza	Kibanda	75
	Lusanga	147
	Kwabutu	40
	Mlingoti	77
Total		**339**

4.2 Subjects selected

A total of 339 children were recruited in the study. The distribution of the study population in relation to age and sex is shown in table 2.

Table 2: The distribution of the study population by age group and sex

Age group in years	Sex					
	Male		Female		Total both sexes	
	No	(%)	No	(%)	No	(%)
10-14	70	(45.8%)	115	(62%)	185	(54.6%)
15-19	83	(54.2%)	71	(38%)	154	(45.4%)
Total	**153**	**(100%)**	**186**	**(100%)**	**339**	**(100%)**

4.3 Prevalence of STH in the study population.

Three hundred and thirty-nine (339) samples were examined for parasites. The overall prevalence of STH in the study population was 160 (47.1 %). 154 (45.4%) had hookworm, 5 (1.47%) had Ascariasis and 1(0.3%) had Trichuriasis.

*Baseline prevalence was Hookworm (71.2%), *A.lumbricoides* (19.8 %) and *T.trichiura* (18.5%) ***UKUMTA data.**

4.4 The commonest parasite found in the study children.

The commonest parasite found in the stools was hookworm. The prevalence of parasites by school is shown in table 3.

Table 3: Prevalence of hookworms by school.

School	Positive	Negative	Total
Kibanda	24(32%)	51(68%)	75(100%)
Lusanga	75(51%)	72(49%)	147(100%)
Kwabutu	18(45%)	22(55%)	40(100%)
Mlingoti	37(48%)	40(51.7%)	77(100%)

4.5: Prevalence of hookworms by age group

The overall prevalence of hookworms was 45.4% while in children aged 15-19 years the prevalence was 42.2%. In the age group 10-14 years prevalence was 48.1% as shown in table 4.

Table 4: Prevalence of hookworms by age group.

Age group	Positive	Negative	Total
	No (%)	No (%)	No (%)
10-14	89(48.1%)	96(51.9%)	185(100%)
15-19	65(42.2%)	89(57.8%)	154(100%)
Total	154(45.4%)	185(54.6%)	339(100%)

4.6: Prevalence of hookworms by sex.

The prevalence of hookworms by sex is shown in table 5. There was slightly higher prevalence of hookworm infection in girls (45.7%) as compared to boys (45.1%). The difference was however not statistically significant (P>0.05).

Table 5: Prevalence of hookworms by sex.

Sex	Positive No (%)	Negative No (%)	Total No (%)
Boys	69 (45.1%)	84 (54.9%)	153(100%)
Girls	85 (45.7%)	101 (54.3%)	186(100%)
Total	154(45.4%)	185 (54.6%)	339(100%)

Chi square = 27.23 **Df = 33** **p value = 0.749**

4.7 Distribution of worm load by type of parasite i.e. Intensity of STH as expressed by egg count.

Table 6: Distribution of worm load by type of parasite.

Parasite	**Light**	**Moderate**	**Heavy**	**Total**
Hookworms	154 (45.4%)	0 (0.0%)	0 (0.0%)	154
T.trichiura	1 (0.29%)	0 (0.0%)	0 (0.0%)	1
A.lumbricoides	5 (1.47%)	0 (0.0%)	0 (0.0%)	5
Total	**160**	**0**	**0**	**160**

Table 6 shows the distribution of worm load by parasite. Hookworm was the commonest parasite. However, the intensity of infection was light in all types of parasites.

4.8 Awareness about STH by sex

Fifty-five point two per cent (55.2%) of schoolchildren were aware of what STH were. There was, however no significant difference in awareness between boys (58.2%) and girls (52.7%) as shown in the table 7.

Table 7: Awareness of respondents about STH by sex.

Sex	Aware	Not aware	Total
	No (%)	No (%)	No (%)
Boys	89 (58.2%)	64 (41.8%)	153 (100%)
Girls	98 (52.7%)	88 (47.3%)	186 (100%)
Total	187 (55.2%)	152 (44.8%)	339 (100%)
Chi square =0.81		**Df = 1**	**p-value 0.368**

4.9 Awareness about STH by age group.

Awareness of STH was 56.2 % in the age group 10-14 years and 53.9 % in children aged 15-19 years old. However, this difference between the two age groups was not statistically significant (P >0.05) as shown in table 8.

Table 8: Awareness about STH by age group

Age group	Aware		Not aware		Total	
	No	(%)	No	(%)	No	(%)
10-14	104	(56.2%)	81	(43.8%)	185	(100%)
15-19	83	(53.9%)	71	(46.1%)	154	(100%)
Total	187	(55.2%)	152	(44.8%)	339	(100%)

Chi square = 0.10 **Df =1** **p-value = 0.750**

4:10 Awareness about the symptoms of STH infections by age group.

Analysis was done by a questionnaire to assess awareness of the signs of STH infections. 123 (66.5%) in age group 10-14 and 114 (74%) in age group 15-19 knew at least one symptom of infection. The symptoms were abdominal pain, excessive hunger and loss of appetite. The analysis revealed that only 33.5% (62) of age group 10-14 and 26% (40) of age group 15-19 years old respectively were not aware of the signs of STH as shown in table 9.

Table 9: Proportion of respondents who knew at least one symptom of STH infection by age.

Age Group	Symptoms					
	At least knew one		Didn't know		Total	
	No	(%)	No	(%)	No	(%)
10-14	123	(66.5%)	62	(33.5%)	185	(100%)
15-19	114	(74.0%)	40	(26.0%)	154	(100%)
Total	237	(69.9%)	102	(30.1%)	339	(100%)

Chi- square =1.93 **Df = 1** **p-value =0.165**

4.11 Awareness of the methods of transmission of STH infections.

Analysis was done to assess if the respondents knew how the transmission of STH took place. 206 (60.77%) of respondents knew at least one mode of transmission while 133 (39.23%) knew more than one mode of transmission. The modes of transmission known were: eating before washing hands, eating contaminated food /water and walking barefooted for hookworms.

Table 10: Proportion of respondents who knew more than one mode of transmission by age group.

Age Group	Knew at least one No	(%)	Knew more than one No	(%)	Total No	(%)
10-14	111	(60%)	74	(40%)	185	(100%)
15-19	95	(61.6%)	59	(38.4%)	154	(100%)
Total	206	(60.8%)	133	(39.2%)	339	(100%)

Chi-square = 8.57 Df = 3 P value =0.035

Table 11: Proportion of respondents who knew more than one mode of transmission by sex.

Sex	Knew at least one No	(%)	Knew more than one No	(%)	Total No	(%)
Boys	95	(62.1%)	58	(37.9%)	153	(100%)
Girls	111	(59.7%)	75	(40.3%)	186	(100%)
Total	206	(60.8%)	133	(39.2%)	339	(100%)

Chi square = 3.45 DF = 3 p value = 0.327

4.12 Awareness about preventive measures against STH infections.

Of the 339 schoolchildren (89.4%) knew at least one preventive measure, while (10.6%) didn't know any preventive measure. 89.5% of boys and 89.2% of girls knew at least one preventive measure. However, the difference was not statistically significant ($p>0.05$). Awareness of the preventive measures against intestinal worms was 92.4% in children aged 10-14 and 85.7% in children aged 15-19 years.

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Table 12: Proportion of respondents who knew at least one preventive measure against STH by age group.

Age group	Knew at least one		Didn't know		Total	
	No	(%)	No	(%)	No	(%)
10-14	171	(92.4%)	14	(7.6%)	185	(100%)
15-19	132	(85.7%)	22	(14.3%)	154	(100%)
Total	303	(89.4%)	36	(10.6%)	339	(100%)

Chi-square 3.32 **Df = 1** **p-value 0.068**

4.13 Distribution of study children by wearing or not wearing shoes after school hours.

About 75.2% (255) of the school children responded that they wore shoes both at school and at home, while 16.5% (56) wore shoes at school only and the rest 8.3% (28) pupils did not wear shoes at all. However although this coverage is apparently high, the prevalence of hookworms was also surprisingly high.

Table 13: Proportion of respondents who reported to wear shoes.

Category: Wearing shoes	Frequency	Percent
At school and at home	255	(75.2%)
At school only	56	(16.5%)
Not wearing	28	(8.3%)
Total	**339**	**(100%)**

4.14 Anthropometric nutritional indices by the survey.

Table 14 shows the prevalence of stunting (height-for-age <-2S.D.), underweight (weight-for-age <-2 S.D.) and wasting (weight-for-height <-2 S.D.) by the survey.

Chronic under nutrition, as indicated by the prevalence of stunting, is a widespread problem among the children in the survey. Overall, the prevalence of stunting was 43.1%. Children being underweight for age were 26.5%. Current malnutrition (wasting) appears to be a less significant problem, as indicated by the low prevalence of wasting 0.6%.

Table 14: Proportion of children who were classified as stunted, underweight or wasted by survey

Survey	N	% Stunted	% Underweight	% Wasted
Baseline*	444	66.0%	50.5%	1.8%
Current	339	43.1%	26.5%	0.6%

***UKUMTA data**

CHAPTER FIVE

5.0 DISCUSSION, CONCLUSION AND RECOMMENDATIONS.

The present study which was designed to assess the impact of deforming programme through schools on the health status of school children, was conducted in an intervention area where mass treatment with albendazole was provided free of charge annually in all schools since 1998. The last round of mass treatment was April/May 2003

The results show that geohelminth infections is still a public health problem among the study population. Among 339 school children examined for Soil Transmitted Helminth infections, the overall prevalence was 47.1%. The difference of the prevalence of STH between the ages group 10 –14 years and age group 15-19 years but was not statistically significant.

5.1 Prevalence of hookworms

The commonest STH found in the study population was hookworm. The prevalence was higher than in Msanje village in Handeni , where Kihamia *et. al.*, (1980) found the prevalence to be 20%. The prevalence rate of hookworm infection was higher than that of other species of intestinal helminths in the study area. Among 339 school children examined for geohelminths, 154 (45.4%) had hookworm, 5 (1.4%) had ascariasis and 1(0.3%) had trichuriasis.

This is in agreement with Macpherson *et. al.,* (1991) that hookworms especially *Necator americanus* is highly prevalent on the coast of Tanzania. Coastal soils are sandy, therefore hookworms especially *N.americanus* is highly prevalent as observed by

Beaver (1953). The high prevalence of 45.4% in Muheza is not surprising because factors that favour transmission are prevalent in the district.

In the present study, there was no significant difference of hookworm infection between boys (45.1%) and girls (45.7%).

The overall prevalence of hookworm was 45.4% while children 15-19 years old the prevalence was 42.2% and 48.1% in the age group 10-14 years. Ten to fourteen years age group was more affected probably because they are more exposed to the contaminated environment than the others. This age group is the most active and probably lack adequate knowledge on preventive measures against geohelminth infections.

5.2 Intensity of STH infection.

There was significant drop in worm load from moderate to light for hookworm and *Ascaris lumbricoides*.

There were 154 cases of hookworm, 1 case of *Trichuris trichiura* and 5 cases of *Ascaris lumbricoides.* However all cases fell under the light worm load category. The light intensity of infection can be attributed to the fact that all children received mass chemotherapy with albendazole in April/May 2003.

There were no statistically significant differences in worm load distribution in both age and sex groups. ($P>0.005$).

In a large scale field study done by Bundy *et. al.*, (1990) in Montserrat, 95% of school children received treatment on regular basis. The results revealed a decline in intensity on both treated and untreated population outside the school.

Poulation dynamic theory has predicted that focusing treatment effort in school age group would significantly reduce transmission in the population as a whole. In Kenya treating only school children had almost the same impact on *Schistosoma mansoni* re-infection rates as a comprehensive programme that sought to treat the entire population. Chan and Bundy (1997) satisfactorily explained these population dynamics by assuming that school children are the major contributors to geohelminth transmission.

5.3 Children's understanding of STH

Majority of children (55.2%) had heard of geohelminths without significant differences between boys (58.2%) and girls (52.7%). Awareness of intestinal worms was 56.2% in the age group 10-14 years and 53.9% in children aged 15-19 years old. However, there was no statistically significant difference between the two age groups ($P>0.05$). Children's understanding of the symptoms of STH was also assessed. 123 (66.7%) of children in age group 10-14 and 114 (74%) in age group 15-19 knew at least one symptom of infection. There was improved health knowledge on disease transmission. 60.8% of schoolchildren knew at least one mode of transmission while 133(39.2%) knew more than one mode of how STH were transmitted. These included eating without washing hands, eating contaminated food / water and walking barefooted. Interestingly however, there was no significant difference between age group 10-14 (60%) and age

group 15-19 (61.6%). There was also no significant difference between boys and girls. Children's understanding of the prevention of geohelminths revealed that there was very high understanding (89.4%), although there was no significant difference between boys (89.5%) and girls (89.2%) and between the two age groups. About 75.2% of the children responded that they wear shoes both at school and at home while 16.5% wore shoes at school only and the rest (8.3%) didn't wear shoes at all. Although children's understanding of the disease was relatively high, the prevalence of STH in the study population was also relatively high (47.1%). This, to a certain extent, explains the fact that health knowledge to school children may not be reflected in their daily practices. Children may know what is wrong but may not know why it is wrong and so not knowing appropriate health behaviours (UKUMTA, 1996).

5.4 Nutritional Anthropometry

An important result of the analysis was improvement of anthropometrical nutritional indices. Chronic under-nutrition as indicated by the prevalence of stunting dropped from 66% to 43.1%. The prevalence of underweight dropped from 50.5% in 1998 to 26.5% in the current study while current malnutrition which appeared to be a less significant problem, as indicated by low prevalence of wasting dropped from 1.8% in 1998 to 0.6% in the present study.

In a study done in Zanzibar by Stoltzfus *et. al.*, (1998) children were given thrice-yearly mebendazole and compared with children that received twice yearly mebendazole and untreated children. The evaluation provided evidence that periodic anthelminthic

treatment caused greater height and weight gains among children participating in the programme.

5.5 Effectiveness of mass chemotherapy

In order to determine the effectiveness of mass chemotherapy (deworming) conducted by UKUMTA in Muheza primary school children in 1998, a comparison had to be made between STH prevalence before and after deworming. The overall baseline prevalence was hookworm (71.2%), *Ascaris lumbricoides* (19.8%) and *Trichuris trichiura* (18.5%). The results revealed that regular mass chemotherapy with mebendazole has reduced the prevalence and intensity of geohelminthiasis and improved the nutritional status of the school children in Muheza district. This was supported by Latham (1984) and Stephenson *et. al.,* (1989) that community chemotherapy programmes are the only way in short-term to reduce drastically the prevalence and intensity geohelminthic infections in most endemic communities. In a study of cost-effectiveness of mass drug therapy for intestinal helminths, Evans and Guyat (1995) revealed that mass treatment is more cost-effective than selective treatment (treatment after individual screening) in high prevalence area and at observed prices.

However, other confounding factors like improvement in socio-economic status of the study population and other factors like food availability and accessibility to health services were not explored in this study.

5.6 CONCLUSIONS

The research objective was to assess the effectiveness of the helminth control programme through schools in the reduction of the prevalence, intensity, morbidity and changing knowledge attitude and practice among school children in Muheza district. Various data collecting technique were employed. These included stool examination by Kato-Katz technique, anthropometric nutritional indices by using a Soehnle 7600 electronic scale for weight and a fixed portable stadiometer for height and structured interview using close and open ended questionnaires.

The study revealed that geohelminthic infection is a serious public health problem in Muheza district. The prevalence of hookworm remained predominantly high (45.4%) although it significantly decreased as compared to that of the baseline (71.2%). This implies that re-infection continued. However, the worm load (intensity) was significantly reduced and remained minimal as a result mass chemotherapy with albendazole.

Another observation was that health knowledge of school children does not reflect their health practice and have little influence on the prevalence.

This study has been able to show that targeting anthelmintic drugs at school-age children as advocated and recommended by WHO is one of the most effective approaches to controlling helminth infection.

5.6 RECOMMENDATIONS

From the study, the following recommendations are made:-

- More research should be carried out to determine a countrywide prevalence of Soil-Transmitted Helminth (STH) infections and the worm burden among school children in rural and urban areas in order to assist policy makers in rational planning,
- The health sector and the education sector should start and maintain efforts to inform, educate and communicate with the community in Muheza about the problem of geohelminthiasis.
- Mass chemotherapy should be adopted for primary school children using albendazole. This could be a meaningful control measure to reduce both prevalence and intensity of geohelminth infections in the community.
- Hygiene behaviour should be improved by scaling up sanitation education, targeted at high risk group such as school-age children.
- Primary school teachers should be deployed in mass chemotherapy delivery for Soil-Transmitted Helminth infection control in their schools after appropriate training.

CHAPTER SIX

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