"PREVALENCE OF ASCARIS LUMBRICOIDES IN CHILDREN ADMITTED TO THE PAEDIATRIC OBSERVATION WARD KENYATTA NATIONAL HOSPITAL".

BY

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DECLARATION

I hereby certify that this Dissertation is my own original work and has not been presented for a Degree in any other University.

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LIST OF TABLES

CONTENTS: PAGE

SUMMARY

500 children attending the Paediatric Observation Ward at the Kenyatta National Hospital were investigated for intestinal helminths, during the period 12/2/84 to 9/4/84. 59 of these children were found to harbour Ascaris lumbricoides, making the prevalence rate in this study 11.8%.

Egg counts were done in 17 cases, using the Kato Thick Smear Method. 11 of these had heavy infestations characterised by egg counts well above 10,000 eggs/gm of faeces.

The children's ages ranged from 4 days to 12 years. Those in the age group 2-10 years were the most affected while those aged below one year were the least affected.

There was no significant difference in the infestation rate between males and females.

Other helminths found in the study were Trichuris trichiuria, hookworm, schistosoma mansoni, strongyloides stercoralis and hymenolepis nana. Their prevalence rates ranged from 0.2% to 3.8%.

There was no marked difference clinically, in the nutritional status between those children with intestinal helminths and those without.

No significant difference was noted in the rate of infestation in those children who had either the pit latrines or the flush toilets in their homes.

Only one child, out of six children who had no toilets at home, was found to have A. lumbricoides.

INTRODUCTION

A. lumbricoides is one of the commonest intestinal parasites in the tropics and subtropics. It is estimated that one quarter of the world's population is infested with it [1]. The prevalence of A. lumbricoides varies greatly in different parts of the world, ranging from 20% to 90% in various countries of the third world [2].

Prevalence rates also vary within the same country. In Kenya, a number of prevalence studies have been done in different parts of the country. These studies show that rates of infection range from 10 - 60% of the population [3, 4, 5. 6, 7, 8, 9, 10, 11, 12].

High infestation with A.lumbricoides has been associated with tropical climate, younger age group in the population and faecal contamination of the environment, either because of lack of proper facilities for sewage disposal or becasue of use of faeces as agricultural fertiliser [1, 13, 14].

Infestation with A. lumbricoides has been associated with significant clinical complications. A common complication in Kenya is intestinal obstruction resulting from infestation with large numbers of worms in the intestinal lumen [15, 16]. Louw (1966) ranked

causes of acute abdomen in one hospital in Cape Town [14].

Studies elsewhere, have shown that brain abscess pulmonary abscess, pancreatic pseudocyst, liver abscess, bile duct obstruction, urinary tract obstruction and malnutrition are associated with ascariasis [13, 17, 18, (19, 20, 21, 22, 23)].

There is therefore little doubt that the problem of ascariasis is of much public health importance. It is this realisation that prompted the author to carry out this study.

OBJECTIVES

To determine the prevalence of Ascaris Lumbricoides infestation among children admitted to the Paediatric Observation Ward at Kenyatta National Hospital.

To determine the intesity of infection in these children.

MATERIALS AND METHODS

500 children admitted to the Paediatric Observation Ward (P.O.W.) at Kenyatta National Hospital (K.N.H.), Nairobi, from February 1984 to April 1984, were included in the study.

During the study period (12/2/84 to 9/2/84), 3015 patients were admitted to the Unit.

Most of the patients attending this unit are from various estates in and around Nairobi; most are from the middle and lower social class.

Every other child admitted to the ward between Sunday 8 a.m. and Thursday 8 p.m., every week during the study period was included.

Informed consent was obtained from all the study patients. Each patient was examined and an appropriate data sheet, containing relevant historical and clinical findings, was filled (Appendix I).

Appropriate stool containers were supplied to the parents with adequate instruction on stool collection.

Stools were collected twice daily, at 8 a.m. in the morning and at 2 p.m. in the afternoon. All the samples were taken to the Microbiology Laboratory and examined with the help of two technical staff of the Department of Microbiology.

All stool samples were first examined for ova of helminths by the Formal ether sedimentation method as described by Ridley and Hawgood [24] as follows:-

1. 1 gm of faeces was thoroughly emulsified with 7 mls of 10% formal saline and strained through a wire gauze (40 mesh per inch) into a centrifuge tube.

2. 3 mls of ether was added and the mixture shaken vigorously for one minute.

3. The mixture was then centrifuged, accelerating slowly and gradually over a period of 2 minutes to a speed of 2,000 r.p.m. and then allowed to come to rest.

4. The debris on the surface and at the interface between the two liquids was loosened from the wall of the tube with an applicator stick and the supernatant was decanted, the last drop or two was allowed to run back.

5. The small deposit was shaken up and poured onto a clean glass slide and examined for ova and larvae of helminths (four cover-slips per specimen).

17 stool samples, out of 59 that were found to contain ova of A. lumbricoides by the above method were further examined by the Kato thick smear method as described by Martin and Beaver [25] to determine the intensity of infection. Examination was as follows:-

1. Standard sample of fresh stool was strained through 105 mesh stainless steel bolting cloth then pressed on a clean glass slide.

2. A strip of cellophane wettable medium (Du Pout de Nemour Inc. Delaware U.S.A.). 22 mm x 30 mm previously soaked in a mixture of glycerine and malachite green (100 ml glycerine, 100 ml water and 3% aqueous malachite green) was pressed against it on an absorbent paper and the stool spread to the

size of the cellophane paper.

3. The smear was left at room temperature for 45 minutes to clear.

4. The entire smear was examined using a microscope under X40 magnification for ova of helminths.

The total number of eggs counted by this method was multiplied by a constant of 24 to get the egg count per gram of faeces.

RESULTS

The study group comprised both males and females whose ages ranged from 4 days to 12 years. Over half of the children in the study were infants.

The most common helminths found in the study were: A.lumbricoides;T. trichiuria, and Hookworm spp. S. mansoni. S. stercoralis and H. nana were also found.

59 children were found to be infected with A. lumbricoides. 43 of these children were from various estates around Nairobi; the rest were from rural areas.

Multiple infestations were found in 18.7% of affected children. The most frequently occurring combination was that of A. lumbricoides and T. trichiuria.

Various types of latrines were found to be in use. This included pit latrines, modern flush toilets and buckets. In a few cases, however, no latrines at all were available and family members resorted to the surrounding bush.

TABLE I

AGE DISTRIBUTION

AGE GROUP	MALE	FEMALE	TOTAL	%
0-1 year	151	128	279	55.8
1-2 years	52	39	91	18.2
2-5 years	51	32	83	16.6
5-10 years	19	16	35	7.0
> 10 years	7	5	12	2.4
TOTAL	280	220	500	100

Table I shows age distribution in the study group. 55.8% of the children were aged one year and below. 18.2% were aged between 1-2 years, 16.6% were aged between 2-5 years. 7% were aged between 5-10 years and very few children (2.4%) were above 10 years of age.

TABLE II

PREVALENCE OF INTESTINAL HELMINTHS

Type of Helminth	No Positive	% Positive
Ascaris Lumbricoides	59	11.8
Trichuris Trichiuria	19	3.8
Hookworm Spp.	13	2.6
Schistosoma Mansoni	3	0.6
Strongyloides Stercoralis	1	0.2
Hymenolepis Nana	1	0.2
TOTAL	96	19.2

Table II shows the prevalence of intestinal helminths among the 500 children in the study. 11.8% of the children had A. lumbricoides 3.8% had T. trichiuria; 2.6 had hookworm infestation and 0.6% had S. mansoni. S. stercoralis and H. nana both occurred in 0.2% of the children.

TABLE III

PREVALENCE OF A. LUMBRICOIDES ACCORDING TO AGE GROUPS

Age Group	No. Positive			% Positive
	Male	Female	Total	
0-1 year	4	4	8	2.9
1-2 years	11	5	16	17.6
2-5 years	15	9	24	29.6
5-10 years	5	5	10	28.6
Over 10 years	1	0	1	8.3

Table III shows prevalence of A. lumbricoides according to age groups. The highest prevalence rate was 29.6% among those aged 2-5 years. This was followed by a prevalence rate of 28.6% in the 5-10 year age group. The 1-2 year old age group had a prevalence rate of 17.6%. Children aged 0-1 year were the least affected. Only 2.9% of children in this age group had A. lumbricoides. Further details of the actual ages of these children are in Appendix II. 8.3% of children aged over 10 years were infested with A. lumbricoides.

TABLE IV

MULTIPLE INFESTATION - VARIOUS COMBINATIONS FOUND

Combination	No. Affected	% Affected
A. lumbricoides + T. trichiura	8	13.6
A. lumbricoides + Hookworm	2	3.4
A. lumbricoides + T. trichiura + Hookworm	1	1.7
TOTAL	11	18.7

Table IV shows 11 children who had multiple infestations. In all, 18.7% of infected children had multiple infestation.

TABLE V

INTESITY OF INFECTION RELATED TO AGE

Age Group	Intensity of infection			Total
	Heavy	Moderate	Light	
0 - 1 year	0	0	0	0
1 - 2 years	1	0	0	1
2 - 5 years	4	2	2	8
5 - 10 years	6	0	1	7
> 10 years	0	1	0	1
Total	11	3	3	17

Egg count of 10,000 eggs/gm of faeces and above was considered heavy infestation, while a count ranging from 2,000 - 9,999 eggs/gm of faeces was considered moderate and a count of less than 2,000 eggs/gm of faeces considered light infestation.

In the 17 children in whom egg counts were done, most of the infections were heavy and the children with the most heavy infections were aged 2 - 10 years. The actual egg counts in these children are shown in Appendix III.

TABLE VI

TYPES OF LATRINES USED BY THE FAMILIES OF CHILDREN IN THE STUDY

Type of latrine	No. of families using it	No. with Ascaris	%
Pit latrines	347	41	11.8
Flush toilets	145	17	11.7
Pit latrines and Flush Toilets	1	0	0
Bucket	1	0	0
Sorrounding bush	6	1	16.7
Total	500	59	11.8

Table VI shows the types of latrines used by the families of children in the study. Ova of A. lumbricoides was found in 11.8% of those children with pit latrines in their homes, 11.7% of those with flush toilets were infected and 16.7% of the children who had no latrines at all in the homes had ascariasis. This apparently higher rate of infestation among those using the surrounding bush should, however, be interprated with caution as the number of families involved were a very small proportion of the study group.

DISCUSSION

The prevalence of A. lumbricoides in this study was 11.8%. All the studies that have been done in Kenya on prevalence of A. lumbricoides confirm the fact that prevalence rates vary widely even within the same country. These studies show that 10 - 66% of the population studied are infested with A. lumbricoides [3-12].

Prevalence of infection tends to be higher in urban areas than in rural areas in most non industrialised countries; this is because of overcrowding in urban areas, with no proper toilet facilities and low standard of hygiene. Ritho [12] states that in Kenya, toilet training is not usually a feature in people staying in slums and as long as the child defeacates outside of the house, the parents are usually satisfied. To quote Louw [14] "Wherever soil pollution prevails if only by toddlers in the back yards, and wherever there is warmth and moisture, infestation by the parasite is a hazard".

57.6% of the children infected with A. lumbricoides were aged between 2 - 10 years, the highest prevalence (29.6%) being in the 2 - 5 year age group. This finding is similar to that found by Wijers et al in Kenya [11].

It is known that the prevalence and intensity of A. lumbricoides are higher in the younger age group within a population. This fact is related to the difference in behaviour between adults and children. In areas where transmission is intense and where, as in the Union of Soviet Socialist Republic and Japan, there has been intensive treatment of infected children, the difference in infection rates between adults and children is less marked.

Prevalence rate in children below one year of age was 2.9% in this study. It is the author's opinion that the low rate of infection in children in this age group is related to decreased exposure to infection. The youngest child with A. lumbricoides infection in this study was 4 months old.

All the children infected with A. lumbricoides did not have any symptoms attributable entirely to ascariasis. The majority (56%) had acute respiratory infections; five children had acute gastroenteritis and one child was diagnosed as having protein-energy malnutrition. The rest had varied medical conditions. In ascariasis, unless acute manifestations are observed, it is very difficult to assess overall morbidity. This was shown by a report on mass treatment for ascariasis among Aborigines in a Settlement in Queensland, Australia [26]. In this study; the mortality rate among children aged 3 months to 5 years attributed mostly to pneumonia had ranged from 29 - 54% of the total deaths in the Settlement. After mass treatment of children for ascariasis was instigated in the Settlement, death rate fell to 8%. Some of these children could have had ascaris pneumonia.

It is well established [27] by experimental infections of A. lumbricoides in man, pig as well as other laboratory animals that the larvae, on hatching, in the small intestine, migrate through the liver to the lungs, where, on the eighth or ninth day after inoculation, they begin migrating further into the bronchial passages and, via the trachea, and oesophagus, return to the intestine.

Growth occurs in the parenchyma of the liver and lungs, and when the larvae enter the bronchioles, they have progressed from the second stage (infective) larvae measuring 0.3 ml. or less in length, to the early fourth stage larvae which is 1.5 mm or more in length. Other experiments [26] have also shown that the larvae, in their migration and development in the liver and lungs, especially the latter, cause two types of lesions. Haemorrhages occur. Initially these are minute when the small sized larvae leave the capillaries and enter the alveoli; haemorrhages are more marked when the relatively larger larvae migrate from the alveoli into the terminal bronchioles. In heavy infections, these focal haemorrhages coalesce to flood large portions of the lungs and may infact cause death of the host by drowning in extravasated blood [27]. The second type of lesion is characterised by focal, mostly eosinophilic, inflammation in the areas occupied by the growing larvae. Eosinophilia of the blood together with cough and pulmonary infiltrations and other pathological changes that are radiologically evident, may occur at this stage [27].

The severity of symptoms and tissue reaction is

proportional to the size of the inoculum [27]. Light infections initially may cause no significant symptoms whereas a heavy infection may produce marked reactions.

In 1922, Koino, a Japanese investigator, swallowed 2000 infective human ascaris eggs and six days later developed pneumonia with dyspnoea, cyanosis, and eosinophilia and pyrexia which lasted seven days. The sputum contained fourth stage ascaris larvae [13, 27]. Beaver and Danaraj [27], described an adult Indian who died in status asthmaticus in whom the lungs showed eosinophilic infiltration with larvae of A. lumbricoides in the bronchioles.

Ascaris infestation may give rise to many complications. The adult worm may migrate from the small intestine to the stomach, oesophagus and pharynx. From the pharynx, the worm may emerge through the mouth or nose of the horrified patient. Bizarre complications include:-

a) Blockage of naso-gastric tubes especially following gastroenterostomy [28].

b) Appearance from the external auditory meatus, the worm having passed via the eustachian tube

and out through a perforated tympanic membrane.

c) Appearance at the medial canthus via the naso-lacrymal duct[28, 29].

d) Appearance at the umbilicus and thereby leading to a diagnosis of patent vitelline duct [28].

A serious complication is laryngeal obstruction causing suffocation, and there are reports of ascarids entering the bronchi via the trachea. They have even been found in the heart! [14].

Ascarids may penetrate the intestinal wall to emerge through abdominal wounds. Sometimes they make their way into the pleural cavity, fallopian tube and urinary tract. Bustamante Sarabia et al [30] reported a case with adult worms in the kidney. Pamba and Musangi [22] reported a case of an adult, female A. lumbricoides found in the urethra of a 2½ year old Kenyan male who presented with haematuria and dysuria. The most common complications, however, present as abdominal emergencies:-

Intestinal obstruction, small bowel volvulus,

intestinal perforation and acute appendicitis. Louw [14] at the Red Cross War Memorial Children's Hospital, Cape Town, found that 12.8% of all cases of acute abdominal emergencies in children aged 1-12 years was due to A. lumbricoides. This was a high rate second only to appendicitis as a cause of acute abdomen in this age group. Warambo [16] analysed the causes of acute intestinal obstruction in 142 African patients admitted to a Surgical Unit at Kenyatta National Hospital, Nairobi. He found that 7.14% of cases of volvulus was due to A. lumbricoides. Ochola - Abila and Barrack [15] in a retrospective study, found that out of 264 children treated at Kenyatta National Hospital for intestinal obstruction during a 7 year period, 50 cases were due to A. lumbricoides.

Infestation with A. lumbricoides has been associated with protein-energy-malnutrition. Stephenson et al [23], working in two Kenyan villages in Machakos, found that even light infestation with A. lumbricoides might adversely influence nutrition status and deworming might enhance growth. They found a decrease in skinfold thickness which occurred while children harboured worms and a subsequent increase in skinfold thickness after deworming. They concluded that Ascaris infection might contribute to protein-energy-malnutrition in developing countries.

Working under controlled conditions, Venkatachalam and Patwardhan (1953) reported a moderate impairement in protein digestion in children infected with A. lumbricoides. These workers interpreted their findings on the basis of possible antitrypsin and antichymotrypsin substances elaborated by adult ascaris in the intestinal lumen of the host [31].

In another study [32], designed to investigate the effect of Ascaris infection on human nutrition, the workers observed that varying degrees of malabsorption of all major nutrients, protein, carbohydrate and fat, occurred in children infected with A. lumbricoides and that most of these abnormalities were corrected by deworming. The same workers in a subsequent study [33] demonstrated that malabsorption in the presence of adult A. lumbricoides infection is accompanied by demonstrable intestinal mucosal abnormalities and that the lesions heal after deworming.

Apart from these two mechanisms in the pathogenesis of protein-energy-malnutrition, loss of appetite has also been commonly observed to occur in infected persons and this can be a serious impediment to development, particularly in children living on suboptimal or frankly deficient diets.

In this study 4 children from the total of 59 infected with A. lumbricoides, had clinical evidence of protein-energy-malnutrition. Although only one had the diagnosis of P.E.M.

A number of studies indicate that ascariasis may also contribute to vitamin A deficiency [1,13,34], children suffering from night blindness have been found to show rapid improvement in their eye symptoms within a few days of the elimination of the parasites [1,13].

Vitamin C deficiency has also been associated with ascariasis. Infected children have been shown to excrete a significantly lower amount of the vitamin following a test dose than do non-infected children [1,13].

28.8% of positive stool samples were examined for intensity of infection. The rest were either too watery or the amount collected was insufficient for this examination. The highest egg count obtained was 194, 136 egg/gm of faeces. This was found in a 1½ year old child.

A single female A. lumbricoides is estimated to produce 200,000 eggs per day. This means that it is not uncommon to find high egg counts in Ascaris infection. High egg counts may also be secondary to continuous reinfection which results in very heavy infections. The intensity of infection with soil transmitted helminths is said to be related to the overall prevalence rates [26]. Where a larger number of people are infected, the frequency of heavy infections is greater.

Infection rates with Ascaris showed no correlation with the type of toilets used, in this study. It was 11.8% in those children having pit latrines in their homes and 11.7% in those with flush toilets; both these rates were relatively high. Possible explanations for this finding include:-

1. Children were probably not using the pit latrines at all or using it improperly for instance, defaecating on the floor of the latrines; a finding only too common in slum areas.

2. Failure to cover the pits of the latrines.

3. From the study, most of the flush toilets were reported broken down and non-functioning.

The installation of latrines is only a first step towards sanitation. If they are improperly used or not used at all, it is unlikely that their installation will alter the overall prevalanece of intestinal worms.

Ascariasis is a costly disease and it may be cheaper to prevent than to treat. This was shown in a detailed study [4] of the economic aspects of Ascaris infection in Kenya.

CONCLUSION

Stool examination for ova of helminths was done in 500 children attending a Paediatric Unit at Kenyatta National Hospital. The following were established.

1. Prevalence of A. lumbricoides in children attending the P.O.W. is 11.8%.

2. Intensity of infection with A. lumbricoides is high in most affected children.

3. In children attending the P.O.W. Kenyatta National Hospital, Ascaris infestation is most prevalent between 1 and 10 years of age.

RECOMMENDATIONS

1. That more work be done to determine the contribution of ascariasis to P.E.M. in our set up.

2. That more work be done to evaluate the contribution of poor hygiene and faecal disposal methods to the incidence and morbidity of ascariasis in children in our set up.

3. That routine treatment with a broad-spectrum antihelminthic drug be offerred to all children aged 2 years and above.

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APPENDIX I

DATA SHEET

1. Date ---------- IP NO. ----------

Name ---------- Age ------ Sex ----------

Tribe ---------- Weight ----------

Diagnosis ---------- Escort ----------

Schooling Yes/No ----------

2. Mother

Married/Unmarried/Widowed/Divorced

Level of education ----------

Occupation ----------

Father

Polygamous/Monogamous/Widower/Divorced

Level of Education ----------

Occupation ----------

3. Residence. Nairobi ----------

Rural Area ----------

No. of sleeping rooms in the house ----------

Total No. of people in the house ----------

Sewage disposal facility available at home
Flush toilet/Pit latrine/ Surrounding bush.

4. He vomited worms in the past Yes/No.

He passes/passed worms in the stool Yes/No.

He complains of abdominal pain ----------

Has been treated for worms Yes/No.

H/O passing worms in another member of the family Yes/No.

5. Clinical Examination

Pallor. Absent/Mild/Mod./Severe.

Features of malnutrition Present/Absent.

Abdomen Normal/Distended.

6. Investigations

Stool

a. Ova and cysts positive ----------

b. Egg count ----------

c. Ova and cysts negative ----------

APPENDIX II

Age in months of the 8 children aged 12 months or less found to have A. lumbricoides.

Age in months	No. of Children infected
4	1
5	1
6½	1
9	1
12	4

APPENDIX III

Egg count/gm of stool in 17 children with A. lumbricoides

194,136

103,680

93,960

72,960

65,064

63,720

52,224

49,176

38,640

34,176

30,648

8,472

6,024

5,112

1,104

792

96