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Status of Hookworm Infection in some Selected Primary School Children in Mkar Metropolis of Benue State, Nigeria.

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Abstract
This work investigated stool samples of primary school children for hookworm infection. Stool samples were collected from 200 primary school children in four randomly selected primary schools (50 children per school) within the age bracket of 1-13 years. The schools were: UBE Ahwa Primary School, NKST Orphanage School, Daystar Primary School, and Mkar Model Primary Schools). Standard microbiological practices were used in sample collection and processing. Microscopic technique was adopted in the analysis and detection of hookworm in samples under appropriate objective lenses. Data were analysed using Minitab 16.0 software. Level of significance was set at 5%. Hookworm prevalence was highest at NKST Orphanage with a prevalence of 30% while other schools had prevalence rates ranging from 10% -14%. Hookworm prevalence was significantly dependent on school types (χ^2 = 15.21, P=0.002, P<0.05), the most infected was NKST Orphanage while the least infected was Daystar Nur/ Primary school (10%). All cases were above the WHO infection threshold of 5%. The overall result in the study area gave a total prevalence of 16.5%. The proportion of infected male to female was 44.5% to 51.5% respectively, but no significant association between sex status and hookworm infection (χ^2 = 0.03, P=0.862, P>0.05). Age group of 1-5 years had more hookworm infections (54.5%) than other age groups. Therefore, hookworm infection was significantly associated with age groups (χ^2 = 16.9, P=0.00, P<0.05). Proper awareness, health education, improved sanitary conditions and treatment regime is advocated among primary schools in the study area.

Keywords: Hookworm, School children, Status, Control

Introduction

Parasites are organisms which have adapted themselves to existence in, or on, another organism (the host) and live at the expense of the tissue and fluids of the host [1]. Parasites are divided into two Broad headings, Ectoparasites and Endoparasites. Ectoparasites includes: *Pediculus Humanus Capitis*. *Pediculus Humanus* Humanus and Endoparasites includes protozoa parasites eg *Entamoeba histolytica*, *Gardia lambia* etc, pletyhelminthic parasites such as *schistosoma* spp., *Taenia* spp., *Nematohelmithic* parasites such *Ascaris lumbricoides*, Hookworm spp (*Necator americanus*, Ancylostoma duodenale), *Trichuris trichuria* etc.

Parasitic diseases have contributed immensely in undermining the health status of people and jeopardizing the economic development of nations in the tropics [2].

Hookworm is an endoparasite, a nematode worm that lives in the small intestine of its host, which may be a mammal such as a cat, dog or human. It belongs to the phylum nematoda and family *ancylostomatidae*. Two common species of hookworm. *Ancylostoma duodenal*e and *Necator amerinus,* currently infect about 1.2 billion persons worldwide [3]. Hookworm infection is widely distributed throughout tropical and subtropical regions of the world. Favorable conditions for the spread of infection include

warm temperature, high humidity, shade and contamination of human faeces [4]. It is estimated that up to one-fifth of the world's population is infected with hookworms. Humans harbor hookworm in their small intestine. The eggs are passed in faeces and will hatch within twenty-four to forty-eight hours were conditions are favourable. After hatching, the larva moults twice in soil and in approximately ten days, become infective filariform larvae. When a bare foot human walks in soil contaminated, with the infective larvae, it pierces the human skin, enter the blood stream and reach the lungs, break through pulmonary capillaries in to the alveoli and then tracheobronchial tree to the epiglottis.

The larvae are then swallowed and reach the small intestine where they develop into adult worms. Eggs will appear in stool within one to three months of infection Female worms will lay between 10,000 eggs per day for up to ten years [5].

Larval penetration of skin may cause local itching and papulo vesicular rash, called 'ground itch'. In the lungs, there may be asthma-like symptoms or pneumonia. In the intestine, hookworm uses buccal capsule to attach onto the small intestine and suck the

blood of its host. Symptom associated with hookworm infestation includes abdominal pain, diarrhea, weight loss, loss of appetite. In chronic infections, the patients may become anaemic as the worms feed on the individuals blood. The loss of blood leads to loss of iron and protein, causing difficulty in breathing, pale complexion, tiredness, fast Heartbeat, generalized swelling and impotence. Consequently there is slow growth rate, heart problems or even heart failure, cognitive performance in children and ultimately their educational achievement [6].

Hookworm infection occurs both in adults and children but more common in children. This is because children are more likely than adults to come in direct contact with faecally contaminated soil containing infective larva. The infection is easily transmitted to these children due to their activities such as playing, digging, eating, rubbing of their body with the soil [7]. The present study was carried out to evaluate the prevalence of hookworm infection among school children in Mkar, Gboko LGA of Benue State, Nigeria. The results would provide a yard stick to measure the progress of the improved approaches to combat hookworm infection in Mkar, and by extension across the nation. The study would also be helpful to parents and guardians in knowing about some of the health problems faced by their wards.

Materials and Methods

Study area

The study area was Mkar, Mkar is situated in Gboko, Benue, Nigeria, its geographical coordinates are 7° 20' 0" North, 9° 2' 0" East and its original name (with diacritics) is Mkar Gboko Benue State Nigeria. Samples were collected from primary school children in some randomly selected primary school in Mkar, between January and April, 2021. This included UBE Primary School, NKST Orphanage School, Daystar Primary School, and Mkar Model Primary Schools.

Sample size and sample collection

A total of 200 stool samples were collected aseptically from the pupils in four (4) different schools in Mkar, Gboko LGA. Universal containers were used to collect stool samples from twenty five (25) female and twenty five (25) male pupils with the age brackets of 1-13 years. Containers were labeled appropriately sample code of each pupil. Data were also collected on the age, sex, source of drinking water and type of toilets facility used. Samples were thereafter taken to the University Mkar Biological Sciences laboratory for analysis.

Sample analysis

The Ether concentration method was used [8]. being the most frequently used techniques for a wide range of parasite with minimum damage to their morphology. Using a rod or a stick, exactly 1g of faeces was emulsified in 4 ml of 10% formol water. Another 4 ml of formol water was added and mixed well followed by sieving the emulsified faeces and collecting the sieved suspension in centrifuge tube. Exactly 4 ml of diethyl ether was added and mixed for about 1 minute. The suspension was centrifuged at 750-1000rpm for 1 min. The segment was collected on a grease free slide and covered with a coverslip. It was examined using x10x and x40 objective lenses.

Data analysis

Data obtained from this study was subjected to appropriate descriptive and inferential statistics using the Minitab software package (version 16.0). Chi square test of association was applied at appropriate degree of freedom with 95% confidence limit. T-test was also applied accordingly

Results and Discussion

The total prevalence of hookworm infection among school children in the study area is given in Table 1. A total of 33 positive cases were recorded out of 200 samples. This gave a prevalence of 16.5%. NKST Orphanage had the highest prevalence of 30% followed by Mkar Model with 14%. Daystar had 12% while UBE AHWA was the least with 10%. Hookworm prevalence was significantly dependent on school types (χ^2 = 15.21, P=0.002, P<0.05). Among the 33 infected children in the study area, the proportions of infected children in the various schools are: 45.5% at NKST Orphanage, 21.2% at Mkar Model, 18.2% at Day Star and 15.2% at UBE Ahwa.

Table 1: Prevalence (%) and Proportion (%) of Hookworm Infection among Children in the Study Area

Name/Location of Nursery and Primary Schools in Gboko	Number of positive samples	% of positive samples relative to total number of positive samples in the study area	Total number of samples	Prevalence %
NKST Orphanage	15	45.5%	50	30%
UBE Ahwa	5	15.2%	50	10%
Mkar Model	7	21.2%	50	14%
Day Star	6	18.2%	50	12%
Total	33	100	200	16.5%

χ^2 (School type and prevalence) @3df= 15.21, P=0.002, P<0.05

Table 2 gives the sex distribution of children in that were infected with hookworm. Out of the 15 infected children at NKST Orphanage, there were 7 male (46.7%) and 8 female (53.3%). Sex distribution at UBE AHWA was 40% male and 60% female. Sex distribution at Mkar Model was 42.9% male and 57.1% female. In the three schools stated above, the proportion of infected female children was higher than male children. However, Daystar school had more male (66.7%) being infected with hookworm than female (33.3%). Out of the total of 33 hookworm infected children in the study area, the proportion of infected male to female was 44.5% to 51.5% respectively. Therefore, more female were infected than male school children in the study area (Figure 1). However, test statistics showed no significant association between sex status and hookworm infection ($\chi^2 = 0.03$, P=0.862, P>0.05).

Table 2: Sex Distribution of Hookworm Infected among School Children

Name/Location of Nursery and Primary Schools in Gboko	Number of infected male	Number of infected female	Total number of positive children
NKST Orphanage	7 (46.7%)	8 (53.3%)	15
Daystar	2 (40%)	3 (60%)	5
Mkar Model	3 (42.9%)	4 (57.1%)	7
UBE Ahwa	4 (66.7%)	2 (33.3%)	6
Total	16 (44.5%)	17 (51.5%)	33

χ^2 (Sex Status and Infection) @1df= 0.03, P=0.862, P>0.05

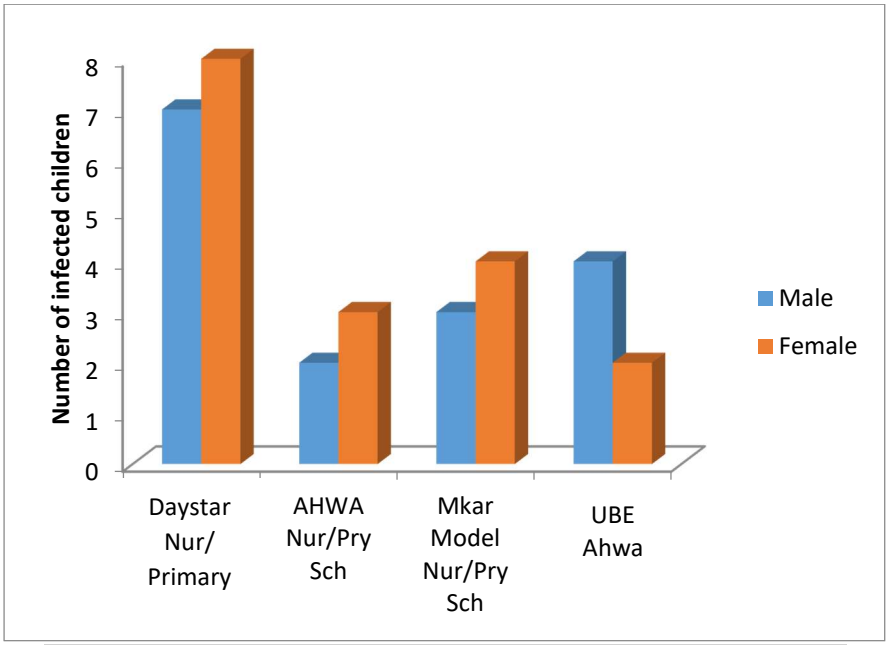

Figure 1: Sex Distribution Pattern among Hookworm Infected Children

Table 3 gives the age distribution of children that were infected with hookworm. Out of the 15 infected children at NKST Orphanage, there were 7 children in age 1-5 years (46.7%) and 8 children in age 6-10 years (53.3%). Out of the 6 infected children at UBE Ahwa, there were 4 children in age 1-5 years (66.7%) and 2 children in age 6-10 years (33.3%). In both NKST Orphanage

and UBE Ahwa, age 1-5 years had more hookworm infection than other age groups. Age distribution at Daystar gave 40% in age 1-5 years and 60% in age 6-10years. Age distribution at Mkar Model gave 42.9% in age 1-5 years and 57.1% in age 6-10years. In both Daystar and Mkar Model, age 6-10 years had more hookworm infection than other age groups. As shown in Figure 2, more children were infected with hookworm between age 1 and 5 years at NKST Orphanage and UBE Ahwa but less in the other schools. Out of the total of 33 hookworm infected children in the study area, age group 1-5 years had more hookworm infections (54.5%) than other age groups. Proportion of infected cases in age group 6-10 years was 45.5% while it was 0% in age group above 10 years (Figure 3). In the four schools, children above 10 years had no hookworm cases. Therefore, hookworm infection in the study area was significantly associated with age groups (χ^2 = 16.9, P=0.00, P<0.05).

Table 3: Age Distribution of Hookworm Infected among Children

Name/Location of Nursery and Primary Schools in Gboko	Age 1-5 years	Age 6-10 years	Age >10 years	Total number of positive children
NKST Orphanage	9 (60%)	6 (40%)	0 (0%)	15
Daystar	2 (40%)	3 (60%)	0 (0%)	5
Mkar Model	3 (42.9%)	4 (57.1)	0 (0%)	7
UBE Ahwa	4 (66.7%)	2 (33.3%)	0 (0%)	6
Total	18 (54.5%)	15 (45.5%)	0 (0%)	33

χ^2 (age and infection) @2df= 16.9, P=0.00, P<0.05

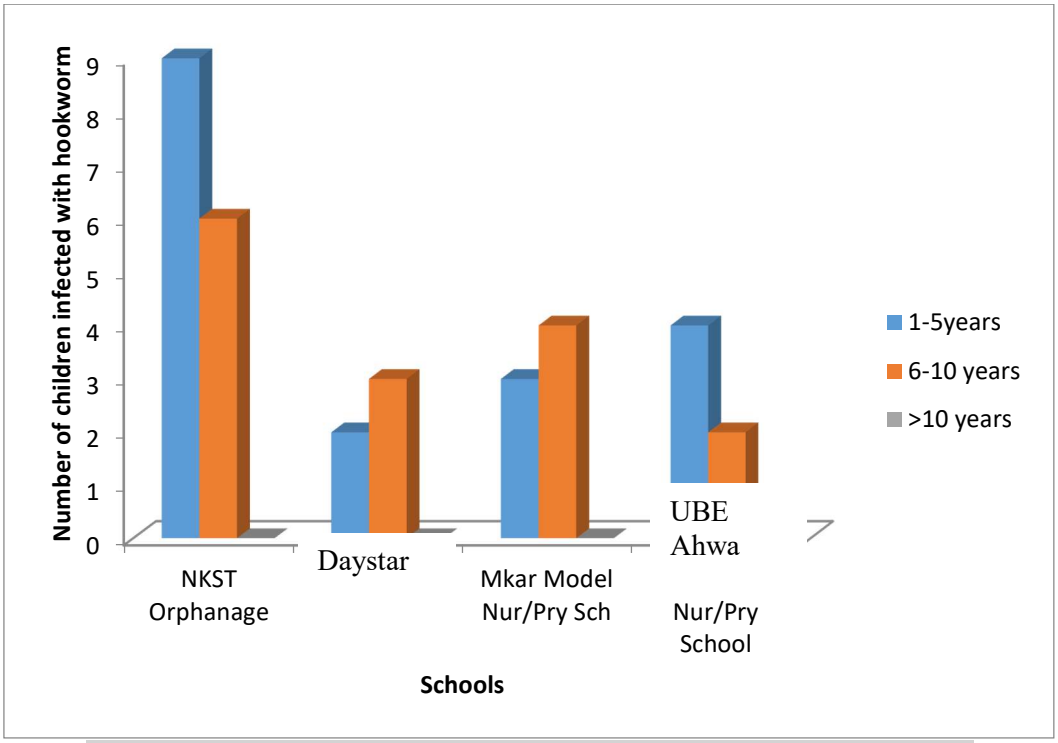

Figure 2: Age distribution of hookworm infected children at the various schools

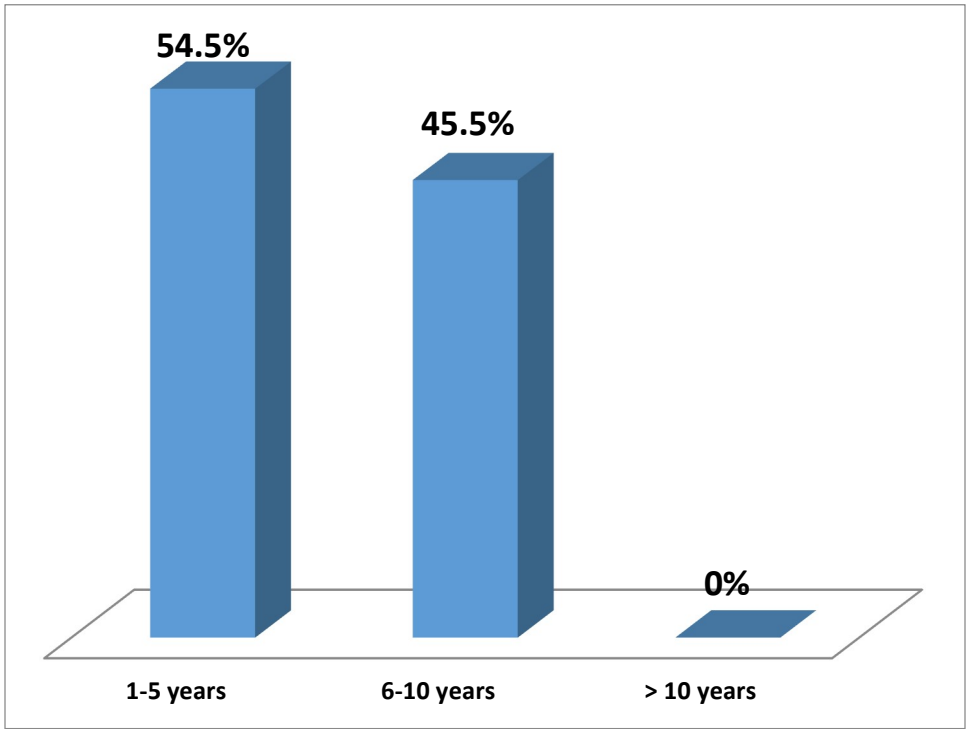

Figure 3: Age distribution of hookworm infected children in the study area

Hookworm infection is a very serious disease being a parasitic blood sucking infection. The outcome of the present study aligns with other reports where high cases of hookworm infection were reported among children [9, 10]. In this work, a total prevalence of 16.5% was high considering the fragility nature of school children and the impacts the infection would cause on them. The infected children are likely to lose focus on their studies thus affecting their educational and social life. The adult and larva worms live in the small intestine of affected children to cause intestinal diseases and it is often associated with malnourishment, anaemia especially in younger children [11]. This outcome of this study did not align with the work of Walana *et al.* [12] who reported a low hookworm prevalence of 0.3% among 47,147 patients in Kumasi Ghana whereas it was very high in other parts of Africa [10, 13]. This suggests that hookworm infection varied from place to place depending on the environmental conditions of an area.

Many factors might have contributed to the high prevalence recorded in this study. As it is common in other infections in African countries, poor hygiene and frequent contact with contaminated soil and water have been reported [10, 13, 14]. In many parts of the world especially in developing nations, hookworm infection is common in areas with poor access to safe water, poor sanitation and hygiene.

The NKST Orphanage had the highest prevalence of 30%. This could be attributed to the type of care given to the children and the type of environment, For instance, the children interact continually as a population or cluster. Life style could facilitate hookworm transmission through the fecal-oral mode. Generally, when the quality of the total environment is compromised, the general well-being of the people are also affected. According to Nasr *et al.* [15], hookworm infestation is aided in crowded environment where contamination of water and food is unavoidable. Other primary schools such as Mkar Model (14%), UBE Ahwa (12%) and Daystar also recorded higher prevalence above the WHO threshold of 5% for African countries [16]. However, hookworm infection in conventional schools was less than in NKST orphanage home. This may be due to differences in the type of care given to children. In conventional primary schools, the duration of children interaction is less compared to the continuous interaction of children at the orphanage home.

This study did not establish any relationship between sex status of children and hookworm infections as both sexes are equally susceptible, although the number of infected females was more

than males. Children interact together regardless of their sex status and they are equally exposed to the same risk factors that aid hookworm transmission. Therefore, the above finding is justifiable. In other studies, adult female patients are more susceptible to hook worm infection than males, due to the frequent exposure of women to helminthes contaminated soils (Walana *et al.,* 2014). Age group is a critical factor that should be given attention based on the outcome of this study because age factor is associated with hookworm infection. The older children above 10 years had no hookworm infection possibly due to their higher level of their maturity than other age groups. This might have resulted into self-awareness, self-consciousness that promotes hygienic practices. For instance, children in this age group are not likely to play in polluted water or defecate openly. This position was previous upheld in other studies [12]. However, age group 1-5 years are not self-conscious, hence children within this age group engage in unhygienic practices and tend to play in hookworm contaminated environment indiscriminately. Soil plays a major role in the transmission of helminth, a factor that predisposes playing pupils to the infection [12]. This study found that more children were infected with hookworm between age 1-5 years than older ages. This finding aligns with other reports where hookworm infection among adult population was found to be associated with age and sex of patients [12, 17]. The present work agrees with a recent report that intestinal worm infestation has become a global health problem and still highly prevalent in the tropical region [10, 18]. However, hookworm infection could be prevented and managed with attitudinal change, proper orientation, early diagnosis, access to medication, improved sanitation and socioeconomic conditions.

Conclusion

The overall hookworm prevalence among children in the study area was 16.5%. It was far above the minimal WHO threshold limit. Among the four schools studies, The NKST Orphanage home had the highest prevalence of 30%. Other primary schools such as Mkar Model (14%), Daystar Nur/ Primary School (12%) and UBE Ahwa (10%) also recorded higher prevalence above the WHO threshold of 5%. This study did not establish any relationship between sex status of children and hookworm infections as both sexes are equally susceptible although the number of infected females was more than males. Age factor is associated with hookworm infection. The older children above 10 years had no hookworm infection while age 1-5 years had the highest infection.

The WHO gave standard guidelines and treatment regime that could reduce or eliminate hookworm in Africa. This should be adhered to. The approved drugs for the treatment of hookworm are anthelminthic drugs called benzimidazoles. It is the responsibility of caregivers or guardians or parents to take their wards to the nearest primary health care unit of the Local Government Area or the State Epidemiological Unit for drug administration which in some cases are free of charge. Thus, there should be measures in place to combat the infection including proper awareness, health education, improved sanitary conditions and treatment regime in primary schools within the study area.

Declaration of conflicting interests

The authors declared no potential conflicts of interest.

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