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Soil-Transmitted Helminth Infections and Hygiene Behavior Among Primary School Children Aged 2-6 Years in Odukpani Local Government Area of Cross River State, Nigeria

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ABSTRACT

Soil-transmitted helminths are a group of parasitic nematode worms causing human infection through contact with parasite eggs or larvae that thrive in the warm and moist soil of the world's tropical and subtropical countries. Infection and transmission are propagated by poor hygienic habits such as indiscriminate disposal of human and animal faeces, which permits contact of faeces and its accompanying microbial load with soil or water. The study determined the prevalence of Soil-Transmitted Helminthinfections and hygiene behavior among Primary School Children Aged 2-6 Years in Odukpani Local Government Area of Cross River State, Nigeria. Fecal samples were collected from four hundred and twenty-five (425) children selected randomly from both pre-school and school-aged children. The samples were parasitologically and microscopically examined. Results revealedhelminths species with an overall prevalence of 41.2% of soil-transmitted helminth. Variables considered in the study were, type of toilet facility and sanitation as well as personal hygiene like Washing of hands after toilet, washing of fruits before eating and wearing of shoes. Those who practiced open defecation method had the highest prevalence (44.5%), pit toilet (39.1%) while those who used water (rivers, streams and lakes) had 37.5%. The difference was not statistically significant at $p<0.05$). The study indicated that, soil-transmitted helminths was prevalent in Odukpani Local Government Area of Cross River State and as such, control measures such as periodic mass deworming, sanitation and health education are recommended. Blending sanitation and infrastructure will go a long way in the elimination of soil-transmitted helminth.

Keywords- school children, infections, soil-transmitted, helminths, hygiene, behaviour.

I. INTRODUCTION

Soil-transmitted helminths are a group of parasitic nematode worms causing human infection through contact with parasite eggs or larvae that thrive in the warm and moist soil of the world's tropical and subtropical countries. More than one dozen different species of soil-transmitted helminths infect humans, especially in the tropical and subtropical parts of the developing world. However, four nematodes in particular stand out because of their widespread prevalence and distribution that result in hundreds of millions of human infections. These include the large roundworm, *Ascarislumbricoides*, the whipworm, *Trichuristrichiura*, and two species of hookworm, *Necatoramericanus*and *Ancylostomaduodenale*[1].

Infection and transmission are propagated by poor hygienic habits such as indiscriminate disposal of human and animal faeces, which permits contact of faeces and its accompanying microbial load with soil or water. Generally, STH infections are associated with poverty, lack of sanitation, impaired hygiene and overpopulation [2].

In Nigeria, soil-transmitted helminth infections have continued to prevail because of low levels of living standard, poor environmental sanitation and ignorance of simple health promoting behaviours [3][4]. Children bear the greatest burden of these infections and as such are faced with health burdens which include malnutrition, stunted growth and intellectual retardation, as well as cognitive and educational deficits [5][6][7]

Evidence suggests that soil-transmitted helminthiasis has a potential effect on growth and development of children [8][9][10]. Despite this, children of pre-school and school age groups continue to receive little or no attention, even though the WHO identified a lack of specific studies on these children and highlighted a paucity of epidemiological data, particularly, soil transmitted helminths. The present study seeks to determine the prevalence of soil transmitted helminths infections in children aged 2-6 years which has not been previously assessed in Odukpani local government area. This will provide base line data for the area.

II. MATERIAL AND METHODS

A. Study Area

The area covered in this study was Odukpani Local Government Area of Cross River State, Nigeria. Odukpani Local Government Area is in the Southern Senatorial District of Cross River State. Odukpani Local Government Area is bounded on the north by Abia State, north-east by Biase Local Government, in the south by Calabar South Local Government, south-east by Akamkpa and Calabar Municipality and by the west by Itu Local Government Area of AkwaIbom State. It has a landmass of 207.16km^2. It has a geographical location of 8.17^0 East on the African Continent (latitude 5^0 7^1 55N and longitude 8^0 20^1 22E). The study area has two main seasons; the rainy and dry seasons. The rainy season usually starts in April and ends in September. The dry season starts in October and ends in March. The Local Government has a sub-equatorial climate and a moderately hot temperature (with an average temperature of 28^{0}C) which does not fluctuate greatly. It is characterized by frequent and high rainfall as well as high relative humidity.

According to the report from the office of Statistics of Cross River (2009), Odukpani Local Government Area has an estimated population of 1,865,604, comprising 1,063,289 males and 802315 females. Odukpani Local Government Area comprises people from within and outside the country, while the native are mainly Efiks. There are thirteen (13) wards in the Local Government Area; these are AdiaboEfut, Akamkpa, Creek Town 1, Creek Town II, Ekori/Anaku, Eniong, Eki, Obomitiat/Mabiabo/Ediong, Odot, Odukpani central, Onim/Ankiong, Ikoneto and Ito/Idere/Ukwa.

A greater number of its inhabitants are fishermen, subsistent farmers; cultivating pumpkin, okra, pepper, cassava, cocoyam, water yam etc., while the rest are civil servants, merchants, businessmen and artisans. The area is poorly developed with poor health care facilities.

B. Study Population

The study population consists of primary school pupils and non-school age children ranging from ages 2-6 years in Odukpani Local government area of Cross River State. With the aid of the serial numbers of children in their class registers, all with even numbers were selected for the study (for those in schools). For the non-school age children houses were selected at random. Ethical approval was obtained from Cross River State Ministry of Health. Permission was obtained from Odukpani Local Government Area Primary Education Board and informed consent was also obtained from parents specifically mothers of infants, school authorities and the village Heads, after they were briefed on the aims and objectives of the study in order to get their consent. Only pupils who returned their consent forms were recruited for the study. A total of 425 stool samples were collected from the children from November, 2019 to March, 2020.

C. Study Design

The study was an experimental research and the detailed methodology included pre-tested questionnaire administration to caregivers and Teachers, collection and examination of samples. One week prior to questionnaire administration and parasitological surveys, a written informed consent for the parents/guardian of participating children were distributed. Copies of the pre-test questionnaire and small plastic containers for collection of stool sample were left with the caregivers and Teachers for distribution to selected children. During the school-based survey, the signed informed consent sheets, and stool samples were collected. A short interview was held with each child, using a questionnaire to determine hygiene behavior, source of drinking water and general sanitation at home. The school Heads with members of staff helped to organize the children for effective sampling.

D. Sample Collection

The schools selected include primary school, IsongInyang (Eniong Ward), primary school, Iboho Ito (Ito/Idere/Ukwa Ward), primary school, AtanEki (Eki Ward), primary school, IkotUkpa (Adiabo/Efut), primary school, AdiaboIkotOtuIbuot (Odukpani Central), primary school, AkwaEfe (Ikoneto), primary school, IkotEsu (Creek Town 1), primary school, UruaEtakUyo (Creek Town 11), primary school, Oboroko (Akamkpa), primary school, OkpokIkpa (Ekori/Anaku), primary school, MbiaboEdere (Mbiabo/Ediong), primary school, OkoyongUsangAbasi (Oniman-Kiong), and primary school, NdonNwong (Odot).

From each of the schools selected across the thirteen wards in the local government area, three hundred and twenty-five (325) pupils were recruited with the aid of the serial numbers of children in their class registers, all with even numbers were selected for the study (for those in schools). 25 children were selected from each school to make up a total of 325 school age pupils while 100 non-school age children were sampled at random from different homes at a space of five house intervals. A total of four hundred and twenty-five (425) children were sampled. Faecal samples were collected two days in two weeks for a period of five months. Each selected pupil was given a sample bottle with which they collected their faeces with the aid of their

caregivers. The bottles were labeled with the pupil's name, age and sex before giving them to the pupils. The names were recorded in a book with other details. 1ml of 70% alcohol was added to the stool sample for preservation by the investigator. The faecal samples were collected and taken to the Department of Biological Science laboratory, Cross River University of Technology, Calabar, for examination.

E. Stool Examination

The samples were examined macroscopically and microscopically.

Direct wet mount method

Direct smears were prepared with normal saline solution for microscopic observation. About 2g of stool samples were emulsified with 3-4 ml normal saline solution and then a drop of emulsified sample placed on a clean microscopic glass slide. Following this, a few drops of iodine solution was added and covered with a cover slip. The resulting smears were viewed under the microscope using the 40x objective for detailed identification of the helminthes. Eggs were identified using standard taxonomical characteristics [7].

Formol Ether Concentration Method

Using an applicator stick about 2g of preserved stool sample was placed in a clean 15ml conical centrifuge tube containing 7ml formalin. The sample was dissolved and mixed thoroughly with applicator stick. The resulting suspension was filtered through a sieve (cotton gauze) into a beaker and the filtrate was poured back in to the same tube .The debris trapped on the sieve was discarded. After added 3ml of diethyl ether to the mixture and hand shaken, the content centrifuged at 2000 rpm for 3 minutes. The supernatant was poured away and a tube replaced in its rack. Iodine stain preparation made from the sediments. Finally the entire area under the cover slip was systematical examined using 10x and 40x objective lenses [11].

F. Data Analysis

Variations in the prevalence of infection between ages and sexes were determined using the χ^2 tests from the contingency tables. The percentage prevalence (%) was calculated in each case. Comparative analysis of the results was done using Chi-square (X^2). A p-value less than 0.05 ($p<0.05$) was considered as statistically significant.

III. RESULTS

A total of four hundred and twenty-five (425) children from 13 wards including both pre-school age and school age children were sampled for soil-transmitted helminths infection. One hundred and seventy-five (175) children were infected by soil-transmitted

helminths giving an overall prevalence of 41.2%. Three STH were encountered namely, *Ascarislumbricoides*, Hookworm &*Trichuristrichuira*.

Table 1 shows the method of faecal disposal and prevalence of soil-transmitted helminth infections among children. 173 (40.7%) used open defecation (bush), 220 (52.2%) used pit toilet for feacal disposal, while 32 (7.5%) used streams and water bodies for disposal with the prevalence of soil-transmitted helminth infection of 44.5%, 39.1%, and 37.5% respectively. Those that practiced open defecation had the highest prevalence of 44.5%. The difference was not statistically significant (df=2, x^2cal=0.565, x^2 tab=5.991 p<0.05)

TABLE 1:Prevalence of Helminth infection in relation to type of toilet facilities used at home in Odukpani Local Government Area of Cross River State

Toilet facilities	No. of children examined	No. of children infected	Prevalence %	x^2
Pit toilet	220(52.2%)	86	39.1	
Open defecation (bush)	173(40.7%)	77	44.5	
Water (rivers/ stream)	32(7.2%)	12	37.5	0.5648
Total	**425**	**175**		

Table 2 shows that the prevalence of soil transmitted helminth infection in children in relation to washing of hands after toilet sometimes, never and regularly was 53 (36.1%), 80 (44%) and 42 (42%) respectively. With the highest prevalence in children that never washed their hands after toilet. The difference was not statistically significant at (df=2, x^2cal=1.122, x^2 tab=5.991 p<0.05).

TABLE 2:Prevalence of STH infection in relation to hygiene practice: Washing of hands after toilet in Odukpani Local Government Area of Cross River State

Washing of hands after toilet	No. of children examined	No. children infected	Prevalence %	x^2

Yes	100	42	42	
No	178	80	44.9	1.12237
Sometimes	147	53	36.1	
Total	**425**	**175**		

Table 3 shows that the prevalence of soil-transmitted helminth infection in children in relation to washing of fruit before eating sometimes, never and regularly, 78 (43.3%) and 76 (40.2%) and 21 (37.5%) respectively. With the highest prevalence in children that washed their fruits sometimes before eating. However, the difference was not significant statistically.

TABLE3: **Prevalence of STH in relation to washing of fruits before eating in Odukpani Local Government Area of Cross River State**

Washing of fruits	No. of children examined	No. children infected	Prevalence %	x^2
Yes	56	21	37.5	
No	189	76	40.2	0.30625
Sometimes	180	78	43.3	
Total	**425**	**175**		

As seen in Table 4, the association was not statistically significant between soil-transmitted helminth infection and wearing of shoes (df=2, x^2cal=0.306, x^2 tab=5.991 $p<0.05$). The prevalence of soil-transmitted helminths in children in relation to wearing of shoes was 82 (44.3%), wear no shoes 64 (41.6%) and wear shoe sometimes was 29 (33.7%)

Table 4: **Prevalence of STH in relation to wearing shoes in Odukpani Local Government Area of Cross River State**

Wearing shoes	No. of children examined	No. children infected	Prevalence %	x^2

Yes	185	82	44.32	
No	154	64	41.6	1.179627
Sometimes	86	29	33.7	
Total	**425**	**175**		

IV. DISCUSSION

In the present study, it was observed that the factors that influenced the prevalence of soil-transmitted helminth infection in Odukpani Local Government Area were improper feacal disposal and personal hygiene as most of the children wore no shoes. Lack of hand washing, shoe wearing and open defecation increased the risk of the infection. This is similar to the reports of [12] who stated that unclean hands played a vital role in the transmission of soil-transmitted helminths in children. The safe disposal of faecal matter of children is thus of critical importance.

The variation in prevalence rate of the soil-transmitted helminths infection could be related to several factors including poor living standard and poor environmental hygiene.

The high prevalence could be attributed to the methods of feacal disposal. Those who practiced open defecation method had the highest prevalence (44.5%), pit toilet (39.1%) while those who used water (rivers, streams and lakes) had 37.5%. open defecation create more avenue for the parasite to strive well and complete their life cycle. This is in line with the report of [13] who reported that soil-transmittedhelminth infection occur predominantly due to inadequate basic amenities and poor environmental hygiene in rural area. The findings of the study revealed that soil-transmittedhelminth infection is still prevalent in communities of cross river state, Nigeria. The high prevalence of soil-transmitted helminth could be linked to the habits of school children as most children eat with unclean hands therefore, facilitating the transmission of soil-transmitted helminth as reported by [14]. The practice of wearing no shoe due to poverty and socioeconomic status play significant role in the transmission of hookworm hence the high prevalence of hookworminfection as the larvae will penetrate the skin of children as reported by [15].

V. CONCLUSION

Soil-transmittedhelminth is still prevalent rural communities of cross river state, Nigeria. The control of soil-transmittedhelminth is essential due to the impaired effects it caused on the school children. This cannot be done without the application one health approach. Blending sanitation and infrastructure will go a long way in the elimination of soil-transmitted helminth. This is by provision of social amenities and toilet facilities other than only administering anthelminthic drugs the children.

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LIMITATION OF THE STUDY

Smaller age range of school children are the limitation of the work. Studies on an expanded age range are required to ascertain the observations.

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