Hook Worm Infection Among Peasant Farmers in Ghakyob District of Kaninkon Chiefdom Jema'a Local Government Area, Kaduna State, Nigeria.

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Abstract: Hookworm is now known as the most damage and insidious character infection among parasitic infections and ye. the most neglected by the global medical community. This however, is constituting great threat to public health sector most especially in the tropical countries. This study was aimed at determining the prevalence of Hookworm infection among peasant farmers in six villages of Ghakyob District of Kaninkon Chiefdom Jema'a Local Government Area of Kaduna State Viz; Buduku, Sabon Gari, Ungwan Baki, Nko, Ungwan Ture and Ungwan VIO. A total of four hundred and twenty (420) stool samples were collected and examined using wet preparation and formol-ether concentration techniques. The overall prevalence was found to be 27.9%, and a statistical significant relationship was established between village of the peasant farmer and hookworm infection with p-value, $P = 0.000 < 0.05$.Sabongari was found to have the highest prevalence of 42.8%followed by Buduku 37.1%, Nko 35.7%, Ungwan Baki 27.1%, Ungwan Ture 15.7% and the least Ungwan VIO 8.6%. Relationship between hookworm infection and sex revealed that the females had higher rate of infection 66(31.4%) compared to male51 (24.3%).In relation to toilet facilities, Sabongari with 22 toilets had a Prevalence of (42.8%), Buduku with 28 toilets had a prevalence of (37.1%), Nko with 20 toilets (35.7%), U/Baki with 31 toilets (27.1%), U/Ture with 15 toilets (15.7%) and U/VIO with 50 toilets had (8.6%) hookworm infection. Other parasites seen apart from Hookworm infection was 17.9%, In conclusion, this study revealed the transmission of human hookworm among peasant farmers in this community to be at alarming rate. Thus, major prevention and control measures should be adopted to avoid further spread of the infection; and more so, there is a need for prompt treatment of the infected persons as well as creating a law that will prohibit indiscriminate defeacation on farm lands.

Key Words: Hookworm infection, Ghakyob District, Stool samples, Prevalence, Peasant Farmers

Introduction

Parasitic diseases have contributed immensely in undermining the health status of the people and jeopardizing the economic development of nations in the tropics. It is therefore obligatory to develop an awareness of the relevance of parasitology in national development and welfare of the people (Adeyeba, 2002). Hookworm remains the great infection of mankind. Itoutranks all other worm infections of man combined in its production, frequently unrealized, of human misery, debility, and inefficiency in the tropics. Silent and insidious characters of hookworm serve as a partial explanation for its neglect by the global medical community. This neglect subsequently intensified during the 1970s, 1980s: and 1990s with the omission of hookworm from the list of diseases covered by the World Health Organization's Special Programme for Research and Training in Tropical countries (Peter *et al*., 2005).

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Human hookworm infection is caused by blood-feeding nematode parasites of the genus.

Ancylostoma and the species *Necato ramericanus*. Worldwide, *N. americanus* is the predominant etiology of human hookworm infection, whereas *A. duodenale* occurs in more scattered focal environments (Hotez *et al*.., 2004)

Intestinal parasitic infections are endemic worldwide and have been described as constituting the greatest single worldwide cause of illness and disease. Poverty, illiteracy, poor hygiene, lack of access to potable water as well as hot and humid tropical climate are factors associated with intestinal parasitic infections (Vikram *et al*., 2008).According to Oliver (1974), it is not easy to assess or estimate the impact of socio-economic factors of the parasitic infections and also it is not easy to estimate the socio-economic impact of parasitic diseases, though Watson (1978) goes so far to say that parasitic diseases probably contribute most to the retardation of socio-economic development and considers them to be public enemy number one.

The importance of farmers in nation development can never be over emphasized, considering how vital food is to our survival and day to

day activities. As a matter of fact, Hookworm infection has been more prevalent in peasant farmers that form the highest percentage of Nigeria economic after petroleum; this is because human constitute a significant proportion of host for intestinal nematodes and most species are soil transmitted i.e. by faecal pollution of the soil, under favourable climatic conditions. A person becomes infected by swallowing infective egg or larvae or by infective larvae penetrating the skin. Before becoming adult in their human host, some of the nematode larvae migrate through the heart and lungs (Cheesbrough, 2010).

Hookworm however, has proven to be extremely difficult to eliminate or eradicate in areas of poverty and poor sanitation (Peter *et al.*, 2005). But today, new international efforts to control the morbidity of hookworm and other soil-transmitted helminth infections are in progress. In an attempt to control the morbidity, the World Health Organization (WHO) and Japanese International Cooperation Agency launched the project of soil-transmitted control first in Asia in 2004 and scaled-up to East and West Africa in 2005 and 2006, respectively (Vittaya *et al.*, 2011).

It is very vital to note that several authors both within and outside Nigeria such as Hotez *et al.*, 2004; Ensink *et al.*, 2005; Gunawardena *et al.*, 2005; Vittaya *et al.*, 2011; Eke *et al.*, 2014 and Williams *et al.*, 2014 have conducted researches on intestinal parasites particularly hookworm but the main vulnerable group of people who are peasant farmers that are always exposed to the predisposing factors associating with hookworm infection were always omitted in their studies. Therefore, this study was aimed at determining the prevalence of Hookworm infection among peasant farmers in six villages of Ghakyob District of Kaninkon Chiefdom Jema'a Local Government Area of Kaduna State.

Methodology

Study Area

This study was carried out in Ghakyob District Kaninkon Chiefdom, Jema'a L.G.A. Kaduna State Nigeria, which is located in the North-Western part of the country at latitude 10.51^{0}N and longitude 7.42^{0}E. Kaduna State is located within the tropical continental climate (Ajeye *et al.* 2018) with two distinct seasons – wet and dry. The vegetation type found in the study area is southern Guinea Savanna type characterized by thick woodlands, tall grasses and herbs with riparian forest along streams and river banks (Udo, 1981). The Guinea savanna is the broadest of all the vegetation type in Nigeria, covering area which has 1000mm to 1500mm of annual rainfall where the rainy season last for 6 months (Ajeye *et al.*, 2018). The primary risk groups are women and their children between the ages of 10 to 17 years who participate actively in farming. From August to December, 2015. Four hundred and twenty (420) Samples were collected from consented peasant farmers whose occupation is mainly farming and examined using Microscopy techniques.

Study population:

The population studied comprised of voluntary consented peasant farmers in Ghakyob District Kaninkon Chiefdom Jema'a L.G.A. Kaduna State, Nigeria, where farming activities are very high involving the vulnerable groups (women and children between ages 10 and 15 years). The age considered in this study was 10 years and above including males and females peasant farmers.

Ethical Considerations

Ethical clearance was obtained from Kaduna State Ministry of Health. A feasibility study of the selected villages was carried out with the co-operation of the district head/village heads; and sensitization lecture was given to the people in all the study areas.

Inclusion and Exclusion Criteria

Children aged 10 years and above who participates actively or assist their parents in farming were included in the study and all consenting farmers.

Children below 10 years of age were excluded from the study, non- consenting parents together with their children as well as all civil servants, business or traders and those who do not depend on farming as their main source of income and livelihood were excluded.

Collection of Samples

Four hundred and twenty (420) faecal samples were randomly collected into sterile labeled transparent plastic sample bottles from peasant farmers in Buduku, Sabon Gari, Nko, Ungwan Baki, Ungwan Ture, and Ungwan VIO villages of Ghakyob District Kaninkon Chiefdom of Jema'a L.G.A. Kaduna State. Detailed data concerning the farmers were also recorded, which included: name, sex, age, presence or absence of toilet facility. The sterile specimen bottles were distributed to the farmers and were instructed to collect in their feacal samples from their first morning stool on the following day. In case of bloody or mucoid stool, they were also told to pick the feacal sample from the area of blood or mucoid stained.

Laboratory Bio assay

The specimens were processed and examined immediately in the laboratory for Hookworm and any other intestinal parasite which may be present. Samples not examined immediately were preserved by adding 10% formol saline and kept in the refrigerator. There after they were taken to General Hospital Kachia Medical Diagnostic Laboratory for completion of examination using the formol-ether sedimentation technique described by Ochai and Kolhatkar(2008).

Macroscopic Examination

The stool samples were examined macroscopically as described by Cheesbrough (2010) to note and recorded the colour, consistency (i.e. whether the sample is formed, unformed, or watery), constituents (i.e. what the sample may contain macroscopically such as blood, mucous, adult worms, segments of cestodes, etc.)

Microscopic Examination

A drop of normal saline was placed at the center of a clean grease-free slide. With the help of an applicator stick, a pea size from a selected area of the stool was picked and emulsified evenly with a drop of normal saline. Selected area included blood or mucous (if present). All coarse particles were removed. Preparation was covered with cover slip, avoiding air bubbles and over floating. The preparation was examined under bright field microscope using x10 objectives and confirmed using x40 objective. Cyst-like object seen, was further confirmed by iodine preparation described by Ochai and Kolhatkar (2008).

Concentration Method

Irrespective of the result obtained in the wet or iodine preparation, this technique was applied to feacal samples that were negative for wet preparation. The method used was the chemical centrifugal sedimentation (formol-ether technique) described by Ochai and Kolhatkar (2008). In this method: 1g of feacal sample was emulsified in 5ml of normal saline in a clean test tube. The preparation was centrifuged at 3000 rpm for 3 minutes and the supernatant discarded. This process was repeated until the supernatant was clear.7 ml of 10% formol saline was added to the deposit and mixed well.3 ml of diethyl ether was added and covered with a rubber bung and shaken vigorously for 20 seconds. The tube was centrifuged at 3000 rpm for 5 minutes after which four layers were visible viz the debris, ether, formol-saline and deposit. The supernatant was poured off and the deposit was poured onto a clean grease-free slide covered with cover slip and examined microscopically using x10 and x40 objectives. Presences of ova or cysts were recorded.

Hypothesis

1. Ho: No relationship between village/sex and the prevalence of Hook worm among peasant farmers in Ghakyop district of Kaninkon chiefdom.

   H1: There is a relationship between village/sex and the prevalence of Hook worm among peasant farmers in Ghakyop district of Kaninkon chiefdom.

2. Ho: No relationship between number of toilet and number of peasant farmers infected with Hook worm.

   H1: There is a relationship between number of toilet and number of peasant farmers infected with Hook worm.

Methods of Data Analysis

The data obtained from the experiment were subjected to descriptive and inferential statistics. Specifically, tables were used to present the data to provide a snap shot available information in the sampled data. In order to established significance result or otherwise for the data, chi-square test of independence was used, which is a hypothesis test for determining whether two categorical variables are related in any way. The test determines whether there is a significance difference between the observed and expected frequencies in one or more categories, and observations usually classified into mutually exclusive classes. The chi-square test statistic is defined by

$$\chi^2 = \sum_{i=1}^{n} {(O_i - E_i)^2}/{E_i}, \qquad (1)$$

where O_i and E_i are the observed and expected frequencies, respectively. The significance of the result depends on a pre-specified significance level (α-level) and the degrees of freedom. For this paper we choose the alpha level to be $\alpha = 0.05$, this is in consistence with the usual value used in most scientific researches. Also, we use correlation analysis to establish whether or not the existence of statistical significance between number of toilet and number of peasant farmers infected with Hookworm.

Results and Discussions

The chi-square result in table 1, the $\chi^2 was$ found to be 31.099 with 5 degree of freedom and the P-value was (P=0.000) which is less than 0.05. Thus, the result was statistically significant and therefore it was concluded that there is relationship between hookworm infection and village of the farmer within the Ngakyob District. This could be due to the fact that some of the farmers in village undergo backyard farming barefooted which is one of the important predisposing factors of hookworm infection.

Result from this study (Table 1) revealed that peasant farmers from Sabon Gari Kaninkon had the highest prevalence rate of hookworm infection 30(42.8%), followed by farmers from Buduku 26 (37.1%), Nko 25 (35.7%), Ungwan Baki 19 (27.1%), Ungwan Ture 11 (15.7%) and the least prevalence rate of infection of 6 (8.6%) in Ungwan VIO. Thus, having a total prevalence rate of 27.9%. hookworm infection for the whole Ngakyob District.

The risk factors associated with hookworm infection are numerous and these include walking

barefooted, poor personal hygiene, Poor sanitary condition, poor socio-economic conditions, indiscriminate defeacation among others and all these predisposing risk factors were very common among the peasant farmers in the study area (Ghakyob District of Kaninkon Chiefdom).

Human hookworm infection caused by *Necato ramericanus* and *Ancylostoma duodenale* has been reported worldwide, especially among people in tropical and subtropical countries with low socio-economic status (Vittaya *et al.*, 2011). Poor sanitary condition which include indiscriminate defeacation on farm land particularly backyard while still undergoing backyard farming without foot wares and other poor socio-economic conditions have been the main predisposing factors to this infection in peasant farmers in this study area. More so, it has been reported that the independent risk factors for acquiring hookworm infection are barefoot walking and raising animals around the house. Indeed, the villagers were seen exposed to contaminated soil by walking barefooted and this is an act to greater risk of hookworm infection (Vittaya *et al.*, 2011).

The moist soil or mud is suitable for the development and growth of filariform larvae which is the infective form (Mabaso *et al.*, 2003; Brooker *et al.*, 2004).Risk factors of hookworm infection have been identified from several cross-sectional studies in many countries, acquiring hookworm infection is directly related to exposure to soil where the infective form (filariform larvae) live and penetrate human skin (Tomono *et al.*, 2003; Traub *et al.*, 2004; Liabsuetrakul *et al.*, 2009;).

Poor personal hygiene and sanitation, particularly defecation practices have been reported as risk factors of hookworm infection. (Olsen *et al.*, 2004; Asaolu *et al.*, 2003; Traub *et al.*, 2004;Gunawardena*et al.*, 2005; Ensink *et al.*, 2005). Hookworm infection has been associated with low socioeconomic status (Traub *et al.*, 2004) and low educational attainment (Traub *et al.*, 2004; Mihrshahi *et al.*, 2009; Liabsuetrakul *et al.*, 2009). All these risk factors studied and observed by other researchers mentioned above were attributed to the peasant farmers in the study area and were found to be truly affiliated to high prevalence of hookworm result obtained in the study area.

No statistical significance in relationship between sex and prevalence in Hookworm, chi-square statistic. $\chi^2 = -3.399$, degree of freedom 1, and P-value (P= 0.065). This means that the sex of peasant farmer has no effect on the prevalence of Hookworm infection. This should be expected as both male and female participate actively in all farming activities without exemption, having the same attributes of farming or planting barefooted without protective wears. However, observed in Table 2 that the female farmers has the higher prevalence infection of Hookworm 66(31.4%) compared to their males counterpart51 (24.3%).The higher prevalence among the female farmers can be attributed to the fact that female farmers engage more frequently on the farming activities than the male. For example, the females participate in the cultivation activity and still come back to sow the seed using their bare feet or hands as the case may be. Again, most of the weeding and harvesting are being carried out mainly by the female while the male restricted to cultivation. Furthermore, females are engaged in other domestic works such as washing of clothes or napkins infected or contaminated with feaces, sweeping or cleaning of the house and its environs could also contribute to the females having higher infection than males. The result of this study agreed with that of Williams *et al.* (2014) which showed a slightly higher prevalence among females than males; but disagrees with that of Eke *et al.* (2014). whose results showed a higher prevalence among males than their female's counterpart.

The relationship between number of toilet facilities in the villages and hookworm infection revealed a negative value of correlation coefficient of -0.164, this means that the more the number of toilet facilities the lesser the number of hookworm infection in the village. However, the result is not significant (P-value = 0.756).

Sabon Gari had the highest prevalence 30(42.8%) of hookworm infection, followed by Buduku 30(37.1 %), then Nko 25(35.7%), U/Baki 19(27.1%), U/Ture 11(15.7%) and the least was VIO 6(8.6%) (Table 3). This should be expected because majority of the people hardly use their toilets in the villages especially during the raining seasons when the crops have grown higher, thus serve as a cover for those who choose to defeacate indiscriminately on farmlands. Further, it was noticed that most of the farmers in the study area goes to farm bare footed.

The prevalence of Hookworm infection117 (27.9%) in relation to other intestinal parasites encountered in this study (Table4) shows that *Ascaris lumbricoides* was the highest 45(10.7%), followed by *Taenia sp.* 10(2.4%), *E. coli* 8(2.0%), *E. hystolytica* 5(1.2%), *S. mansoni* 4(1.0%) and *H. nana* 3(0.7%). These are all intestinal parasitic worms that can cause health complication with hookworm infection, their total prevalence put together was 75(17.9%) while that of hookworm alone was 117(27.9%), of course this is not surprising since the study group was mainly peasant farmers and the fact is that hookworm infection is highly associated with farming occupation. Polyparasitism was observed in only 10 farmers and other parasites in 40 farmers. However, 303 peasant farmers out of the 420 examined were free from hookworm infection.

Table 1: Showing Prevalence of Hookworm infection in the six villages

Name of Villages	No. of Samples	No. Positive (%)	χ^2 stat., degrees of fredom ($p-value$)
Sabon-Gari	70	30 (42.8)	31.099, 5 (0.000)
Buduku	70	26 (37.1)	
Nko	70	25 (35.7)	
U/Baki	70	19 (27.1)	
U/Ture	70	11 (15.7)	
U/VIO	70	6 (8.6)	
Total	**420**	**117(27.9)**	

Table 2: Showing Prevalence of Hookworm Infection in Relation to Sex.

Sex	No. of Samples	No. Positive (%)	χ^2 stat., degrees of fredom ($p-value$)
Males	210	51 (24.3)	3.399, 1 (0.065)
Females	210	66 (31.4)	
Total	**420**	**117(27.9)**	

Table 3: Showing Prevalence of Hookworm infection in relation to toilet facility

Name of Villages	No. of Toilet Facilities	No. of Samples	No. Positive (%)	Corr. Coeff. (p-value)
Sabon-Gari	22	70	30 (42.8)	-0.164 (0.756)
Buduku	28	70	26 (37.1)	
Nko	20	70	25 (35.7)	
U/Baki	31	70	19 (27.1)	
U/Ture	15	70	11 (15.7)	
U/VIO	50	70	6 (8.6)	

Table 4: Showing Other Parasites Encountered in the Study Population.

Other Parasites	No. Examines	No. Positive	(%)
Ascaris lumbricoides	420	45	(10.1)
H.nana	420	3	(0.7)
Taenia species	420	10	(2.4)
S. mansoni	420	4	(1.0)
E.coli	420	8	(2.0)
E.histolytica	420	5	(1.2)
Total	**420**	**75**	**(17.9)**

Conclusion and Recommendations

From the study, it can be concluded that the prevalence of Hookworm infection therefore varied considerably among farmers from different villages in respect to their sanitary condition, exposure or engagement in backyard farming and toilet facilities available. This investigation revealed that Hookworm infection is higher among farmers in Sabongari than other villages in Ghakyob District. Also, more prevalence was recorded among female than male farmers. Therefore, since the prevalence of Hookworm infection is associated with especially the practice of defaecation on farm land, backyard and bush. Hence, these should be prohibited.

There is need to improve sanitation and hygienic condition of the people. Pipe-borne water should be made available to the populace. There should also be improved sewage disposal system, good toilet facilities and untreated human faeces or dungs should not be used as agricultural fertilizers on farm unless decomposed to destroy the ova of Hookworm by heat generated or ammonium sulphate should be added to the fresh faeces to a strength of twelve percent (12%) to destroy the Hookworm embryo within 24hours (Davey. 1972).

Mass treatment of the infected farmers is also recommended especially in the villages. Awareness campaign programmes on the risk of walking or farming barefooted should be created and there should be more effective environmental sanitation programmes. Generally, there should be a better toilet facilities and improved hygienic condition of the people which will in turn improved the living standard of the people and the Nigerian economy in general.

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