INCIDENCE OF HOOKWORM INFECTION AMONG FARMERS IN SELECTED LOCAL GOVERNMENT AREAS OF KADUNA STATE, NIGERIA

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ABSTRACT

The focus of this study was to determine the prevalence of hookworm infection among farmers in three selected Local Government Areas (LGAs) of Kaduna State, Nigeria, namely: Jema'a, Chikun and Zaria, representing the 3 senatorial zones of the State. A cross sectional, descriptive study was carried out between November 2014 and October 2015. One thousand two hundred (1,200) stool samples were collected from eligible peasant farmers that were enrolled in the study. One LGA was selected from each of the three Senatorial Zones of Kaduna State by simple random sampling method. Stool samples were analysed for presence of hookworm ova using direct wet mount and formal-ether concentration technique and examined by microscopic technique. Out of the 1,200 stool samples examined, the overall incidence of hookworm infection was found to be 224/1200 (18.7%) with respect to Local Government Area, the infection rate was highest in Jema'a with 96/400 (24.0%) while the least was 59/400 (14.8%) in Zaria Local Government Area with a statistical significant difference (P = 0.002). The incidence of the infection in relation to gender shows 118/543 (21.7%) incidence rate in females and that of males to be 106/657(16.1%). Hence, females had higher rate than males with a significant statistical difference at P = 0.013. In conclusion, this study revealed the transmission of human hookworm among peasant farmers in Kaduna State to be at alarming rate. Thus, major prevention and control measures should be adopted to curve the spread of the infection. There is the 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, farmers, Kaduna State, Nigeria.

INTRODUCTION

Human hookworm infection is a soil-transmitted infection caused by *Necator americanus* and *Ancylostoma duodenale*. It is the leading cause of anaemia and protein malnutrition, afflicting an estimated 740 million people in the developing nations of the tropics (CDC, 2016). However, recently an estimated prevalence worldwide, hookworm infection has reduced to 440 million people with approximately 10% of them experiencing anaemia (CDC, 2017).

Hookworm infection is spread by faecal contamination of the soil. Infection occurs when infective third-stage filariform larvae (L_3) penetrate the hands, feet, arms or legs, especially when a person walks bare-footed (Paniker and Jayaram, 2007). Farmers are the most vulnerable group thatacquire this infection. Signs of advanced severe infection include anaemia and protein deficiency, including emaciation, cardiac failure and abdominal distension (Ayoya *et al.*, 2006; Drisdelle, 2006). The infection has been noted to be more common in families who are involved in agricultural pursuits (Damen *et al.*, 2007).

Hookworm infections are still endemic in low and middle income tropical countries with greater impact on the socioeconomic and public health of the bottom billion of the world's poorest people (Ngui *et al.*, 2012). This is an important health threat to adolescent girls, and women of reproductive age. Up to 1.5 million pregnant women are estimated to be infected with hookworm (USAID, 2012).

In pregnant women, anaemia resulting from hookworm disease results in several adverse outcomes for both the mother and her infant, including low birth weight, impaired milk production and increased risk of death for both the mother and child (De Silva *et al.*, 2003; Gyorkos *et al.*, 2006; WHO, 2017).

The resultant effect of hookworm infection includes severe anaemia leading to high morbidity and mortality and consequently

The resultant effect of hookworm infection includes severe anaemia leading to high morbidity and mortality and consequently causing low productivity and food insecurity (Hotez *et al.*, 2005).

The specific objectives of this study were to:

i. Determine the incidence of hookworm infection among peasant farmers using microscopic technique.

ii. Compare the incidence (rate) of hookworm infection in relation to Local Government Areas of study.

iii. Determine if socio-demographic factor is associated with hookworm infection in the study population.

MATERIALS AND METHODS

Study Area:

The study was carried out in three selected LGAs of Kaduna State, namely: Jema'a, Chikun and Zaria LGAs representing the three senatorial zones of the state. The state is located between latitude 90° and 140° north of the equator and longitude 70° and 100° east of the Greenwich meridian, it occupies a landmass of about 70,210 square kilometers on the map of Nigeria. The topography is that of an undulating plateau that forms part of the rich tourist attractions in areas like Kufena in Zaria, Kagoro, Kwoi, and Gwantu. According to the National Population Commission/NPC (2006) census figure, Kaduna state has a population of over 6 million people. Kaduna State has 23 Local Government Areas and 3 Senatorial Zones (North, Central and Southern) Senatorial Zones.

The main occupations of majority of the people in the study area is peasantry farming, petty trading, mining and few white-collar jobs. The state has two distinct seasons (dry and wet or raining seasons). The former takes place from November to March while the latter occurs between April and October.

Study design:

A cross sectional, descriptive study was carried out between November 2014 and October 2015. One thousand two hundred (1200) eligible peasant farmers were enrolled in the study by simple random sampling method.

Study population:

The population studied comprised voluntary consented male and female farmers in Jema'a, Chikun and Zaria Local Government Areas representing Southern, Central and Northernsenetorial zones of the state respectively, where farming activities are very high involving the vulnerable groups (women and children between ages 10 and 15 years).Ethical clearance was obtained from Kaduna State Ministry of Health. A feasibility study of the selected LGAs was carried out with the co-operation of the district heads during which sensitization lecture was given to the people in all the study areas.

Sample Collection and Analysis

Sample Size:

Using a previous12.7% prevalence of Hookworm infections in Central Nigeria by Anosike*et al.* (2005), the sample size was calculated using the formula of Israel (1992):

$$n = \frac{Z^2 pq}{d^2}$$

Whereas,   Z =Standard normal distribution at 95% confidence level,
With confidence interval of 1.96
p= prevalence of infection from previous study, 12.7% = 0.127
q= 1-p, (1-0.127) =0.873
d = Absolute desired precision of 5% =0.05
Therefore,   n = [(1.96)² x 0.127x0.873] /(0.05)²
n= 170.3688and approximated to 400 samples

The calculated sample size was 170.3688 butwas approximated to four hundred (400) stool samples. These were collected from each senatorial zone of the state which totals to one thousand two hundred (1,200) stool samples.

SAMPLE ANALYSIS

Microscopy

A total of 1,200 stool samples were collected, comprising 400 samples from each Local Government Area of the three senatorial zones of the state. Specimens were collected using a clean, leak-proved, transparent, screw-capped, labeled containers and then packed in an insulated iceboxes before being transported to the Department of Microbiology Laboratory of the Ahmadu Bello University.

Microscopy was carried out using Direct Wet Mount and Formal-Ether Concentration Techniques. Using an applicator stick, a pea-size of the mixed stool was taken into 10ml of normal saline (physiological saline), it was emulsified and sieved through gauze using glass funnel into a pointed end glass centrifuge tube then washed twice by centrifuging at 3000rpm for 5 minutes, the supernatant was discarded and the deposit resuspended and transferred into a screw-cap centrifuge tube then 7ml of 10% formal saline was added then followed by 3ml of ether, it was covered and was shaken vigorously for 20 seconds, then centrifuged at 3000 rpm for 3 minutes.

After centrifuging, the parasite's ova were separated to the bottom of the tube and the faecal – debris was collected in a layer between the ether and formal saline. Using the applicator stick , other 3 layers were removed leaving only the sediment at the bottom of the tube which were resuspended and a drop of it placed at the centre of a clean grease free slide and covered with cover slip carefully avoiding air bubbles. It was then examined systematically under x10 and x40 objectives respectively (Cheesbrough, 2010). The results were recorded as Scanty 1-3 (+) per preparation, few 4-10 (++), Moderate 11-20 (+++) and Heavy 21-40 (++++) (Cheesbrough, 2015).

Data Analysis

The results obtained were analyzed using Statistical Package for Social Science (SPSS) Version 22. Pearson chi-square test was used to measure the association between variables. Statistical significance was indicated by a two-tailed test at 95% confidence intervals and $P \leq 0.05$ was considered significant.

RESULTS AND DISCUSSIONS

Out of the total 1,200 stool samples examined, the overall infection was 224/1200(18.7%) among the peasant farmers (Figure 1).In report from Nigeria by Bala,(2010) who worked on relative prevalence of human hookworm species, *N. americanus* and *A. duodenale* in Jos-North Local Government Area of Plateau State using coprocultural technique of which he observed 71.5% of *Necatoramericanus*, 4.2% of *Ancylostomaduodenale* and 24.3% mixed infection of both species with an overall prevalence of 5.1%. This was lower than the one obtained in this study and the reason could be the differences in the study groups and study areas. However, Williams *et al.* (2014) in his retrospective study in Kumasi, Ghana had a prevalence rate of hookworm of 0.3% as overall which is lower than the one obtained in this study. Verlee*et al.* (2003) in his study of prevalence of intestinal parasites in Northern Vietnam of which he surveyed six ethnic groups Muong, Kinh, Dao, Thai, Tay and Hmong obtained an overall prevalence of hookworm infection 52% which is higher than the one obtained in this study. The differences may be due to genetic mutation, the climatic condition, type of soil, the tradition as well as the agricultural, cultural practices of the people and their environmental sanitary attributes.

With respect to Local Government Area (LGA), prevalence of hookworm infection was highest in Jema'a 24.0%(96/400) while the least was 14.8%(59/400) in Zaria Local Government Area with a statistical significant difference of $P = 0.002$ (Table 1). There was a significant difference in prevalence of hookworm infection among peasant farmers in the different LGAs studied. This could be as a result of their differences in risk factors associated with hookworm infection.It was also noted from the questionnaire that most of the farmers in Zaria LGA have the privileged of using pipe borne treated water and bore holes as their source of drinking water, while most of the farmers in Jema'a and Chikun use water mostly from rivers/streams and wells which are more liable to all kinds of pollution including faecal contamination. This could be the reason for the differences in prevalence rate.

The incidence of hookworm infection in relation to gender was considered in this study and out of the 543 females studied, 118/5432 (1.7%)infection rate was obtained while out of the 657 males 106/657 (16.1%) only were infected. Hence, females had higher incidence than males with a significant

statistical difference P = 0.013 (Table 2). This agrees with Williams *et al.* (2014) who observed a prevalence of hookworm infection in a retrospective study in Kumasi, Ghana to be higher in female (62.7%) than male (37.3%) though the percentage prevalence rate obtained in their report was lower. However, Akinbo*et al.,* (2011) in theirreport had more episodes of hookworm infection among male patients (18.3%) than their female counter part (13.7%).

It is obvious that Culture, tradition and social bias in behaviour as well as occupation have been established as risk factors influencing hookworm infection among different sexes. Another contributing factor is the engagement of the females in other domestic works such as washing of clothes and napkins infected or contaminated with faeces as well as cleaning of the house and its environs.

CONCLUSION

From the results of this investigation, it can be concluded that in Kaduna state the incidence of hookworm infection among the subjects has been found to be 224/1200(18.7%); and that Jema'a LGA had the highest incidence rate of24.0%(96/400). Lastly, the study revealed that females (22.2%) were more infected than their males counter parts (16.1%). This indicates a potential risk of severe anaemia among individuals particularly the vulnerable groups such as pregnant women and children of school age who participate actively in farming. Therefore, the effect of hookworm to their health would in turn affect farm yield and general productivity of the country as well as increase in mortality rate and economic effect of the nation.
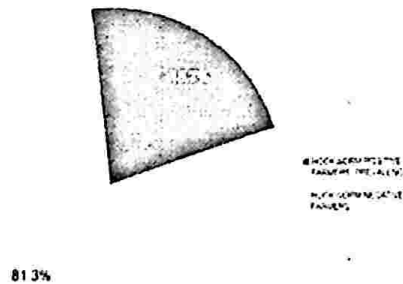

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Figure 1: Incidence of Hookworm Infection in Kaduna State, Nigeria.

Table 1: Incidenceof Hookworm Infection in Relation to Local Government Area:

Local Govt Area	Number of Samples Examined	Number Positive (%)	p-value
Jema'a	400	96 (24.0)	
Chikun	400	69 (17.3)	0.002
Zaria	400	59 (14.8)	
Total	**1, 200**	**224 (18.7)**	

Table 2:Incidenceof Hookworm Infection In Relation to Gender

Gender	Number of Samples Examined	Number Positive (%)	p-value
Female	543	118 (21.7)	0.013
Male	657	106 (16.1)	

RECOMMENDATIONS

1. In view of the high incidence rate of hookworm infection among peasant farmers in Kaduna state, there is need for awareness campaign programme in respect to risk factors associated to hookworm infection and contineous monitoring of hookworm distribution in Nigeria to provide information essential for prevention, control and treatment programme.

2. Mass treatment of infected farmers and the general public is highly recommended, especially in the rural areas where peasant farming is being practiced. Also the use of untreated human excreta, animal dung or raw sewage as fertilizer on farms should be discouraged.

3. The Government of Kaduna State should enforced the law on environmental sanitation and ensure proper disposal of sewage and faecal matter in both rural and urban areas of the state.

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