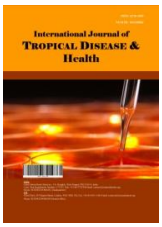

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Parasitic Infections among Independent Refuse Disposal Workers in Port Harcourt, Rivers State, Nigeria

Eze Chinwe Nwadiuto[1*] and Mbah Kelechi Sam[1]

[1]Department of Animal and Environmental Biology, University of Port Harcourt, P. M. B. 5323, Choba, Rivers State, Nigeria.

Authors' contributions

This work was carried out in collaboration between both authors. Author ECN designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author MKS managed the analyses of the study and managed the literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

Background: A study was carried out to ascertain the prevalence of parasitic infections among independent refuse disposal workers in Port Harcourt, Rivers State, Nigeria, and to ascertain the risk factors that enhance their vulnerability to parasitic infections.
Aims: The study was undertaken to determine parasitic infections among independent refuse disposal workers in Port Harcourt, Nigeria.
Methods: Urine, stool and blood specimens were collected from 210 male refuse disposal workers. Standard parasitological procedures were employed in sample collection and examinations for the presence of various parasitic organisms.
Results: Results showed 86.2% of the subjects were infected with *Plasmodium sp,* 94.3% were infected with one or more of 9 parasitic species, of which hookworm had the highest prevalence *(*91.4%). Others included are *Ascaris lumbricoides, Trichuris trichiura, Taenia sp, Strongyloides stercoralis, Enterobius vermicularis, Schistosoma mansoni*, *Entamoeba hystolytica, Girdia lamblia.*

**Corresponding author: Email: chinwe.eze@uniport.edu.ng;*

Schistosoma haematobium was not recovered from the urine specimens. Age group 26-29 years had the highest malaria prevalence of 89.1%, followed by age group 18-21 years (88.4%) while parasitic infection rate was highest among the age group 18-21(97.6%). Refuse disposal workers who reside in Rumuokoro camp had the highest malaria and intestinal parasites followed by Eneka. Poly-parasitism with *A. lumbricoides* and hookworm recorded the highest prevalence of 58 (27.8%) and fifteen subjects had triple poly-parasitism, with *A. lumbricoides*, hookworm and *T. trichiura.* Only 49 of the 210 respondents used one or more of the various personal protective equipment, while 161 used none at all.

Conclusion: Intestinal parasitic infection is highly prevalent among the independent refuse disposal workers in Port Harcourt. Inadequate use of personal protective equipment, poor personal hygiene and deplorable living conditions were identified as the major risk factors that enhanced transmission. It is therefore, imperative that the government enforces the use of personal protective equipment, implementation of preventive chemotherapy with health education to reduce morbidity and control transmission among the workers.

Keywords: Independent; refuse disposal; parasitic infections; risk factors.

1. INTRODUCTION

Wastes generated from man's activity is a huge environmental predicament resulting in wide spread pollution that threatens human health [1]. Solid wastes are unpleasant aesthetically, generate obnoxious odours particularly when the bacteria responsible for putrefaction begin to act on the organic content [2]. These un-disposed waste dumps serve as breeding grounds for vectors like mosquitoes, cockroaches and rodents that transmit diseases such as malaria, diarrhoea, and Lassa fever which are of public health concern [3].The consequences of inappropriately managed refuse on health are abundant and depend on the type of waste, persons exposed, length of exposure and accessibility of interventions to the individuals exposed [2]. Exposure may occur depending on the type of protective equipment, awareness of risk, principles and practices of waste sorting and tools which such workers have [2]. Few studies have revealed the existence of occupational health and safety hazards among refuse collectors; contact with high concentrations of organic aerosols [4], cardio-vascular and gastrointestinal challenges [5], contagious diseases like hepatitis A, B, and C, HIV, and syphilis [6]. Wachukwu, and Elanya [7], reported heightened liver enzymes, leucocytopenia, and occupational dermatologic diseases amongst solid waste disposal workers in Port Harcourt. The dearth on baseline epidemiological studies on independent refuse disposal workers can affect adequate evaluation on refuse workers, management and parasitic control programs. Therefore, the study was undertaken to determine the prevalence of parasitic infections and associated risk factors among independent refuse disposal workers in Port Harcourt.

2. MATERIALS AND METHODS

2.1 Study Area and Population

The area covered during this study is part of Port Harcourt, Obio-Akpor city, Rivers State Nigeria. It is a major hub of economic activities in Nigeria, harbouring people of different walks of life including those that are low, medium and high-income earners. In Obio-Akpor City, there is an independent refuse disposal work force, unskilled and with little or no education, who utilized low-scale inexpensive techniques and equipment, chiefly the carts, spokes, jute bags and headlamps for illumination at night. Majority of them have no protective wares like coveralls, safety boots, hand gloves and nose masks. They collect refuse from house to house (with minimal charges) which they load full in the carts and push them to designated temporary dumpsites (usually by the roadside). Whereas, the government waste management contractors usually come with their trucks and crew to cart away the heaps of refuse to permanent dumpsites and landfills. The refuse handlers also sorts and select materials from the municipal wastes such as cans, bottles, disposed household wares which they sell for recycling. They live in various bush encampments/ settlements from where they go for refuse collection and scavenging as early as 7am each day. The present study was conducted at the selected camps/settlements located in Eleme, Eliozu, Eneka, Rukpoku and Rumuokoro all in Obio-Akpor city and each camp/settlement houses between 30-50 young men.

2.2 Sample Collection and Examination

A total of 210 participants who voluntarily participated were recruited from five settlements where independent refuse disposal workers camp in Rivers State, (Eleme = 44, Eliozu = 22, Eneka = 39, Rukpoku = 54 and Rumuokoro = 51). Each of the participants was given two specimen bottles for stool and urine samples, while blood was collected intravenously and preserved in EDTA bottles, before laboratory examinations. Both thick and thin blood smears were made on the same slide, dried and stained with Giemsa and examined for common blood parasites. Parasitological diagnosis of schistosomiasis was based on examination of the urine for the ova of *S. haematobium* using centrifugation technique [8]. For stool specimen collection, each worker was given a numbered specimen bottle and a sheet of newspaper. The procedure for introducing stool into the bottle was thoroughly explained. The formol- ether concentration method [8] was closely followed for laboratory examination of stool specimens. Other information such as age, number of years and experiences in the job, knowledge and behavioral attitudes were gathered from structured questionnaires administered to the participants.

2.3 Data Analysis

All the data on urine, stool and blood specimens were stratified according to age and various encampments. Data were analyzed using standard statistical tests and comparisons were made using Chi-square test of significance. Values were considered statistically significant at $p<0.05$.

3. RESULTS

This study investigated the prevalence of parasitic infections among refuse disposal workers in Port Harcourt. Blood, urine and stool samples were collected from 210 male refuse disposal workers in five locations in Port Harcourt for parasitological analysis. A total of ten (10) parasites were encountered. These parasites include helminthes (*A. lumbricoides*, Hookworm *sp., Trichuris trichiura, Taenia sp, Strongyloides stercoralis, Enterobius vermicularis, and Schistosoma mansoni*) and protozoa *(Plasmodium sp., Entamoeba hystolytica and Girdia lamblia). Schistosoma haematobium* was not recovered in the urine samples. The occurrence of these parasites varied significantly ($P < 0.05$). Hookworm had the highest occurrence (91.4%), followed by *Plasmodium sp* (86.2%), *A. lumbricoides* (62.4%) and the least *E. vermicularis* (0.9%). (Table 1). Age group 26-29 years had the highest malaria prevalence of 89.1%, followed by age group 18-21 years (88.4%), 22-25 years (85.5%), 30-33 years (83.9%) and age group ≥34 had the least (78.9%). Out of the 210 subjects, 198(94.3%) were infected with one or more of the intestinal parasites. Age distribution of the prevalence of the intestinal infections did not show a definite pattern, but the infection rate was highest among the age group 18-21(97.6%), followed by age group ≥34 (94.7%), 26-29 years (94.4%), 22-25 years (93.4%) and least among them was age group 30-33(90.3%).The observed difference in prevalence by age was not statistically significant ($P>0.05$). (Table 2). Refuse disposal workers who reside in Rumuokoro camp had the highest malaria and intestinal parasites followed by Eneka .There was also no significant association between infection of intestinal parasites and the location of the refuse disposal workers ($p> 0.05$), Table 2. *A. lumbricoides*, Hookworm and *T. trichiura* were the most encountered parasites among the population. Hookworm infection was the most prevalent parasite amongst the population (91.4%) while *E. vermicularis* showed the least prevalence 2(0.9%). Comparing the distribution of parasites within the age groupings, hookworm infection was most encountered among all the age groups while *S.mansoni*, *Strongyloides stercoralis* and *Schistosoma mansoni* were not encountered among subjects aged 30 years and above. However, subjects within the age 18-21 years had the highest prevalence of hookworm; 93.0%, *A. lumbricoides*; 88.4% and *Trichuris trichiura;* 6(13.9%). *Schistosoma mansoni* and *Taenia sp* were not encountered in age group ≥34 (Table 3). *A. lumbricoides,* Hookworm and *T. trichiura* were encountered in all the locations while *S. mansoni* was not present in Eliozu and Eneka. A total of 91 subjects were infected with more than one intestinal parasite. Poly-parasitism with *A. lumbricoides* and Hookworm recorded the highest prevalence of 58(27.8%), while that with *A. lumbricoides* and Taenia recorded the least prevalence 1(0.5%). Fifteen subjects had triple poly-parasitism, with *A. lumbricoides*, hookworm and *T. truchiura* occurring most. Polyparasitism with four intestinal parasites (*Asc aris*+hookworm+*taenia*+*trichiura)* occurred only in Rukpoku, while that with *Ascaris*+hookworm+ *trichiura* + *G. lamblia* occurred in only Eneka. However, the highest overall prevalence of intestinal by poly-parasitism was recorded in

Eleme 23(52.2%), while the least (39.2%) was recorded in Rumuokoro. Information regarding the educational level/attainment of the refuse disposal workers as gathered from the questionnaire showed that all the respondents that had no formal education at all, were infected, 146 (69.5%). Those that had only primary education also expressed a high prevalence of 50(23.8%), while those that had up to secondary education had the least infections 2(0.95%). Only 49 of the 210 respondents used one or more of the various personal protective equipment, while 161 used none at all. All the 210 respondents reported eating while at work while 11 out of the 210 respondents admitted to having ever taken worm expellers. However, subjects that rarely washed and as such had no specific time of washing their work cloth expressed the highest prevalence of 77.7%. Only 9 out of the 210 responded no, while the rest 201 had had different forms and degrees of injuries attributable to their job.

Table 1. Overall prevalence of parasitic infections among the refuse disposal workers in the study

Parasites	Total no. (%) infected (n =210)
Plasmodium sp	181 (86.2)
Ascaris lumbricoides	131(62.4)
Hookworm *sp*	192 (91.4)
Trichuris trichiura	16 (7.6)
Taenia sp	8 (3.8)
Strongyloides stercoralis	3(1.4)
Enterobius vermicularis	2(0.9)
Schistosoma mansoni	6(2.9)
Entamoeba hystolytica	19(9.0)
Girdia lamblia	13(6.2)

Table 2. Prevalence of *Plasmodium sp* and intestinal parasites in relation to age

Age groups	No. examined	No. Infected (%)			
		Plasmodium sp	**p-value**	**Intestinal parasites**	**p-value**
18-21	43	38(88.4)		42(97.6)	
22-25	62	53(85.5)		58(93.4)	
26-29	55	49(89.1)		52(94.4)	
30-33	31	26(83.9)		28(90.3)	
≥34	19	15(78.9)		18(94.7)	
Total	210	181(86.2)	0.674	198(94.3)	0.829
Locations					
Eleme	44	37(84.1)		41(93.2)	
Eliozu	22	19(86.6)		20(90.0)	
Eneka	39	34(87.7)		37(94.8)	
Rukpoku	54	46(85.2)		51(94.4)	
Rumuokoro	51	45(88.2)		49(96.1)	
Total	210	181(86.2)	0.58	198(94.3)	0.83

Table 3. Distribution of the intestinal parasites among the age groups

			Species of parasites								
Age (Yrs)	**No. Examied**	**No. infected (%)**	**AL (%)**	**HW (%)**	**TT (%)**	***Taenia* (%)**	**SS (%)**	**EV (%)**	**SM (%)**	**EH (%)**	**GL (%)**
18-21	43	42(97.6)	38(88.4)	40(93.0)	6(13.9)	1(2.3)	1(2.3)	0(0)	1(2.3)	4(9.3)	5(11.6)
22-25	62	58(93.4)	40(64.4)	57(91.9)	3(4.8)	3(7.0)	2(3.2)	1(1.6)	3(4.8)	6(9.7)	3(4.8)
26-29	55	52(94.4)	29(52.7)	51(92.7)	4(7.2)	2(3.6)	0(0)	1(1.8)	2(3.6)	5(9.1)	3(5.5)
30-33	31	28(90.3)	16(51.6)	28(90.3)	2(6.5)	2(6.4)	0(0)	0(0)	0(0)	3(9.6)	1(3.2)
≥34	19	18(94.7)	8(42.1)	16(84.2)	1(5.3)	0(0)	0(0)	0(0)	0(0)	1(5.2)	1(5.2)
Total	210	198(94.3)	131(62.4)	192(91.4)	16(7.6)	8(3.8)	3(1.4)	2(0.9)	6(2.9)	19(9.)	13(6.2)

AL= Ascaris lumbricoides; HW=Hookworm sp; TT= Trichuris trichiura,Taenia = Taenia sp; SS= Strongyloides stercoralis; EV=Enterobius vermicularis; SM=Schistosoma mansoni, EH=Entamoeba hystolytica; GL=Girdia lamblia)

Table 4. Distribution of intestinal parasites among refuse disposal workers in Port Harcourt

Location	No. examined	No. Infected	AL (%)	HW (%)	TT (%)	Taenia (%)	SS (%)	EV (%)	SM (%)	EH (%)	GL (%)
Eleme	44	41(93.2)	29(65.9)	39(88.6)	3(6.8)	2(4.5)	1(2.3)	0(0)	3(6.8)	0(0)	4(9/0)
Eliozu	22	20(90.0)	14(63.6)	19(86.4)	2(9.1)	0(0)	0(0)	0(0)	0(0)	3(13.6)	2(9.0)
Eneka	39	37(94.8)	24(61.5)	36(92.3)	2(5.1)	1(2.6)	0(0)	0(0)	1(4.5)	5(12.8)	0(0)
Rukpoku	54	51(94.4)	34(62.9)	50(92.6)	5(9.8)	2(3.7)	1(1.8)	2(3.7)	2(3.7)	5(9.3)	5(9.3)
Rumu-Okoro	59	49(96.1)	30(58.8)	48(94.1)	4(7.8)	3(5.9)	1(1.9)	0(0)	0(0)	6(11.8)	3(5.9)
Total	210	198(94.3)	131(62.4)	192(91.4)	16(7.6)	8(3.8)	3(1.4)	2(0.9)	6(2.9)	19(9.0)	13(6.2)

AL= Ascaris lumbricoides; HW=Hookworm sp; TT= Trichuris trichiura,Taenia = Taenia sp; SS= Strongyloides stercoralis; EV=Enterobius vermicularis; SM=Schistosoma mansoni, EH=Entamoeba hystolytica; GL=Girdia lamblia

Table 5. Poly parasitism of intestinal parasites observed in the study locations

Poly-parasitsm	Eleme n=44 (%)	Eliozu n=22 (%)	Eneka n= 39 (%)	Rukpoku n=54 (%)	Rumokoro n=51 (%)	Total%
AL+HW	14(31.8)	6(50.0)	9(23.0)	16(29.6)	13(25.4)	58(27.6)
AL + TT	1(2.3)	0(0)	1(2.5)	1(1.8)	0(0)	3(1.4)
AL +GL	0(0)	0(0)	2(5.1)	0(0)	0(0)	2(0.9)
HW+TT	0(0)	1(4.5)	0(0)	0(0)	1(1.9)	2(0.9)
HW+GL	1(2.3)	1(4.5)	0(0)	0(0)	0(0)	2(0.9)
AL+EH	0(0)	0(0)	1(2.5)	0(0)	2(3.9)	3(1.4)
HW+EH	0(0)	0(0)	1(2.5)	0(0)	1(1.9)	2(0.9)
AL+Taenia	1(2.3)	0(0)	0(0)	0(0)	0(0)	1(0.5)
HW+Taenia	1(2.3)	0(0)	1(2.5)	0(0)	0(0)	2(1.4)
AL+HW+TT	2(14.3)	1(4.5)	1(2.5)	1(1.8)	1(1.9)	6(2.8)
AL+HW+*Taenia*	0(0)	0(0)	0(0)	1(1.8)	1(1.9)	2(0.9)
AL+HW+GL	1(2.3)	0(0)	0(0)	1(1.8)	1(0)	3(1.4)
AL+HW+EH	0(0)	0(0)	1(2.5)	0(0)	0(0)	1(0.5)
AL+HW+SS	1(2.3)	0(0)	0(0)	0(0)	0(0)	1(0.5)
AL+HW+EV	1(2.3)	0(0)	0(0)	1(1.8)	0(0)	2(0.9)
AL+HW+TT+GL	0(0)	0(0)	1(2.5)	0(0)	0(0)	1(0.5)
AL+HW+TT+*Taenia*	0(0)	0(0)	0(0)	1(1.8)	0(0)	1(0.5)
Total	23(52.2)	9(40.9)	17(43.6)	22(40.7)	20(39.2)	91(43.3)

Key= (AL= Ascaris lumbricoides; HW=Hookworm sp; TT= Trichuris trichiura, Taenia = Taenia sp; SS= Strongyloides stercoralis; EV=Enterobius vermicularis; SM=Schistosoma mansoni, EH=Entamoeba hystolytica; GL=Girdia lamblia)

Table 6. Risk factors that predispose refuse disposal workers to parasitic infections

Factors	No. of respondents	No. infected (%)	p-value
Educational Attainment			
Secondary	12	2(0.95)	
Primary	52	50(23.8)	
Illitrate	146	146(69.5)	0.004
Direct exposure to refuse (Use of PPE)			
Helmet	1	1(0.48)	
Safety boots	13	12(5.7)	
Coveralls	8	6(2.9)	
Hand gloves	18	14(6.7)	
Nose masks	4	3(1.4)	
All(complete PPE)	5	1(0.48)	
None at all	161	161(76.7)	0.003
PERSONAL HYGIENE			
(Washing of work-clothes)			
Daily	10	1(0.48)	
Once a week	36	34 (16.1)	0.0007
No specific time	164	163(77.6)	
Eating while at work			
Yes	210	198(94.3)	
No	0	0(0)	0.002
Washing of hands with soap before eating			
Yes	13	1(0.48)	
No	197	197(93.8)	0.002
Use of anthelminthic drugs			
Yes	11	2(0.9)	
No	199	196(93.3)	0.0007

4. DISCUSSION AND CONCLUSION

The descriptive cross-sectional study revealed a high prevalence of parasitic infections among refuse disposal workers. The presence of parasitic infections among independent refuse disposal workers in Port Harcourt supports earlier observations that parasitic infections constitute a major public health problem in the country and high endemicity of intestinal parasitic infections in Rivers State [9,10]. Ten different parasites were recovered among the

independent refuse disposal workers in Port Harcourt. These include; *Plasmodium falciparum, A.lumbricoides*, Hookworm *sp*., *Trichuris trichiura*, *Taenia sp, Strongyloides stercoralis, E. vermicularis, Schistosoma mansoni, Entamoeba hystolytica* and *Girdia lamblia.* The study showed that *Plasmodium falciparum* and intestinal parasites were the most widespread in the study area. The overall prevalence of *Plasmodium falciparum* recorded (86.2%) was high, this aligns with the results of [11]. Several studies have shown that refuse serves as excellent breeding grounds for mosquitoes [3,12]. Major factors that might have been responsible for this endemicity are time when they do their work and lack of protective coverings while working in the evenings which represent the peak time for mosquito bites. Furthermore, the deplorable residence of these refuses workers and non-use of mosquito-treated nets largely predispose them to mosquito bites. This study recorded a very high prevalence of 94.3 % of intestinal parasite infections among the refuse disposal workers in Port Harcourt. The prevalence in this study is however comparable to Eassa et al. [13] who, in his study, also reported a high prevalence of intestinal parasitic species among municipality solid-waste workers. The recovery of nine intestinal parasites in this study shows that the level of personal hygiene among the subjects was low. The high prevalence could be due to their behavioral pattern and their occupational imperatives and dispositions, as most of them were observed eating and drinking while at work, with unwashed hands and do not conform to the use of personal protective equipment. Refuse disposal workers have been identified as a group of people at a heightened risk of exposure to parasitic infections and the potential health consequences [14,15,2,13]. This result agrees with the work of Okoronkwo [14]. However, when compared with [16], who reported 21.7% prevalence in their study, it is worthy of note that, their study subjects worked with the government-owned (municipal) waste management company and as such might have had access to certain care and privileges like better wages, provision of PPE, health care services, periodical worker de-worming exercises, health and safety awareness programs etc. whereas, in this present study, the subjects never received any form of intervention at all and are largely ignorant of the outrageous health consequences and occupational risks involved in unwary refuse handling. Intestinal parasites among the various sampled locations did not vary significantly and this could be attributed to the fact that, the habits, practice, manner of life, state/condition of residence, and level of personal hygiene, socio economic status and method of refuse handling among the subjects in the different locations did not vary. Also independent refuse disposal workers are not limited to their places of residence; hence they randomly traverse different parts of the city while discharging their duties. The study revealed a significantly higher prevalence (97.0%) of intestinal parasites in subjects between 18-21 years old. However, there was no significant difference ($p>0.05$) in intestinal parasites infections and age, this suggested that parasitic infections were independent of age among the subjects. This agrees with Odu et al. [17], who reported that the prevalence of intestinal parasites is not age-dependent. This might be due to habits as well as poor or lack of environmental sanitation, especially where the subjects eat and drink while at work. Also, low body immune system especially as concerned refuse disposal workers might be responsible for high infection rate reported in this study. Hookworm was the most predominant (91.4%) and this could be attributed to the fact that these subjects do not wear appropriate foot wears and other body protective wares while at work; this is in line with Eze and Onoja [18]. Among all the intestinal parasites observed in this study, hookworm, *Ascaris lumbricoides* and *Trichuris trichiura* were observed in all the sampled locations. Awi-Waadu [9], described these three parasites as the most common intestinal parasites in the tropics pointing out that poor environmental sanitation and socioeconomic status are the key factors that promote the breeding and spread of these parasites. The pattern of infection with multiple helminthes in this study was similar to those reported earlier [18]. The majority of the refuse disposal workers examined in this study had two or more helminth parasites. The incidence of three or four helminth parasites observed in the study are a reflection of very poor personal hygiene and unhygienic practices among the subjects compounded by poor environmental sanitation, ignorance and illiteracy. The present study revealed that refuse disposal workers with no formal education had higher parasite prevalence compared to those that had formal education. It could be that those that had formal education were relatively more knowledgeable in terms of the risks in handling refuse than those without formal education. This agrees with the findings of Ahmed [19], who noted that waste collectors with higher education have a greater awareness of the potential

hazards and the health impacts with regard to methods of waste collection and handling, and that they had less accidents and injuries relating to sharp objects as compared to their counterparts with minimum or no education. The study also showed that domestic refuse collectors with higher education were more aware of the negative health implications of poor personal hygiene. Hence, they bathe after work; practice thorough hand washing whenever in contact with waste materials. These good and healthy habits undoubtedly gave them an edge over those with little or no education. All the study participants responded yes to the question about eating while at work. Many reasoned that they leave their camps very early in the morning and get back late at night, hence it was not out of place that they eat or drink water while at work. This factor, though seemingly unavoidable, contributed immensely to their being infected as studies have shown faecal-oral route as the major portal of entry of pathogens into their hosts [20]. It was also observed in this study that most of the study subjects handle refuse with bare hands, after which they eat with the same hands, yet unwashed. Some other studies acknowledged some other unwholesome attitudes among refuse collectors such as storing food among refuse, patronizing food vendors at the dumpsites, drinking bottled water picked from the wastes [21], just to mention but a few. There appears to be generally a very low level of utilization of personal protective equipment among the refuse disposal workers as the poor result recorded in this study is the same with those in several parts of the world including Jos Nigeria, where Okoronkwo [14], made a regrettable discovery that most of the refuse workers in his study had sold off their protective boots, coats, face-masks and hand-gloves in order to raise money for sustenance, as a result of poor wages. Consequently, they became grossly infected with pathogenic parasites.

CONSENT

Prior to the commencement of the study, advocacy visits were made to the heads of the five (5) settlements selected for the study where the independent refuse disposal workers reside in Port Harcourt. They were duly consulted and this was necessary to ensure maximum co-operation from the participants. Considering the strict socio-cultural observances peculiar to them, this preceded actual data collection. Oral consent was given by each participant(s) before commencing this study.

ETHICAL APPROVAL

Ethical approval was gotten from the ethical committee of the University of Port Harcourt, Choba before the commencement of this research.

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Jha MK, Sondhi OAK, Pansare M. Solid waste management – A case study. Indian Journal of Environmental Protection. 2003;23:1153–11260.
2. Abdhalah KZ, Tilahun NH, Blessing M. A review and framework for understanding the potential impact of poor solid waste management on health in developing countries. The Journal of the Belgian Public Health Association. 2016; 74:55.
3. Onyido AE, Okolo PO, Obiukwu MO, Amadi ES. A survey of vectors of public health diseases in un-disposed refuse dumps in Awka Town, Anambara state, South Eastern Nigeria. Research Journal of Parasitology. 2009;4:22-27.
4. Douwes J, Wouters I, Dubbeld H, Kristin VI, Steerenberg P, Doekes G. Upper airway inflammation assessed by nasal lavage in compost workers: A relation with bio-aerosol exposure. American Journal of Industrial Medicine. 2000;37:459-468.
5. Yang CY, Chang WT, Chuang HY, Tsai SS, Wu TN, Sung FCA. Adverse health effects among household waste collectors in Taiwan. Environmental Research. 2001;85:195-199.
6. Dounias G, Rachiotis G. Prevalence of hepatitis a virus infection among municipal solid-waste workers. International Journal of Clinical Practice. 2006;60:1432-1436.
7. Wachukwu CK, Eleanya EU. Health impact assessment of solid waste disposal workers in Port Harcourt, Nigeria. Journal of Applied Science. 2007;3562-3566.

8. Cheesbrough M. District laboratory practice in tropical countries. Cambridge University Press. 2006;2(1):1-440.
9. Awi-Waadu GDB. The prevalence of gastro-intestinal tract parasites in the inhabitants of bori military cantonment in Port Harcourt local government area of Rivers State, Nigeria. African Journal of Applied Zoology and Environmental Biology. 2008;7:50–60.
10. Odu NN, Okonko IO, Erhi O. Study of Neglected Tropical Diseases (NTDs): Gastro-intestinal helminthes among school children in Port Harcourt, Rivers State, Nigeria. 2011;3(9):6–16.
11. Eleanya EU, Wachukwu CK, Ollor OA, Amuh FU. Indices of cardiovascular diseases and malaria parasitemia amongst solid waste disposal workers in Port Harcourt Nigeria. British Journal of Medicine and Medical Research. 2015;12(6):1-13.
12. Ozumba NA, Nwosu EO. Some implications of undisposed wastes in enugu urban, Southwestern Nigeria: A preliminary epidemiological perspective study, Proceedings of the 27th annual conference of the Nigeria. Society for Parasitology. 2003;48-58.
13. Eassa SM, El-Wahab EW, Lotfi SE, El Masry SA, Shatat HZ, Kotkat AM. Risk factors associated with parasitic infection among municipality solid-waste workers in an Egyptian community. The Journal of Parasitology. 2016;102(2):214-221.
14. Okoronkwo OM. Intestinal parasites among waste-handlers in jos metropolitan area of Plateau State, Nigeria. Sahel Medical Journal. 2004; 7(1):13-17.
15. Afon A. A survey of operational characteristics, socioeconomic and health effects of scavenging activity in Lagos, Nigeria. 2012;30(7):664.
16. Ewis AA, Rahma MA, Mohamed ES, Hifnawy TM, Arafa AE. Occupational health related morbidities among street sweepers and waste collectors at beni-suef, Egypt. Egyptian Journal of Occupational Medicine. 2013;37(1):79.
17. Odu NN, Elechi VI, Okonko IO. Prevalence of intestinal helminths infection among primary school children in urban and semi-urban areas in Port Harcourt, Rivers State, Nigeria. World Rural Observations. 2013;5(1):52–61.
18. Eze Chinwe N, Onoja Helen. High intestinal parasitic diseases among Fulani pastoralists in Rivers State, South-South Nigeria. International Journal of Current Research. 2016;8(08):35507-35512.
19. Ahmed K. Investigation of occupational health and safety hazards among domestic waste collectors in bethlehem and Hebron Districts. 2004;1-79.
20. Arora DR, Arora BB. Medical Parasitology 4th Editon CBS Publisers. 2014;4:1-285.
21. Bica VC, Dillenburg AF, Tasca T. Laboratory diagnosis of human giardiasis: Comparison between spontaneous sedimentation in water and zinc sulfate centrifugal floatation. Revista do Hospital das Clínicas de Porto Alegre. 2011;1:3139–3145.

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