

Prevalence of vectors of public health importance in major dumpsites in Port Harcourt metropolis, Rivers state, Nigeria

ABSTRACT

Vectors are important factors in the transmission of many parasitic diseases. The determination of the prevalence of vectors of public health importance in major dumpsites in Port Harcourt metropolis was investigated. Eight major dumpsites within the metropolis were randomly selected and the study was conducted within August 2018 and June 2019. Record on age of the dumpsites were obtained from the regulating agency and composition of dumpsites was made by physical observation. The composition of the dumpsites ranged from plastic cans, decomposing food, metals, cartons, bottles, faecal matters to plant materials. Vectors were collected using Sweep nets, sticky traps, water traps and manual hand picking with gloves and forceps. Vectors of public health importance collected from the dumpsites included *Chrysomya megacephala* (Family: Calliphoridae), *Musca domestica* (Family: Muscidae), *Anopheles spp.* (Family: Culicidae) *Aedes spp* (Family: Culicidae), *Periplanata Americana* (Family: Culicidae) and *Blatta orientalis* (Family: Culicidae). Out of the 360 vectors collected, 12.5%, 49.4%, 5.3%, 18.9%, 10.5% and 3.1% were *C. megacephala*, *M. domestica*, *Anopheles spp*, *Aedes spp*, *P. americanus* and *B. orientalis* respectively. There was no statistically significant difference ($P > 0.05$) in the prevalence of vectors in relation to the dumpsites investigated. *M. domestica* was the most prevalent vector. High prevalence of vectors of public health importance was recorded in all the eight dumpsites investigated. Hence, there is a possibility of a potential high risk of transmission of gastrointestinal helminths and malaria among residence within the dumpsites, scavengers and sanitation workers of the waste management agency. Proper waste management strategy, regular fumigation exercise and health education for sanitation workers and scavengers will curb the breeding of vectors.

Key Words: Dumpsites, Vectors, Public Health, Port Harcourt Metropolis

INTRODUCTION

A vector is an organism which carries or transmits diseases. It is an organism (usually an arthropod) which transfers infective forms of a parasite from one host to another [1]. Vectors can also be defined as arthropods and other invertebrates which transmit infection by inoculation into or through the skin or mucous membrane by biting or by deposit of pathogens on food or on skin or other objects. Vector borne diseases are responsible for over 17% of all infectious diseases, accounting for over 700,000 deaths annually[2].

36 There are several vectors that transmit communicable diseases. For instance, mosquitoes and
37 ticks have been implicated in the transmission of malaria and lyme disease respectively.
38 Traditionally, vectors do not cause diseases themselves but are known to spread infections by
39 serving as a vehicle through which pathogens are transported from one host to another.
40 Vector-borne diseases have a debilitating effect on health and hamper economic growth,
41 hence, a person with repeated bouts of malaria will definitely need healthcare and lose
42 productive days at work. Malaria alone, is responsible for over 400,000 death every year
43 globally and affects mostly children under the ages of 5years[2]. Diseases like
44 onchocerciasis (river blindness) also have a devastating health impact on health and if an
45 infected person is left untreated, it could result to blind, rendering the person useless to
46 production in relation to economic worth. Additionally, other vectors like rats destroy food
47 and household materials, causing enormous economic loses.

48 The relevance of vectors in the transmission of some of these diseases cannot be
49 overemphasised. Most of these vectors breed in areas laden with human and animal
50 excrement, waste water ditches, tin cans, car tyres and organic domestic waste such as
51 vegetable matter found in urban areas [3]. These waste materials and more are mostly found
52 in dumpsites [4]. Wastes generated from industrial, commercial and domestic sources are
53 collectively gathered and dumped in specific locations generally referred to as dumpsites.
54 The contents of dumpsites create favourable breeding ground for vectors of diseases. This
55 increases the risk of spreading pathogens of infectious diseases to the public [5]. Record
56 shows that about 43.2 million tonnes of waste is generated in Nigeria annually [6]. These
57 wastes are generated in major cities like Lagos, Port Harcourt, aba etc.

58 Refuse generation in Port Harcourt comes from industrial, domestic, and commercial sources.
59 Refuse generation rate has been increasing steadily and will likely continue to do so in future
60 due to the rapid growth of population in Port Harcourt metropolis [7]. [5] reported that the

61 conventional waste management system is still being used in Port Harcourt metropolis by the
62 waste management authorities, instead of the Integrated Solid waste management system
63 (ISWMS), and that about 75% of the storage facilities in the city are sub-standard and
64 insanitary with no colour coded containers for different corresponding kinds of wastes.

65 This shows that the waste management system in Port Harcourt is inefficient and lags in
66 coordination. Although the activities of the agency (Rivers State Waste Management
67 Agency) saddled with the responsibility of waste management in Rivers state cannot be
68 completely undermined, its policy and effort in management of generated waste especially
69 within Port Harcourt metropolis has yielded no positive impact on both vector control and
70 aesthetics of the city. The dumpsites are mostly located around human residence, enhancing
71 possible availability of the three key components (a favorable environment, a susceptible
72 host and the disease causing organism) that ensure the thriving of infectious diseases[8].

73 In view of the above, it becomes scientifically relevance to conduct a research that will
74 investigate the prevalence and species of vectors of public health importance associated with
75 dumpsites in Port Harcourt metropolis.

76 **MATERIALS AND METHODS**

77 **Study Area:** This study was conducted in Port Harcourt metropolis, a fast growing city in
78 the Niger Delta region of Nigeria. The city lies along the Bonny River on latitude 4°49'27"N
79 longitude 7°2'1"E. It covers an area of about 369 km² with a temperature of about 22°C and
80 90% Humidity. Port Harcourt metropolis consists of Port Harcourt Local Government Area
81 and some parts of Obio-Akpor Local Government Area [9]. The city is characterised by
82 tropical wet climate with lengthy and heavy rain fall. Only the months of December and
83 January could truly be considered as dry season months. Its heaviest precipitation occurs in
84 the month of September with an average of 367 mm of rain while December is the driest

85 month of the year, with an average rainfall of 20 mm. This research was carried out within
86 August 2018 and February 2019. The population of the city is estimated to be 2,060,000
87 inhabitants [10]. However, the 2016 census gave a figure of 538, 558 (280.703 males and
88 257,855 females) and projection of 756,600 in 2016[11]. This research was carried out within
89 August 2018 and June 2019

90 **Sampling Sites**

91 There are several major dumpsites in Port Harcourt metropolis, however eight dumpsites
92 were randomly selected for this study. Data collected from Rivers State Waste Management
93 Agency (RIWAMA) and residence within dumpsites indicated that all the selected dumpsites
94 have been in use for the at least 3-5 years and are still functional. The dumpsites selected are
95 located at various areas within Port Harcourt metropolis (Table 1). These dumpsites included
96 the sites located at Timothy Nsirim Road, Mile 4, Obiri Ikwerre Airport Road Sorting
97 dumpsite site, Obiri Ikwerre Airport Road Major dump site, Alakahia Uniport East West
98 road, Aprikom Road, off Chinda Road, Ada George, Port Harcourt, Eagles cement road
99 Rumuolumini , Timothy lane, Olara community, Rumuola and opposite Naval Medical
100 Centre, Borikiri, Port Harcourt . These dumpsites were designated sites 1, 2,3, 4, 5, 6, 7 and 8
101 respectively.

102 **Collection of Vectors**

103 There was physical observation of the dumpsites for possible vector composition and other
104 material components, the methods of [12] was adopted for the collection of vectors. The
105 methods included the use of self-made sweep nets, sticky traps, water traps and hand picking,
106 wearing disposable gloves and picking with forceps. Vectors collected were preserved in
107 well labelled ventilated specimen bottles and transported to the research laboratory,
108 Department of biology, Ignatius Ajuru University, Rivers state for identification and

109 examination for presence of parasites. Samples that could not be examined were preserved in
110 well labelled specimen bottles containing 10% formalin.

111 **Statistical Analysis**

112 Data generated were analysed using simple percentages and SPSS version 23. One way
113 Analysis of Variance (ANOVA) was used to determine the significant difference between
114 variables at 0.05 significant level. The prevalence (VP) and relative abundance of vectors
115 (RVA) were determined using the formulae below:

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$$117 \text{ Vector prevalence (VP)} = \frac{\text{No. of specific vector}}{\text{Total number of vectors}} \times 100$$

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$$120 \text{ Relative abundance of vectors (RVA)} = \frac{\text{No. of specific species of vectors}}{\text{Total No. of vectors}} \times 100$$

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123 **RESULTS**

124 **Description of dumpsite:** The location, composition and age of the dumpsites are presented
125 in table 1. Plastic cans, polythene bags, decomposing food particles, chemical sludge, rusted
126 metals, biochemical waste, cartons, cloths, bottles, faecal matter, plants materials were
127 common materials seen in virtually all the dumpsites. Again, all the dumpsites are in high
128 density areas (Table 1).

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132 **Table 1: Composition and location of dumpsites**

Site No.	Location	GPS	Composition	Age range
1	Timothy Nsirim Road, Mile 4 PH	4°49' 12" N 6°58' 48" E	Food particles, hair, foil, plates, Polythene bags, orange peel,	Above 5years

			faeces, cans etc	
2	Obiri Ikwerre Airport Road Sorting dumpsite site	4° 54' 19" N 6° 57' 55" E	Plastic cans, decomposed food particles, vegetable, fabric materials, hair, peels, Nylon, metal cans, Plastic water bottles, faeces	About 3 years
3	Obiri Ikwerre Airport Road Major dump site	4° 54' 4" N 6° 57' 49" E	Plastic cans, decomposed food particles, vegetable peels, Nylon, metal cans, Plastic water bottles, faeces	About 3 years
4	Alakahia Uniport East West road	4° 53' 12" N 6° 55' 22" E	Papers, Polythene bags, food wastes, glass bottles, baskets, plastic bottles, faeces, etc	Above 5 years
5	Aprikom Road, off Chinda Road, Ada George, PH	4° 49' 14" N 6° 58' 15" E	Plastic, papers, Dirty water logs, nylon, fruit peels, faeces, decomposed food particles, etc	Above 5years
6	Eagles cement	4° 48' 21" N 6° 56' 37" E	Polythene bags, Plastic cans and bottles, foil plates, faeces, etc	About 3years
7	Timothy lane, Olara community, Rumuola	4° 50' 7" N 7° 0' 1" E	Nylon bags, banana peels, orange peels, paw paw peels, decomposed food, Faecesetc	Above 5years
8	Opp Naval Medical Centre, Borikiri, Port Harcourt	4° 45' 8" N 7° 2' 26" E	Faeces, polythene bag, garbage, decomposed food particles, plastic cans and bottles, etc	Above 3years

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138 **Vector abundance:** A total of 360 vectors of public health importance were collected from

139 the eight dumpsites investigated (Table 2). The vectors collected and identified included

140 *Chrysomya megacephala* (Family: calliphoridae), *Musca domestica* (Family: Muscidae),
141 *Anopheles spp* (Family: Culicidae), *Aedes* (Family: Culicidae), *Periplanata americanus*
142 (Family: Culicidae) and *Blatta orientalis* (Family: Blattidae) (Plate 1). Out of 360 vectors
143 collected, 12.5%, 49.4%, 5.3%, 18.9%, 10.5% and 3.1% were *Chrysomya megacephale*, *M.*
144 *domestica*, *Anopheles*, *Aedes*, *Periplanata americanus* and *Blatta orientalis* repectively
145 (Table 1). The results also showed that dumpsite 4 (Alakahia Uniport) had the highest
146 relative abundant number of vectors (20.6%), followed by dumpsite 1 (Timothy Nsirim road-
147 18.9%), dumpsites 8 (Opp. Naval Medical centre, Borokiri-13.3%), dumpsite 2 (Obiri Ikwere
148 airport road-13.1%), dumpsite 7(Timothy lane, Olara-11.1%), and dumpsite 5(Aprikom road-
149 10.8%) (Fig. 1). There was no statistically significant difference ($P > 0.05$) in the prevalence
150 of vectors in relation to the location of dumpsites investigated.



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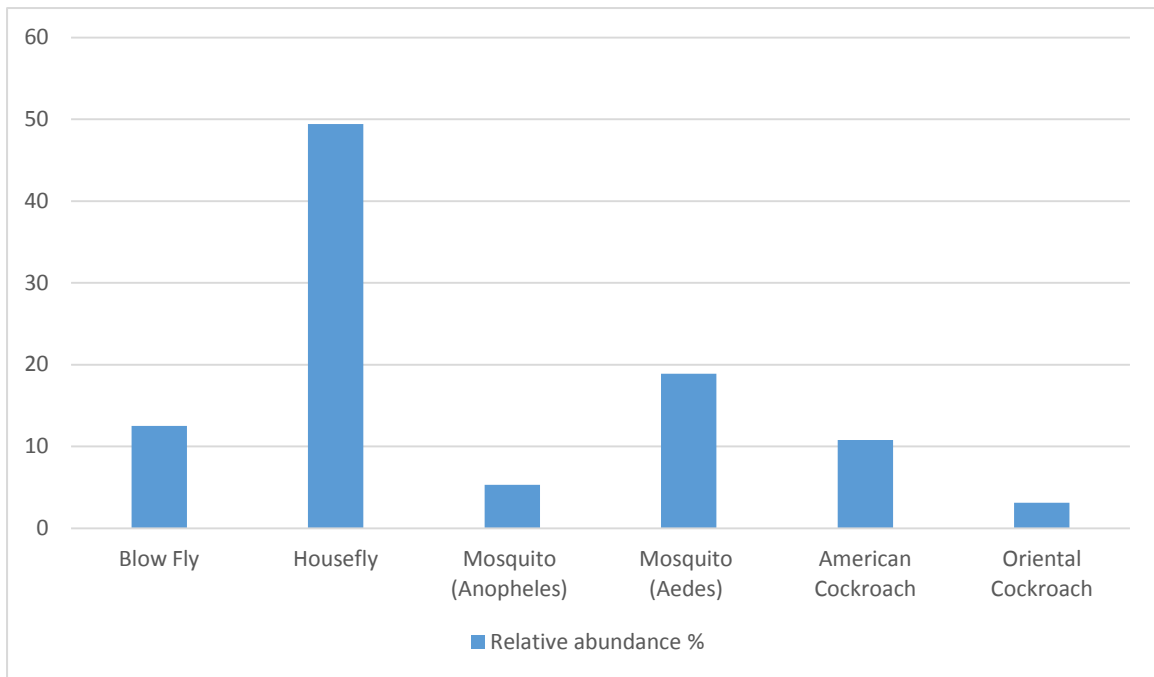
153 **Plate 1:** A: Housefly (Green arrow) and Blow fly (Black arrow) **B:** American cockroach
 154 **C:** Anopheles mosquito
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157 **Table 2. Abundance of vectors in dumpsites**

Vectors	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Total	%
Blow Fly (<i>Chrysomya megacephala</i>)	7	-	2	9	12	3	5	7	45	12.5%
Housefly (<i>Musca domestica</i>)	27	18	12	31	22	16	23	29	178	49.4%
Mosquito (<i>Anopheles</i>)	5	3	-	9	-	-	-	2	19	5.3%
Mosquito (<i>Aedes</i>)	16	17	6	11	5	-	6	7	68	18.9%
American Cockroach (<i>Periplaneta Americana</i>)	4	9	3	14	-	-	6	3	39	10.8%
Oriental Cockroach (<i>Blatta orientalis</i>)	9	-	2	-	-	-	-	-	11	3.1%
Total vectors collected	68	47	25	74	39	19	40	48	360	
Relative abundance of vector collected per dumpsite %	18.9 %	13.1 %	6.9 %	20.6 %	10.8 %	5.3 %	11.1 %	13.3 %		100%

158 **P > 0.05**



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Fig 1: Relative abundance of vectors.

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170 **DISCUSSION**

171 Vectors play very important role in the transmission of disease-causing microorganisms and
172 in the absence of these vectors, the transmission of several diseases could be easily managed.
173 The results of this study indicated that waste management strategies adopted by the Rivers
174 State Waste Management and Sanitation Authority is faulty and has resulted in the
175 indiscriminate breeding of disease vectors in non-evacuated refuse dumps and major
176 dumpsites across Port Harcourt metropolis. Refuse dumps are observably visible on the
177 median of virtually every major street in the metropolis.

178 All the dumpsites investigated had mixed composition ranging from household biodegradable
179 waste, polythene bags and other plastic material, hospital/biomedical wastes, automobile and
180 industrial waste to plant materials. This observation agreed with [13] that listed waste
181 composition of dumpsites in Nigeria include the above materials.

182 In our study, a total of 360 vectors belonging to six genera were collected and identified.
183 *Musca domestica* and *Chyssoma megacephala* occurred in all the eight dumpsites
184 investigated. The abundance of *M. domestica* in all the dumpsites could be attributed to the
185 fact that the insect is always linked with filthy places and decomposing substances [14].
186 Similar observation was recorded by [15] in Kaduna town, Northern Nigeria. *M. domestica*
187 (Family: Muscidae) was also the most prevalence vector in all the dumpsites and the insect
188 has been implicated in the transmission of helminthic infections [16], protozoa infections
189 such as *Gardia spp* [17, 18], *Crytosporidium spp* [19] including bacteria such as *Escherichia*
190 *spp*, *Salmonella Spp* and *Chlamydia spp* [20,21].

191 *Chrysomya* was also found in all the dumpsites visited. The prevalence of this vector could be
192 as a result of the capacity of oviposition on dead organisms, a sure sight at all the dumpsite
193 investigated [15]. Species of *Chrysomya* have been implicated in the transmission of myiasis.

194 *Anopheles spp* and *Aedes spp* were the two genera of mosquitoes encountered in the
195 dumpsites. Similar results were obtained by [12] and [15] in Onitsha metropolis and Kaduna
196 town respectively. The high prevalence of these mosquitoes in the area could be as a result of
197 the presence of cans containing water and stagnant water within the dumpsite.

198 Other arthropods of public health importance collected from the dumpsites included
199 *Perplanata americana* and *Blatta orientalis*. Similar result was obtained by [12] at dumpsites
200 in Onitsha. These species of cockroach have record of transmission of various disease-
201 causing organisms including protozoa, viruses, helminthes and bacteria [21].

202 Generally, the results our study lends credence to [22] which placed Nigeria among countries
203 without clear cut and workable frame work on sanitation, The report also pointed out that
204 sanitation in Nigeria is at the house level which is not comprehensive enough to address the
205 sanitation in Nigeria. Again, [23] recorded that although there is an increase in water supply
206 and sanitation in other African countries like Ethiopia and Congo Democratic Republic, a
207 substantial decline in water supply and sanitation from 32% in 1990 to 7% in 2015.

208 Considering the public health concern posed by refuse dumps especially when not evacuated
209 and/ or treated, it becomes necessary for the government at all levels to initiate policies that
210 will stimulate public awareness on the dangers of indiscriminate dumping of refuse and
211 separation of waste materials.

212 It is also appropriate for the government through its relevant agencies to establish dumpsites
213 with modern treatment facilities. Again, it is observably clear that the monthly sanitation

214 exercise is not enough to keep Port Harcourt hence the introduction and empowerment of
215 sanitation inspectors and health officers for regulation of the sanitary habit of Port Harcourt
216 residence will go a long way to curb indiscriminate dumping of refuse on the median of the
217 roads and other places not designated for refuse dump. Again, regular fumigation exercise of
218 dumpsites will reduce the breeding of vectors.

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