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Human Intestinal Parasites Associated with Non-biting Flies in Ile-Ife, Nigeria

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ABSTRACT

Non-biting flies are known to traverse contaminated sites, human habitations and, by extension, food during which enteric pathogens carried from filthy sites are disseminated. Humans, knowingly or unknowingly, ingest such pathogens with food, especially in cases of fresh foods. This study was conducted to elucidate the presence, prevalence and transmission rate of human enteric parasites from contaminated sites in Ile-Ife. Non-biting flies were caught with insect sweep nets from abattoirs, garbage piles, fresh food markets and public latrines between December 2014 and May 2015. Each fly, having been identified, was placed in vial half-filled with normal saline and rocked gently to dislodge the externally attached organism after which it was subsequently dissected to remove the gut content. These were examined under light microscope. 1083 flies were caught, out of which 124 were found with at least one human intestinal parasite. Abattoirs recorded the highest number of infected flies (14.34%). Nine human intestinal parasites were recorded. *Entamoeba coli* (32.33%) was most prevalent followed by *Ascaris lumbricoides* (15.79%). Garbage piles had the highest number of flies (324) while public latrines had the highest transmission rate, (19.76%). The difference between the number of parasites retrieved from the body surface and gut content was found statistically significant.

Key words: Bionetwork, Human, Intestine, Parasite, Non-Biting Flies.

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INTRODUCTION

Infectious diseases are product of the pathogen, vector, host and environment. Entry or ingestion of human intestinal parasites is always inadvertent and evidences suggest that acquisition of parasites is neither rare nor strictly fortuitous (Lafferty, 2006). Humans actively consume parasites' free living stages such as eggs, larvae, cyst and trophozoites (Thieltges, 2008). Parasites, often times, pre-munitively coexist and colonize human gastrointestinal tract. Relatively, small numbers of human intestinal parasites are capable of perturbing the orderly intestinal structures or functions (Michael and Farthing, 2003; Fox et al., 1998). Vector-borne human intestinal parasitic diseases are interspersed, many times, by the non-biting flies, which optimize disease and illness (WHO, 2014). This is due to flies ubiquity, overtly divergent and unmatched structures, reproduction, feeding habits and ecological diversity (Bruce, 1988). More still, flies have always inevitably travelled with no territorial boundaries from place to place in search of food or breeding substrates.

Consequently, they bridge the bionetwork of spread of human intestinal parasites in un-sanitized developing countries. This is because these flies frequently traverse faecal contaminated and filthy sites (Parrish and Ryan, 2014; Mahfouz et al., 1997). Although, other routes of transmission such as contaminated water, human

carriers and unhygienic food handling are possible links. Several studies across the globe, including those of (Sulaiman et al., 1988) showed that non-biting flies carry different stages of helminths and protozoan parasites. Eggs of *Ascaris lumbricoides*, *Trichuris trichiura* and hookworm have been isolated from *Chrysomya*, *Sarcophaga* and *Musca* species collected from refuse dump and similar sites. Cysts of *Entamoeba histolytica* and eggs of cestodes and nematodes have as well been found with filth flies (Kettle, 1990). Incidentally, Doiz et al. (2000) implicated houseflies as proficient vectors of eggs of *Enterobius vermicularis*, *Strongyloides stercoralis, Toxocara canis.* Carriage of cysts and trophozoites of *Entamoeba coli*, *Giardia* and *Trichomonas* spp were also recorded.

Houseflies caught on rubbish dumps in Ibadan, Nigeria, harbour same intestinal parasitic cysts and eggs in their alimentary canal as those found in the faeces of the community dwellers in the environment (Dipeolu, 1977). Non-biting-flies-borne infections affect public health mainly in the developing countries where control and prevention strategies are often times impaired by socio-economic constraints (Otranto et al., 2009; Rosennthal, 2009). In view of this, there is continuing worries about the enormous burden of human intestinal parasites in this part of the world. More so, the increasing deleterious effects this has on health and potential routes to human, especially in unsanitary environment like those surveyed in this study. The presence of these flies in the area served as a motivating force for this study.

MATERIALS AND METHODS

Field Work

Adult non-biting flies were caught with fine insect sweep net between the hours of 10:00 am and 12:00 noon from four major collection sites. These are Abattoirs, Fresh-food markets, Garbage piles and Public latrines in Ile-Ife. The collection of flies was carried out from December 2014 to May 2015. Flies caught were anaesthetized with ethyl acetate soaked cotton wool and transported to the department of Medical Microbiology and Parasitology, Obafemi Awolowo University, Ile-Ife, Nigeria for identification.

Identification of Non-Biting Flies

The caught flies were first sorted and identified into species (Mello, 2003). An illuminated Loupe (led light of a little magnifying lens) 20×/21 MM was used to view the arrangement of the eyes, antennae and body pattern. The flies were identified into various families and species based on of their gross morphological features (Service, 1980).

Isolation of Parasites from Non-Biting Flies

Each identified species of fly was then transferred with sterile forceps into labelled 10 ml vial half-filled with normal saline, capped and allowed to stand for 10 min. Each fly was then washed thoroughly by rocking (hand shaking) gently for 2 min to create a suspension whereby organisms attached externally to the bodies of the flies were dislodged. Thereafter, each fly was removed and preserved in 70% alcohol. The washes were then centrifuged at 2000 rpm for 5 min. The supernatant was decanted and the sediments placed on clean glass slide, covered with cover slip and examined microscopically under x10 x40 objective lenses to identify the probable human intestinal parasites harboured externally. Lugol's solution was added from the tip of the slide for possibility of helminth eggs. Photomicrographs of human parasites' eggs, larvae and cysts were taken using Amscope MT microscope camera version 3.0.0.1 fixed into light Microscope.

Dissection of Non-Biting Flies

The flies, having been removed from 70% alcohol and rinsed in distil water, were dissected under dissecting microscope (SWIFT 71M0044, Stereo Zoom) from the posterior end up to the second tergite with fine forceps. The gut content was then smeared on glass slide and examined under microscope for possible parasites eggs or cysts.

Staining Technique

The slides were later stained with modified Ziehl Nelson stain and re-examined for oocyst of *Cryptosporidium spp*. The stained slides were then examined for probable stages of human intestinal parasites (Hadi, 2011).

Data Analysis

The difference in number of parasites' developmental stages isolated from the external surface and the gut content from identified species were subjected to *t* test using IBM SPSS. 2013.

RESULT AND DISCUSSION

Species of non-biting flies caught were nine in number. These include *Fannia scalaris, Musca domestica, Calliphora stygia, Calliphora vicina, Lucilia illustris, Tricholioprocta hardyi, Sarcophaga haemorrhoidalis, Musca vetustissima* and *Hermetia illuscens*. The total number of flies caught was 1083. Garbage piles had the highest number of flies (324) while abattoirs (258), fresh food market (253) and public latrines (248) followed in

Table 1: Transmission rate of parasites among non-biting flies from collection sites.

Sampling	Non- biting flies examined	Number of positive flies	Human intestinal parasites retrieved	% of positive flies	Transmission rate in %
Abattoirs	258	37	23	14.34	8.91
Fresh food markets	253	21	25	8.3	9.88
Garbage piles	324	31	36	9.57	11.11
Public latrines	248	35	49	14.11	19.76
Total	1083	124	133	46.32	49.66

decreasing order (Table 1). One hundred and twenty-four (124) non-biting flies had human intestinal parasites isolated from either or both body surface and gut content. Thirty (30) non-biting flies had parasite in the gut content, while 16 non-biting flies had at least 2 human intestinal parasites identified from it. No human intestinal parasite was isolated from *C. vicina, M. vetustissima, H. illuscens.* Of the flies caught from abattoirs, 14.34% was found carrying one or more developmental stage(s) of human intestinal parasites with transmission rate of 8.91%. Of the non-biting flies caught from public latrines, 35 (14.11%) were carriers of human enteric parasites with 19.76% being potential contaminants of other surfaces. 21 (8.3%) of flies caught from fresh food markets carried human gastrointestinal parasites with transmission rate of 9.88%. Garbage piles had 31 (9.57%) of its non-biting flies contaminated while flies from such sites had tendency of transmission at 11.11%.

Public latrines seemed to be most contaminated sites since about 20 out of one hundred non-biting flies was found carrying human intestinal parasites (Table 1). Two species of human intestinal protozoan and seven human intestinal nematodes' eggs or larvae were retrieved from the body surface and gut of the caught flies. These are *Entamoeba coli*, *Entamoeba histolytica* and *Ascaris lumbricoides, Strogyloides stercoralis, Echinostoma sp, Fasciola hepatica, Taenia spp,* Hookworm, *Enterobius vermicularis,* respectively. Generally, it was observed that more parasites were isolated from the body surface than from the gut content. *Entamoeba coli* was readily available on or in all flies and accounted for 32.33% of the human intestinal parasites retrieved, followed by *A. lumbricoides* eggs which accounted for 15.79%. Both *E. histolytica* cysts and *S. stercoralis* larvae were 12.03% each while *E. vermicularis* and *F. hepatica* eggs were each 3.01% of the parasites isolated. *Taenia spp* and *Echinostoma sp* eggs were 9.02 and 6.77% (Figure 1 and Table 2). One hundred and thirty-three (133) different stages of human intestinal parasites were isolated, of which *E. coli* was recorded with the highest frequency. *E. vermicularis* had the least frequency of occurrence and was found from garbage piles and public latrines.

Highest number of parasite was isolated from non-biting flies caught from public latrines and this accounted for 37.12% of the total human intestinal parasites reported in this study. *A. lumbricoides* was next to *E. coli* in prevalence followed by *Taenia spp* in Public latrines. Abattoir had the least number (17.43%) of isolated human intestinal parasites with *S. stercoralis* being the most prevalent. *Taenia spp* is found predominant in garbage piles after *E. coli* and was 27.27% of the total parasites isolated. *A. lumbricoides* and *Echinostoma sp* were found at equal frequency in fresh food markets and was 18.18% each of the human intestinal parasites identified in this study. This site had the least variety of human intestinal parasites as opposed to the highest variety of non-biting flies caught from it (Table 2). It was observed that the number of parasites isolated from non-biting flies body surface were more than the number retrieved from the gut contents (Figure 2) and was found to be statistically significant ($t=0.014$, $df= 2, 17$ $p<0.05$).

The mean human intestinal parasites isolated from both flies' parts, body surface and gut content were 11.67 and 3.00, respectively. The difference between number of the non-biting flies collected and number of human intestinal parasites retrieved was found to be significant with paired sample *t* test ($t=0.00$, $df=15$, $P<0.01$) and positively correlated. *M. domestica* had the highest parasites retrieved from it followed by *F. scalaris.* This study revealed the presence of human intestinal parasites in non-biting flies in Ile-Ife. Consequently, it unveiled the passive involvement of other non-biting flies, apart from the generally conceived *M. domestica,* as indirect mechanical transmitter of human enteric parasites. It also demonstrated that non-biting flies are carriers of important and predominant pathogens of tropical diseases such as human amoebiasis, gastroenteritis and helminthiasis which abound in our locality in spite of the improving level of environmental and personal hygiene.

It is of note that parasites were isolated from some of the flies collected from all of the sites sampled. This is an indication of the fact that parasite-infested flies were wide spread almost throughout the area and such parasites are likely to be deposited on human foods as the flies forage the area of study. Similar situation was reported in Awka, Nigeria (Nwangwu et al., 2013). Hence, there is the possibility of people within these areas suffering from one or all of these parasitic infections. The relatively high abundance of these parasites among non-biting flies captured in the pit latrines showed that parasitic

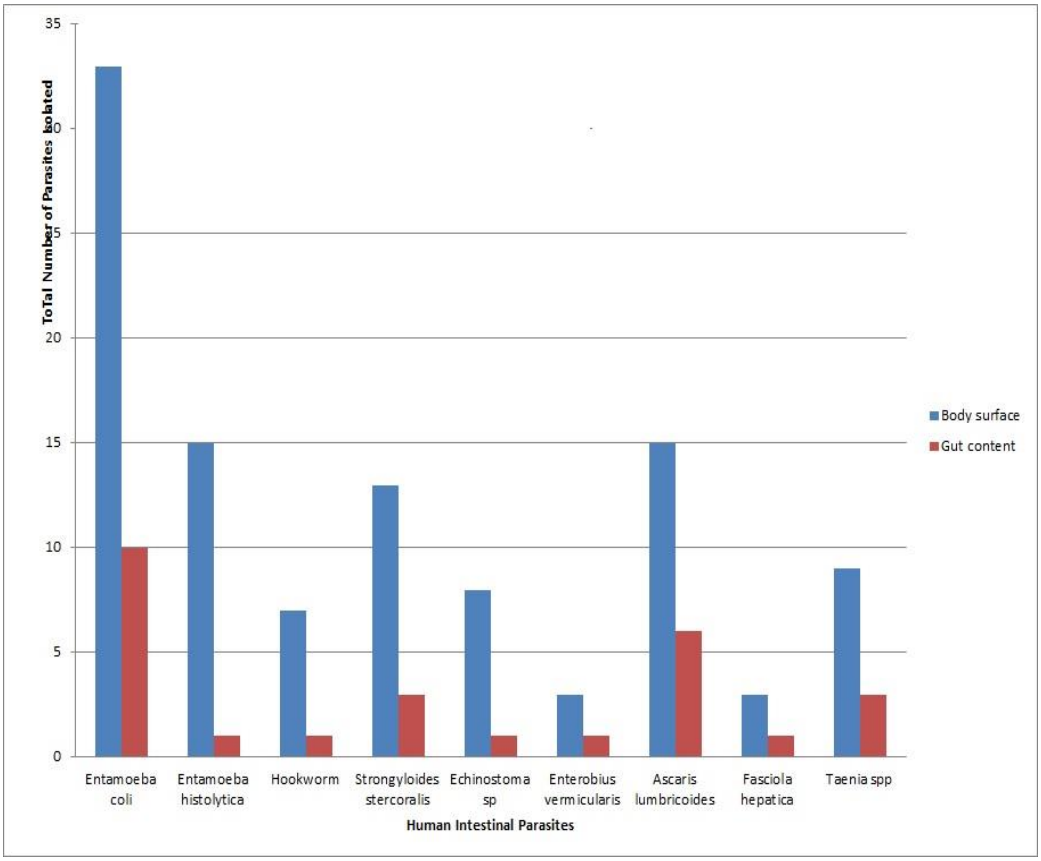


Figure 1. Parasites isolated from the body surface and gut contents of non-biting flies.

Table 2: Human intestinal parasites retrieved from non-biting flies at each collection sites.

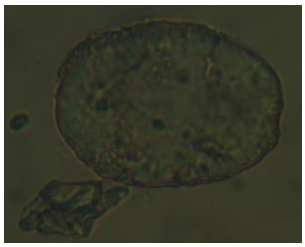
Parasites	Non-biting flies collection sites				
	Abattoirs	Fresh food market	Garbage piles	Public latrines	Total (%)
Entamoeba coli	6	9	10	18	23 (32.33)
E. histolytica	-	3	8	5	16 (12.03)
Hookworm	1	1	4	2	8 (6.01)
S. stercolaris	9	3	3	1	16 (12.03)
A.lumbricoidis	3	4	-	14	21 (15.79)
Hepatica	2	1	1	-	4 (3.01)
Taenia sp	2	-	6	4	12 (9.0)
E.vermicularis	-	-	2	2	4 (3.01)
Echinostoma sp	-	4	2	3	9 (6.77)
Total	23 (17.43%)	25 (18.18%)	36 (27.27%)	49 (37.12%)	133 (100)

organisms thrive more in environments contaminated with faeces from where subsequent transmission may occur to other parts of the area under study. Similar studies conducted in Ekpoma and Ibadan, Nigeria, showed that of all parasites retrieved from the body and gut of the houseflies, *E. histolytica* was among the parasites that were prevalent (Nmorsia et al., 2006; Adeyeba and Okpala, 2000) just as it was found from three sites out of four sites sampled in this study. This also agrees with the findings reported in China by Pai et al. (2003) as to the presence of *E. histolytica* in *M. domestica*.

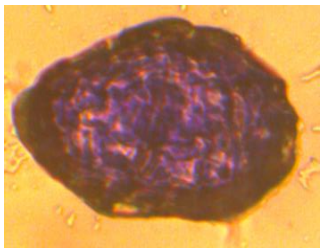
More hookworm eggs were found on the external surface of flies (Figure 1) as had been reported from the study of Sulaiman et al. (1989).

CONCLUSION

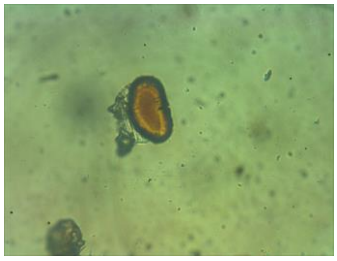
The presence and abundance of non-biting flies aids dissemination of disease pathogens especially when



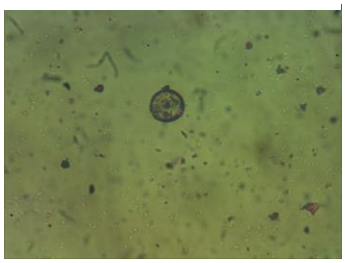
Fasciola hepatica (egg)



Ascaris lumbricoides (unfertilized egg)

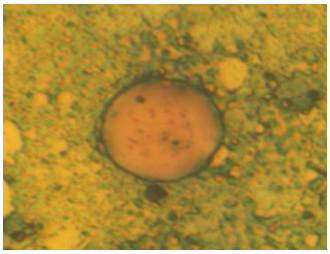


Enterobius vermicularis (egg)



Taenia spp (egg)

Strongyloides stercoralis (L_1 larva)



Entamoeba histolytica (cyst)

Figure 2. Some developmental stages of human intestinal parasites retrieved from non-biting flies in the study area.

found in and around human dwellings and places where food are being prepared. This is a pointer to imminent health and economic problems if the abundance is not quickly checked. The fact that most adult non-biting flies live an average of 2 to 4 weeks or longer in cooler weather, coupled with the capability of microorganisms' survival on and within them as long as they live, and ultimately, the constant indiscriminate visitations on human foods, contaminated sites and human habitation as well as livestock houses increase the menace of intestinal parasitic infection to human health.

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