HOUSEFLY-BORNE HELMINTH PARASITES OF MOUAU AND ITS PUBLIC HEALTH IMPLICATION FOR THE UNIVERSITY COMMUNITY

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ABSTRACT

The parasitic load on houseflies (Musca domestica) in Michael Okpara University of Agriculture Umudike was investigated, with the view to finding out the public health implications for the university community. A total of 544 houseflies were captured and examined for parasitic loads, using concentration/floating technique for detection of parasites. The highest fly abundance recorded was 302, captured from the farm centre, followed by 219 captured from the hostel; the lowest was 23 captured from the canteen. Parasite species found were all helminthes as represented by Ascaris lumbricoides, Necator americanus and Fasciola hepatica, all in ova form. Ascaris lumbricoides had the highest percentage prevalence of 54.54%, followed by Necator americanus 42.42%, and Fasciola hepatica 3.03%. A simple chi square test was carried out and the results indicated a significance difference in the prevalence of flies and parasites recovered from the sites. Based on this, it is therefore recommended that health education -on the dangers of being infected, mode of transmission of these parasites and prevention-should be intensified within the university to avert possible disease outbreak.

Keywords: Houseflies, Parasitic load, Public health, Helminths, Health education

INTRODUCTION

The housefly (*Musca domestica*) is a fly of the suborder Cyclorrhapha. It is the most common of all domestic flies, accounting for about 90% of all flies in human habitation all over the world (Nmorsi *et al*., 2006); and indeed one of the most widely distributed insects, found all over the world. It is considered a pest that can transmit serious diseases. According to Service (2004), about 170 genera and 4200 species in the family Muscidae are recognized, some of which are medically important including the housefly, *M. domestica.* It is a typical example of synanthropic animal, one that lives in association with humans (Subejo, 2010). It is considered one of the most important pests which cause health problems in the environment as it accompanies human during their daily activity everywhere, on work site or in rest places causing disturbances to them (Howard, 2011). Housefly imposes itself on human and all what is available, food and waste and is considered as very dangerous to public health and causes economic problems to farm animals (Service, 1980). House flies move around mostly during the day and like warm places and showing preference for direct sunshine. Their filthy habits, culminating in their indiscriminate movements between filth and food and defecation while feeding, make houseflies efficient transmitters of germs (Olsen, 1998). The role of house flies in the transmission of helminth eggs, that is, *Ascaris lumbricoides, Trichuris trichiura, Enterobius vermicularis, Toxocara canis* and *Strongyloides stercoralis*,

protozoan cysts and trophozoites such as *Entamoeba histolytica, Giardia* species, *Trichomonas* species, *Taenia* species, *Hymenolepsis* species, *Dipylidium* species, *Diphyllobothrium* species and bacteria such as *Shigella* species, *Escherichia coli* is well documented (Graczyk *et al.,* 1999; Mullen and Durden, 2002).

Besides contaminating food with eggs and maggots, flies can carry bacteria that cause intestinal diseases. Flies can travel from faecal materials to our food very easily, carrying bacteria with them on body hairs or the sticky pads on their feet. When feeding, flies expel saliva and faeces that may also contain bacteria. Sometimes flies lay eggs or maggots on the flesh or wounds of man and animals. Since housefly feed on contaminated substances such as human and animal excreta, sputum, excretion from wound, the flies can carry pathogens on their spongy mouthpart, body, and leg hairs, which is directly transmitted to the next visited surface e.g. human food (Manzon and Sanchoz, 1997).

The abundance of housefly causes important nuisance by disturbing people during work and at leisure. It has a negative psychological impact because their presence is considered a sign of unhygienic conditions. Houseflies spread diseases because they feed freely on human food and filthy matter alike. The fly picks up disease-causing organisms while crawling and feeding, they contaminate food material; water, kitchen utensil, animal feed etc, humans and animal are infected by eating contaminated food. These contaminated food materials cause bacterial diseases like typhoid, cholera, dysentery, and viral diseases like poliomyelitis, viral hepatitis.

Despite the abundance of house flies in Michael Okpara University of Agriculture Umudike-necessitated by the recent increase in number of students and staff,-no scientific information exists on the parasitic load on house flies within the University and the potentialities they hold in transmission of pathogenic organisms- capable of causing serious public health problems to entire University community.

MATERIALS AND METHODS

The study was conducted in Michael Okpara University of Agriculture, Umudike. Umudike is a community in Abia State, Nigeria and about 10 kilometers of Southeast of Umuahia the state capital. Umudike is located on latitude 5^0 28′ 33″N and longitude 7^0 32′ 66″ E. Monthly temperature ranges between 25 – 32 ^{0}C. Total annual rainfall ranges from 1700 to 2100 mm (Nwokocha *et al.,* 2006).

Housefly Collection: The houseflies were collected from the different synanthropic spots within the university. These sites include the female hostel, farm centre and canteen (Figure 1).

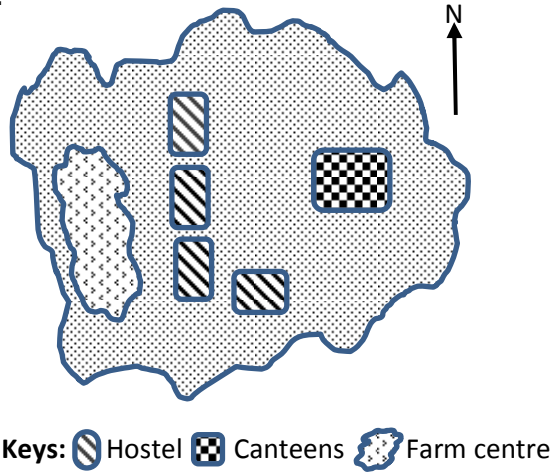

Figure 1: Houseflies collection sites in Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria

Houseflies were captured using trapping method, the traps were made with a cylindrical container and a cone shaped paper cover. Fresh meat and fish were put into the trap to serve as bait that attracted the flies that were captured afterwards. The collection process was done for five weeks (between October and November, 2015) and carried out between 9 am and 4 pm. The houseflies were collected at intervals of one hour for each of the traps, which were located around the hostels, farm center and canteen. The captured flies were taken to the laboratory of Zoology and Environmental Biology Department, Michael Okpara University of Agriculture, Umudike for analysis of helminth associated with house fly.

Preparation and Technique: Formaldehyde was poured on sample (houseflies) to prevent decay after capturing. Concentration/floating technique for detection of parasites and ova was used. The flies were washed with the formaldehyde so as to obtain the parasites on their exoskeleton (body), which was decanted afterwards. 1 ml of the decanted solution was put in a test tube and was filled with Willis Solution (common salt solution). A cover slip was placed on the bream of the test tube. The principle behind this technique is that, the Willis solution reduces the density of the parasites enabling them to float to the bream of the test tube, which is collected by a cover slip placed on a glass slide containing iodine and was viewed under the microscope using the oil immersion of the microscope. Identifications were made using color atlas of parasitology by Sullivan (2009). A simple chi square test was used to test if there was a significant difference in the prevalence of the parasites species on the houseflies, based on locations.

RESULTS

The results gleaned from the research incriminate *Musca domestica* as the carrier of some of the pathogens within the university. A total number of 544 flies were captured and the highest number of flies was recorded from the farm centre (n = 302). This is followed by the numbers recorded from the hostel and canteen (n = 219, and 23 respectively) as listed in Table 1.

Table 1: Overall percentage abundance of houseflies per sampling sites in Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria (n=544)

Site	Number of flies trapped	Percentage abundance per site
Farm center	302	55.51
Hostel	219	40.26
Canteen	23	4.23
Total	544	100%

A total of 3 species of parasites were obtained on examination of the flies to establish their parasitic load; *Ascaris lumbricoides,* hookworm *(Necator americanus)*, and *Fasciola hepatica* these are listed in Table 2. These were observed as eggs, as no adult stages were recovered.

Table 2: Parasites stages recovered from houseflies in sampling sites in Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria

Parasite organism	Phylum	Form seen
Ascaris lumbricoides	Nematoda	Egg
Fasciola hepatica	Plathyhelminths	Egg
Necator americanus	Nematoda	Egg

Ascaris lumbricoides has the highest percentage prevalence with parasitic load of 54.54 %, Hookworm (*Necator americanus)* 42.42 % and *Fasciola hepatica*, 3.03% as shown in Table 3.

The overall percentage abundance of parasites on vector per site was recorded as follows: farm center has a total of 5.95%, the hostel was 5.94 % and the canteen had 8.70 % as listed in Table 4.

Table 5 showed the percentage abundance of each parasite on vector per site.
A simple chi square test was used to test if there was a significant difference in the prevalence of the parasites species on the houseflies, based on locations and it was found that there was a significant difference in the prevalence of the parasite species based on location. It appeared that the prevalence of the parasites depended on the breeding sites of vectors. The same was done on the prevalence of houseflies; and there was a significant difference in the prevalence of houseflies based on location, as was the case in the parasites; showing that the prevalence of flies depended on the breeding sites. The values for the percentage weekly abundance of flies per location are shown in Table 6. Week 2 had the highest weekly abundance of 78.77, while week 5 had the lowest weekly abundance of 33.39.

DISCUSSION

The study showed that houseflies carry some parasites on their body. Ova of three parasites

Table 3: Prevalence of all parasites collected from different sites and the number of parasites found in Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria

Site	*Ascaris lumbricoides*	*Fasciola hepatica*	*Necator americanus*	Total number of parasite
Farm center	12(36.36)	0(0)	6 (18.18)	18(54.54)
Hostel	5(15.15)	0(0)	8 (24.24)	13 (39.39)
Canteen	1(3.03)	1(3.03)	0(0)	2(6.06)
Total	18(54.54)	1(3.03)	14(42.42)	33(100)

n = 33, Number in parenthesis = percentage

Table 4: Overall percentage abundance of parasites on vectors per sampled site in Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria

Site	Number of flies examined	Number of parasites	Percentage of parasites on vectors
Farm center	302	18	5.96
Hostel	219	13	5.94
Canteen	23	2	8.70
Total	544	33	6.07

Table 5: Percentage abundance of each parasite on housefly by site in Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria

Sites	Number of flies examined	*Ascaris lumbricoides*	*Necator americanus*	*Fasciola hepatica*
Farm center	302	12(3.97)	6 (1.99)	0 (0.00)
Hostel	219	5(2.28)	8 (3.65)	0 (0.00)
Canteen	23	1(4.35)	0 (0.00)	1 (4.35)
Total	544	18(3.31)	14 (2.57)	1(0.18)

Number in parenthesis = percentage

Table 6: Weekly percentage abundance of houseflies per sampled site in Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria

Period	Sampled site			Total
	Farm Centre	Hostel	Canteen	
Week 1	30 (9.93)	25(11.42)	10(43.)	64.2
Week 2	102(33.7)	70(31.96)	3(13.0)	78.77
Week 3	55 (18.21)	49(22.37)	5(21.7)	62.32
Week 4	94 (21.12)	31(14.16)	4(17.3)	52.7
Week 5	21 (6.95)	44(20.09)	1 (4.35)	33.9
Total	302(55.5)	219(40.2)	23(4.2)	100

Number in parenthesis = percentage

were found associated with house fly were *Ascaris lumbricoides,* hookworm (*Necator americanus*) and *Fasciola hepatica,* which was in agreement with earlier reports of Ajero and Nwoke (2007) and Wanna *et al*. (2008), where they reported the presence of these parasites in houseflies. The implication of status of houseflies in the transmission of helminth eggs is of serious public health concern to the University community, since houseflies are known to live in close association with human beings. Houseflies are common around the household, in garbage and in human and animal excreta; they are vectors of pathogens (Getacherv *et al,* 2007).

Among the parasites that were recovered from captured flies, *Ascaris lumbricoides* had the highest percentage prevalence of 54.54 %, followed by hookworm (*Necator americanus*) 42.42 % and *Fasciola hepatica* 3.03 %. *Ascaris lumbricoides* is a species of roundworm associated with

ascariasis. *Ascaris* is the most common roundworm infection. According to the WHO (2012), as many as one billion people were infected by *Ascaris lumbricoides* worldwide, this figure was alarming and confirmed the large number seen in this study. Ascariasis is highly prevalent in places without modern sanitation like the sites where this study was carried out. According to the Center for Disease Control, hookworm infections occur in an estimated 576 to 740 million people worldwide (CDC, 2010). It mainly affects people in developing nations in the tropics and subtropics due to poor sanitation (CDC, 2010). The poor sanitary conditions of the farm centre and hostel which yielded the highest number of hookworm confirmed earlier reports (Getacherv *et al,* 2007; CDC, 2010; WHO, 2012).

Fasciola hepatica which causes fasciolosis is now recognized as an emerging human disease. WHO (2009) had estimated 2.4 million people infected with *Fasciola,* and a further 180 million were at risk of infection. This number was comparatively low and in line with the small number of *Fasciola hepatica* (3.03 %) obtained in this study.

The percentage abundance of parasites on flies per site showed that increased vector abundance does not necessarily indicate the increased parasite abundance. For instance the total number of flies captured from the farm center was 302 while, percentage of parasite on them was 5.96%, the hostel was 219 with a parasites percentage of 5.94% and total of 23 flies were captured in the canteen with parasites percentage of 8.70%. This therefore means that the location where the vectors were captured determined the parasitic load. The flies captured around the hostel and canteens showed more parasites prevalence irrespective of the fewer number of flies, this may be as a result of improper disposal of waste, making the surrounding unhygienic.

The abundance of flies was more in the farm center than the other locations because cattle have a distinct smell and flies get attracted to it (Bursell, 1998). Houseflies are numerous in areas with large animal population due to the presence of animal fecal matter. The flies are attracted to the hostels due to the decomposing trash and other food waste. The inability to maintain good sanitation leads to an increase in population of houseflies especially in warm tropical countries.

This study confirmed that housefly (*Musca domestica*) is a vector that transmits parasites to humans in Michael Okpara University of Agriculture, Umudike. Prevention and control of the morbidity and possible mortality associated with these housefly and parasitic infections and reduction can be base on chemotherapy, environmental sanitation, health education (WHO, 1998). Therefore, trash should be properly disposed into sealed containers; dumpers should be emptied regularly and kept as far away from buildings. Manure and other decaying animal materials should be promptly removed.

Conclusion and Recommendations: Houseflies (*M. domestica*) have a negative psychological impact as they are considered as nuisance and a sign of unhygienic conditions. Houseflies spread diseases because they feed freely on human food and filthy matter alike. The flies pick up disease causing organisms while crawling, feeding and thereby contaminates food and drinks while feeding. These contaminated food materials cause bacteria disease like typhoid, cholera, dysentery and virus diseases like viral hepatitis.

Subsequently, the following measures may be taken to check the population of houseflies within the university and reduce the spread of disease causing organisms which they transmit and forestall possible disease outbreak. The recommendation includes (i) Sanitation or cultural control: Good sanitation is the basic step in any fly management program, (ii) The use of traps: They can be killed using an electrocuting grid, (iii) Biological control: Using biological preys like muscidifurax raptor wasp which feed on a fly puparium, thereby reducing the population, (iv) Integrated fly control: The use of insecticides against adult flies and (v) Health education on the dangers of being infected, mode of transmission of these parasites and prevention should be intensified in communities through the health centres. (vi) People can be told the importance of washing

hands after going to the toilet, (vii) Basic social amenities such as clean portable water, culturally acceptable means of disposal and treatment of human wastes and faeces from the principles vehicles of dissemination of the infective agents and (viii) Chemotherapy can also go a long way to take care of infection and so should be employed based on medical advice.

REFERENCES

AJERO, B. E. and NWOKE, B. E. B. (2007). Human nematode ova in cyclonhaphan flies in Owerri town, southeastern Nigeria. *Journal of Medical Sciences,* 2(13): 110 – 112.

BURSELL, E. (1998). The effect of wind-borne odours on the direction of flight in tsetse flies. *Physiological Entomology*, 12: 149 – 156.

CDC (2010). Health awareness on hookworm. *Centre for Diseases Control and Prevention Annual Review,* 28:16 – 18.

GETACHERY, S., GEBRA, M. and ERKO, B. (2007). Non biting cyclonhaphan flies (Diptera) as a carrier of parasites in slum areas of Addis *Ababa Ethiopia. Acta Tropica,* 103: 186 – 194.

GRACZYK, T. K., CRANFIELD, M. R., FAYER, R. and BIXLER, H. (1999). Houseflies *(Musca domestica)* as transport hosts of *Cryptosporidium parvum. American Journal of Tropical Medicine and Hygiene,* 61(3): 500 – 504.

HOWARD, J. J. (2011). Nuisance flies around a landfill: Patterns of abundance and distribution. *Waste Management Research,* 19: 308 – 311.

MANZON, R. B. and SANCHEZ, A. R. (1997). A comparison of the role of *Musca domestica* and *Chrysomyamega cepala* as a mechanical vector of helminthic parasites in a typical slum area of metropolitan Manila. *Southeast Asian Journal Tropical Medical Public Health,* 7: 361 – 369.

MULLEN, G. L. and DURDEN, L. A. (2002). *Medical and Veterinary Entomology*. Academic Press, New York.

NMORSI, O. P. G., UKWANDU, N. C. D. and AGBOZELE, G. E. (2006). Detection of some gastrointestinal parasites from four synanthropic flies in Ekpoma, Nigeria. *Journal of Vector Borne Diseases,* 43(9): 136 – 139.

NWOKOCHA, C. C., OLOJEDE, A. O., ANO, A. O. and MBAGWU, S. C. (2006). Mulching an ultisol at Umudike effects on aggregate stability and rhizome field of turmeric (*Curcuma longa* Linn). Pages 378 – 381. *In*: ASUMUGHA, G. N., OLOJEDE, A. O., IKEORGU, J. G., ANO, A. O. and HERBERT, N. (Eds.). *Repositioning Agriculture for Sustainable Millennium Development Goals in Nigeria. Proceedings of the 40th Annual Conference of the Agricultural Society of Nigeria*, Held at National Root Crop Research Institute, Umudike, Abia State, Nigeria, October 16 – 20, 2006.

OLSEN, A. R. (1998). Regulatory action criteria for filth and other extraneous materials III. Review of flies and food borne enteric disease. *Regulatory* Toxicology *and Pharmacology,* 28: 199 – 211.

SERVICE, M. W. (1980). *A Guide to Medical Entomology*. The Macmillan Press Limited, Hong Kong.

SERVICE, M. W. (2004). *Medical Entomology for Students*. 3rd Edition, Cambridge University Press, Cambridge, United Kingdom.

SUBEJO, P. (2010). *Insect Identification: Musca domestica*. http://insectpedia.blgspot.com/2010/09/housefly-musca. Date accessed 25th October, 2015.

SULLIVAN, J. T. (2009). *A Color Atlas of Parasitology.* University of San Francisco, San Francisco, USA.

WANNA, M., SURAPOL, S. and PUBAMPEN, S. (2008). Houseflies: Potential transmitters of soil transmitted helminth infections in unsanitary community. *Journal of Tropical Medicine and Parasitology,* 31: 14 – 22.

WHO (1998). *The House-fly: Biology and Control.* Document, WHO/VBC/86, 937. Available on Request from Division of Control of Tropical Diseases,. World

Health Organization, Geneva, Switzerland.

WHO (2009). *The Housefly Intermediate Level Training and Information Guide.* World Health Organization, Geneva, Switzerland.

WHO (2012). *Helminth Control in School-age Children: a Guide for Managers of Control Programmes*. World Health Organization, Geneva, Switzerland.