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Parasitic Load on *Musca Domestica* (Dipthera: Muscidae) From Different Synanthropic Enviroments in Jos Metropolis, Plateau State, Nigeria

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Abstract

This study was carried out from five (5) different sampling sites in Jos North Local Government Area of Plateau state, Nigeria during the wet season (May to July, 2016). Five hundred houseflies were captured in the different synanthropic sites in the study area. Six different parasite species were isolated from both the external body surfaces and the gut of the houseflies. These include the four nucleated cysts of Entamoeba histolytica; ova/eggs of Taenia species, Ascaris lumbricoides, Trichuris trichiura and Hookworm, and also the larvae of Strongyloides stercoralis. Open defecation site (Tudun Wada) had the highest parasite prevalence of 13(39.39%) and 8(42.11%) for both external body and gut parasitic load respectively while the lowest prevalence of 2 (6.06%) and 1(5.06) were observed in Terminus market for external body and gut parasitic loads respectively. E. histolytica had the highest prevalence of 15(45.45%) and 7 (36.84%) for external and gut parasites respectively while Hookworm and T. trichiura had the lowest prevalence of 1(3.03%) each. S.stercoralis, A. lumbricoides and E. histolytica were the only parasites found in the digestive tracts of the flies. There was no association ($p>0.05$) between occurrence of the different parasites and sample sites in neither the external nor endo parasites. Likewise, there was no significant difference ($p>0.05$) in occurrence of parasites in relation to the different body parts. This confirms that houseflies are mechanical carriers and possible transmitters of disease pathogens to man in this locality due to the intimacy shared between these Dipterans and Man. Hence, there is the need for improved sanitation and proper health awareness in Jos metropolis to avert possible disease outbreaks and epidemics associated with poor sanitary conditions.

Keywords: Houseflies, Protozoa, Helminthes and Transmitters

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Introduction

Houseflies (*Musca domestica*) live in close association with humans and are said to be synanthropic because they feed on human food stuff and waste where they pick up and transport various disease agents (Akinbaode, *et al*., 1984 and Keidjing, 1986). Apart from the transmission of bacteria, viruses and fungi, muscoid flies have also been linked with soil transmitted helminthes (STH) (Che-Ghani, *et al*., 1993). The main source of transmission is defecation outside latrines by heavily infected persons, contaminated water, food handlers and indirect transmission by non-biting flies (Mott, 1989 and Getachew, *et al*., 2007).

Houseflies have been known to act as mechanical vectors of various pathogens such as bacteria, fungi, protozoan cysts and helminth eggs (El-Sherbini, 2011,). They have also been observed to be potential mechanical transmitters of parasitic helminthes and contribute significantly to the spread of food borne parasitic diseases since gastrointestinal parasites such as *Ascaris lumbricoides,* Hookworm, *Trichuris trichiura,* and *Hymenolepis nana* have been detected on the exoskeleton of houseflies (Balla, *et al*., 2014, Oghale *et al.,* 2013). Muscid flies have also been reported to be mechanical vectors of protozoan parasites such as *Giardia sp* and *Entamoeba histolytica* with several eggs of several tapeworms (Gracyzk, *et al*., 2005).Refuse houseflies have been incriminated in 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, and *Escherichia coli*. *Eimeria tenella*, the coccidian parasite of poultry can be mechanically transmitted by house flies (Graczyk *et al.,* 1999; Mullen and Durden 2002) House flies move around mostly during the day and like warm places showing a preference for direct sunshine. Their filthy habit is seen in the way they defecate while they feed, thereby distributing germs (Olsen, 1998). As mechanical vectors, they pick up the infective agents on the outside of their bodies and transmit them in a passive manner. Flies can carry human pathogens on the spongy mouth parts, on body and leg hairs or on the sticky pads of the feet (Graczyk *et a*l., 1991).

Angiostrongylus infection has been reported among travelers returning from the Caribbean and it was observed that the infection occurred after consumption of vegetable salad contaminated with the infective stage of the worm embedded; houseflies are able to carry infective stage of the worm and act as transport hosts for the metastrongylid larvae thereby making housefly a liable transport host of *Angiostrongylus* (the lung worm) with known medical significance to man (Maipanich, *et al*., 2012). *M. domestica* has been reported in recent studies to have developed resistance to pesticides commonly used for its control thereby emphasizing the public importance of this fly (Abbas, *et al*., 2014).

Despite the abundance of houseflies in the study area, there is little information on their vector potential as transmitters of parasites. This study is aimed at determining the parasitic load and identifying the parasites present on both the body surfaces and digestive tracts of *M. domestica* captured from different synanthropic areas of Jos Metropolis, Plateau state, Nigeria.

Materials and methods

This research was carried out from May to July 2016 in Jos North Local Government Area of Plateau state, Nigeria. The Local Government has an area of 291km^2 an altitude of 1,217m (3,993ft) above sea level, an annual rainfall of 140mm (55inches). The study was carried out during the rainy (wet) season. Flies were collected from five (5) locations in Jos namely. Farin gada market, Terminus market, Jos abattoir, Refuse dump site and Open defecation site, between 9am -12pm at each visit. Five hundred (500) flies were captured using the sweep net method over the surfaces where the flies were resting or feeding). One hundred flies were collected from each site. Flies captured in nets were

placed in a killing jar which is a plastic bucket with a cover and containing cotton wool soaked in chloroform to immobilize the flies, Flies were transferred into labelled sample bottles using sterilized forceps.

The captured flies were transferred into labeled containers and transported immediately to the Entomology Laboratory, Parasitology Department of the National Veterinary Research Institute, Vom. They were killed by placing in a freezer at temperatures of 5^0C to - 20^0C. The dead flies were sorted using keys to identify and isolate only *M. domestica*.

About 10ml of normal saline was added into each plastic container containing flies and shaken vigorously to dislodge parasites from external body surfaces. The suspension was then transferred into a conical test tube and centrifuged at 3,000rpm for 10 minutes. Supernatant fluid was discarded and 1% Lugol's iodine stain was added to the sediment and examined under the light microscope (Fote dar *et al.*, 1992). Appropriate keys to identification of the various parasites were used (WHO, 2012).

For the internal parasites, the flies were first surface- sterilized by placing them in 70% ethanol and then rinsed in sterile water. The flies were then crushed with a sterilised hand mortar and pestle to release their internal contents. The squashed flies were homogenised with 20ml of normal saline, (Nwangwu *et al.*, 2013).

A clean, sterile centrifuge tube half-filled with the suspension was centrifuged at 3000 r.p.m for 10 minutes. The supernatant was decanted while the sediments were placed on a clean glass slide, covered with a glass cover slip and examined under a 10X objective of the microscope. A drop of Lugol's iodine was dropped through the edge of the cover slip and examined under a X40 objectives lens to identify the cysts and eggs of protozoans and helminthes respectively.

Data obtained was analyzed using R Console software version 3.2.2. Proportions of parasitic load in relation to study sites, occurrence of parasites species and as well as body parts were compared using Chi-square test at 5% level of significant.

Results

The parasitic loads on the body surfaces and the guts of the houseflies captured from different synanthropic environments namely; Faringada market, Terminus market, Jos abattoir, Refuse dump site and Open defecation site, during the rainy season in the study area, are presented on tables 1 and 2 respectively. The overall parasites prevalence was 52(10.4%). A total of six (6) parasite species were recovered from the external body surface and digestive tracts of *M. domestica* namely; *Ascaris lumbricoides*, *Entamoeba histolytica*, *Taenia* sp, *Strongyloides stecoralis*, Hookworm and *Trichuris trichura* . The most occurring parasite was *Entamoeba histolytica* 22(42.31%), followed by *A. lumbricoides* with 17(32.69%) while the least prevalence of 1(3.03%) each were recorded in Hookworm and *Trichuris trichiura.* The occurrence of parasitic species was higher 33(63.46%) on the external body surfaces than 19(36.54%) observed in the digestive tracts. Prevalence of the parasites in relation to the sites showed that the highest parasite abundance was recorded in flies caught at the open defecation site with 21(40.38 %) while the least, 3(5.77%), occurred in those captured at the Jos Terminus market out of a total of 52 parasites isolated. There was however no association ($p>0.05$) between species of parasites occurrence and sample sites.

Table 1: Parasite Load on the Bodies of *M. domestica* captured in the Study Area in Jos Metropolis, Plateau

Sampling site	No. Examined	Parasites Isolated No.(/%)					
		Ascaris lumbricoides	*Entamoeba histolytica*	*Taenia spp*	Hook worm	*Trichuris trichiura*	Total
Faringada market	100	2 (6.06)	2 (6.060	1 (3.03)	0 (0.0)	0 (0.0)	5 (15.15)
Terminus market	100	1 (3.03)	1 (3.03)	0 (0.0)	0 (0.0)	0 (0.0)	2 (6.06)
Jos Abattoir	100	2 (6.06)	2 (6.06)	1 (3.03)	0 (0.0)	0 (0.0)	5 (15.15)
Refuse dump site	100	3 (9.09)	4 (12.12)	1 (3.03)	0 (0.0)	0 (0.0)	8 (24.24)
OpenDefecation site	100	4 (12.12)	6 (18.18)	1 (3.03)	1 (3.03)	1(3.03)	13 (29.39)
Total	500	**12 (36.36)**	15(45.45)	4(12.12)	1(3.03)	1(3.03)	33(100)

Table 2: Distribution of parasites retrieved from the gut of houseflies from different sampling sites in Jos Metropolis, Plateau State, Nigeria

		Parasites Isolated No(%)			
Sampling site	No. Examined	*A. lumbricoides*	*E. histolytica*	*S. stercoralis*	Total
Faringada market	100	1(5.26)	1(5.26)	1(5.26)	3(15.70)
Terminus market	100	0(0.0)	1(5.26)	0(0.0)	1(5.26)
Jos Abattoir	100	0(0.0)	1(5.26)	1(5.26)	2(10.53)
Refuse dumpsite	100	1(5.26)	2(10.53)	2(10.53)	5(26.32)
Open defecatn site	100	3(15.79)	2 (10.53)	3(15.79)	8(42.11)
Total	500	5(26.32)	7(36.84)	7(36.84)	19(100)

Discussion

This study shows that houseflies are mechanical vectors of important protozoan and helminth parasites in Jos Metropolis. This findings are in agreement with the reports of Gracyzk, *et al*., (1999), Balla, *et al*., (2014), Nwangwu, *et al*., (2013) and Umeche and Mandah,(1989) who isolated parasites from both the external body surfaces and internal organs of houseflies. The high (38.46%) parasite load encountered in the open defecation site is in line with the findings of Oghale *et al.,* (2013) (30.00%) in Umuahia, Balla *et al.,* (2014) (42.55%) in Maiduguri, and that of Ogunniyi *et al.,* (2015) (19.76%) in Ile-Ife, all in Nigeria. Ogunniyi *et al (2015)* observed that parasitic organisms thrive more in environments contaminated with faeces and are subsequently transmitted in the locality under study.

Houseflies were found to harbour *T. tichiura*, *A. lumbricoides,* and hookworm eggs/ova and *E. histolytica* cysts on their external body surfaces which is similar to the findings of Oghale *et al.,* (2013) in Umuahia, Nigeria, who demonstrated the external carriage of eggs of *Taenia* species, hookworm, *T. trichiura and A. lumbricoides* by houseflies. Graczyk *et al.,* (1999), Umeche and Mandah (I989), Balla *et al*. (2014) and Nwangwu *et al.,* (2013) all reported parasites carried on the external body surfaces of houseflies which are similar to those isolated from this study. The parasites isolated from the digestive tracts of the houseflies in this study were *A. lumbricoides*, *E. histolytica* and *S. stecoralis* and the findings agree with the report of Gehad and El-Sherbini (2010) and Graczyk *et al.,* (2005), who reported similar species of parasites in the gastrointestinal lumen of the housefly. On the other hand, many researchers have reported higher parasites occurrence rates in the gastrointestinal lumen than on body surfaces (Getachew *et al*., 2007). The observation of *T. trichiura* and *A. lumbricoides* eggs, as well as hookworm ova, on the flies corroborates the findings of Umeche and Mandah (1989), who reported that houseflies are mechanical transmitters of soil-transmitted helminths. These authors also observed that the flies could carry and spread parasites and pathogens to other places, since they are able to travel up to 20 miles to unsanitary sites. The presence of a nematode larva *S. stecoralis* has been reported by Mawak and Olukose (2006) in Jos, Nigeria from the external surface of the fly unlike in this study where it was observed only in the gut of the housefly. *E. histolytica* was the most prevalent parasite found in all of the locations where the flies were captured. This is in agreement with the findings of Ogunniyi, *et al*., (2015), in Ile-Ife, Nigeria who revealed that *E histolytica* cysts were found in three out of four locations used for the study. As a result, children are likely to suffer most, as most of the parasites isolated are soil – transmitted. Hence, the attitude of eating sand (geophagy) or playing in it and not washing their hands before eating, makes them vulnerable. They also indulge in indiscriminate defecation around homes, thereby increasing contamination of the environment. Bundy *et al*., (1992) showed that children are an ideal target group for STH as they frequently defecate indiscriminately around their houses, particularly in the courtyards, sitting rooms, drains and bushes, even where every household has a latrine.

Conclusion

In conclusion, Housefly was found to be a mechanical vector of both Helminthes and Protozoan parasites thereby making it a significant agent of spread of food borne and soil transmitted parasitic diseases. Since this study identified the presence of six gastrointestinal parasites on flies' external body parts and digestive tracts, its role in disease transmission should not be underestimated. Other microorganisms, such as bacteria and viruses that cause infection in humans have also been reported to be transmitted by houseflies. Therefore, it becomes very important to device control measures through the use of insecticides and also Health education on improving the standard of environmental sanitation worldwide.

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