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THE ROLE OF HOUSEFLY (*Musca Domestica*) IN MECHANICAL TRANSMISSION OF INTESTINAL PARASITES IN MAIDUGURI METROPOLIS, NORTH EASTERN NIGERIA.

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Abstract
Housefly is the best known and most widely distributed insects accounting for 90% of all flies in human habitation. A study was undertaken to determine the role of housefly (Musca domestica) in the transmission of human intestinal parasites in Maiduguri metropolis. A total of 1151 Houseflies were collected using insect sweep net, from four different breeding sites and were examined for human intestinal parasites using Formol-saline concentration techniques. The highest fly abundance recorded was 453 (39%) while the least recorded was 135 (12%) houseflies. Four intestinal parasites were isolated from fly external body with the following frequency of infection in their external surfaces respectively; Ascaris lumbricoides 22(2%), Hookworm 21(1.8%), Trichuris trichiura 3(0.3%), Hymenolepis nana 1(0.09%) and the transmission rate from four sampling sites was (0.8%) Abattoir, (2.0%) open defecation area, (1.3%) Maiduguri main market and (1.6%). Housefly was found to be a potential mechanical transmitter of parasitic infection and significantly contribute to the spread of food borne parasitic diseases, since this research detected the presence of four gastrointestinal parasites in flies' exoskeleton and therefore its role in disease transmission cannot be over emphasized.
Keywords: Housefly, Intestinal parasites, Maiduguri, Mechanical transmission, Nigeria

1.INTRODUCTION

Housefly (*Musca domestica*) is the best known and most widely distributed insects found all over the world, but it is more adaptable in warm areas (Goulson *et al* 2005). It is the classical example of synanthropic animal, one that lives in association with humans which account for about 90% of all flies in human habitation (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 many disturbances to them (Howard2011). 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 all farm animals (Sevvice 1980). Houseflies are of human and veterinary concern, because it acts as a mechanical vector for a range of pathogens. More than 100 pathogens are associated with housefly which may cause disease in human, such diseases are; Cholera, Typhoid fever, Tuberculosis, Aspergillosis, Poliomyelitis, Hepatitis, Ascariasis, Amoebic dysentery (Peter and Chiodui 1997 and Graczyk *et al* 2001). An almost invisible dot of faeces in the environment may contain the eggs or larvae that can develop further and transmit to nearby humans (Graczyk *et al* 2001). Outbreak and cases of food-borne diarrheal diseases in urban and rural areas are closely related to the seasonal increase in the abundance of houseflies' populations in warm places where unsanitary conditions prevail and are usually scarce (Gehad and Elshirbini 2
scarce (Gehad and Elshirbini 2010). It has been reported by regulatory agencies concerned with sanitation and public health that housefly are associated with unsanitary condition and involved in dissemination of human enteropathogens that serve as causative agents of gastro-intestinal diseases to humans, based on strong attraction of filth and human food (Otronto and Tarsitano 2003)) .
The filthy breeding habit, feeding mechanisms and indiscriminate travel between filth and food make houseflies as an efficient vector and transmitters of human enteric protozoan and helminth parasites such as cysts of *Entamoeba histolytica, Entamoeba coli, Giardia intestinalis* and oocysts of *Toxoplasma gondii, Isospora spp,* and Egg or larvae of *Ascaris lumbricoides, Trichuris trichiura, Hook warm* (Graczyk *et al* 2001 and Otronto and Tarsitano 2003). The transmission of these human protozoan and helminth parasites by housefly is predominantly mechanical, which occurs via mechanical dislodgement from external body, faecal deposition and regurgitation *i.e.* Vomit(Grazyk *et al* 2005]. 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 (WHO 1990, Manzon and Sanchoz 1997).

Human intestinal parasites infection is one of the most common infections in human especially in tropical and subtropical countries. More than one billion of the world populations including at least 400 million school aged children are chronically infected with the round worm *Ascaris lumbricoides*, whip worm *Trichuris trichiura,* and hook worm *Ancylostoma duodenale* (1990). Intestinal obstruction, anaemia, Trichuris dysentery syndrome (TDS) are potentially fatal clinical problems which complicates the infection. Houseflies have been incriminated as mechanical and biological vectors of these infections (Manzon and Sanchez 1997). Many authors have indicated the potential of housefly as carrier of parasites (Manzon and Sanchez).

A study was carried out in Egypt on the roles of housefly in mechanical transmission of parasites where Hookworm and *Trichuris trichiura* were isolated at transmission rate of 11.8% in household and *Ascaris lumbricoides* at transmission rate of 25.9% in defecation (Gehad and El sherbini 2003).

In south eastern Nigeria, a study was conducted by Ajero (Ajero 2007)on the nematode ova in cyclorrhaphan flies in Owerri town, were he isolated *Ascaris lumbricoides* ova at highest prevalence rate of 52% (Wanna *et al* 2008).

Nmorsi working in Ekpoma Nigeria reported the presence of some gastro-intestinal parasites *Ascaris lumbricoides, Hookworm*, *Cryptosporidium parvum* in Housefly (Nmorsi *et al* 2006). Teshone *et al* Isolated the presence of many intestinal parasites in the external body and gut content of houseflies, *Ascaris lumbricoides* (36.9%), *T. trichiura* (38.8%), Hook worm (13.0%), *Hymenolepis nana* (0.6%), *Strongyloides stercoralis* (1.7%), *Entamoeba histolytica/dispar* (48.1%), and *Giardia intestinalis* (10.4%) (Teshome and Worku 2009). Several studies have been reported in intestinal parasitic infection. Unfortunately, specific report on the role of housefly as a mechanical vector of gastrointestinal parasites in Maiduguri metropolis was not found, therefore the effort to investigate the roles played by housefly in transmission of pathogenic parasites will provide an information that breakdown the chain between the parasites and the houseflies.

The aim of this study was to detect the presence of parasites' ova, larvae and cyst from the exterior surface of housefly, to investigate the roles played by housefly in the transmission of protozoan and helminthes parasites and to provide information on the public health importance of the study.

2.0 Materials and Methods

2.1 Study Area

The study area was Maiduguri metropolis, Borno state located in the north eastern part of Nigeria on latitude 10^{o}N and 14^{o}N and longitude 11 30^{o}E and 14 45^{o}E.

2.1.1 Study Sites

The study was conducted in four different selected sites in the Metropolis namely; Maiduguri main market, Abattoir, Housing environment and an open defecation area in Gwange near fish market. These sites were chosen because numerous flies feed and rest in those areas.

2.2.0 Housefly Collection

About 1151 Houseflies were captured using sweep net method. The net was made by mosquito net, a quarter inch iron to form the rim and a wooden handle. The flies were captured using the net over the surface where flies visit, such as meat, fish, vegetable, faeces and building. The operation was carried out between 8-11am, the captured flies were place into a labeled universal container and transported immediately to the Parasitology laboratory for further processing.

2.3 Laboratory Processing

2.3.1 Formal-Ether Concentration Technique

About 7ml of formal saline was added to a clean universal bottle containing the pooled Houseflies and washed vigorously using manual shaking technique to dislodge the parasite from the exoskeleton of the flies. The preparation was then strained in to a centrifuge tube using a funnel and filter. 3ml of ethyl ether was added to the centrifuge tube and the tube was covered and shaken vigorously. The tube containing the filtrate was centrifuged at 3000 rpm for 5mins. The tube was tilted and all the supernatant fluid was discarded.

A drop of Lugol's iodine was added to the sediment and then re-suspended by tapping the bottom of the tube gently. Therefore a drop of the re-suspended deposit was placed on a clean grease free slide. A cover slip was then place over the drop. Finally, the preparation was examined under the microscope using x10 and x40 objectives respectively to report any parasites ova or larva present (Ochei and Kolhatkar 2000).

3.0 Results

A total of 1151 houseflies were studied in Maiduguri metropolis all were identified as *Musca domestica* using the morphological characteristic (Gordon and Lavoipiere 1986). Table 1 shows the distribution of houseflies in four sampling sites namely Abattoir, an open defecation area in Gwange near fish market, Maiduguri main market and housing environments. The highest abundance of 453 houseflies was recorded in abattoir accounting for (39%) of the total houseflies, while the least of 135 houseflies was recorded in houses environment accounting for only (12%) of total houseflies population. Table 2 presented the parasite loads of the four study sites in which eggs and larvae of four parasites namely *Ascaris lumbricoides, Hookworm, Trichuris trichiura, Hymenolepis nana* have been recovered from the external body surfaces of houseflies studied. The highest mean parasitic load of 20 parasites egg and larvae was recovered from exoskeleton of houseflies investigated in an open defecation area in Gwange which harbored all the four parasites that have been isolated, While the least parasitic load of three parasite eggs was detected in the flies investigated in housing environment harboring only one among the four parasites isolated. Table 3 shows the transmission rate of parasites by houseflies in the four study sites.

Table 1: Percentage Distribution of Houseflies in Four Sampling Sites in Maiduguri Metropolis

SAMPLES	LOCATION	SAMPLING SITES			
		ABATTOIR	AN OPEN DEFECATION AREA	MAIDUGURI MAIN MARKET	HOUSES ENVIROMENT
HOUSEFLIES	1	85	59	57	16
	2	60	66	43	23
	3	83	53	37	27
	4	77	37	35	21
	5	95	25	50	33
	6	53	78	23	15
		453(39%)	318(28%)	245(21%)	135(12%)
TOTAL	1151 houseflies				

Table 2: Number of Parasite Eggs Detected From Four Sampling Sites in Maiduguri Metropolis

SAMPLING SITES	NO. OF FLIES EXAMINED	NO. OF PARASITE EGGS/LARVAE DETECTED			
		A.lumbricoides	*Hookworm*	*T.trichiura*	*H. nana*
ABATTOIR	453	5	11	0	0
OPEN DEFEACATION AREA	318	9	7	3	1
MAIDUGURI MAIN MARKET	245	5	3	0	0
HOUSES ENVIROMENT	135	3	0	0	0
TOTAL	1151	22(2%)	21(1.8%)	3(0.3%)	1(0.09%)

Table 3: Transmissions Rates in Percentage of Parasites by Houseflies.

SAMPLINGSITES	NO. OF FLIES EXAMINED	TOTAL NO. OF PARASITE EGGSDETECTED	% OF POSITIVE FLIES	TRANMISSION RATES IN %
ABATTOIR	453	16	3.5%	0.8%
OPEN DEFEACATION AREA	318	20	6.3%	2.0%
MAIDUGURI MAIN MARKET	245	8	3.3%	1.3%
HOUSES ENVIROMENT	135	3	2.2%	1.6%
TOTAL	1151	47	15.3%	4.7%

4.0 Discussion, Conclusion and Recommendation

4.1 Discussion

A study on the roles of housefly in mechanical transmission of parasites was conducted in Maiduguri metropolis where four parasites have been isolated from external body surface of housefly namely; *Ascaris lumbricoides, Trichuris trichiura, Hookworm,* and *Hymenolepis nana* which is in agreement with the research of Wanna *et al* (W anna *et al* 2008) Ajero (Ajero 2007), Nmorsi and Gehad *et al* , where they reported the presence of those parasites in houseflies. The implication of status of houseflies in the transmission of helminth eggs is alarming since houseflies are known to live in close association with human beings. Houseflies were common around the household, in garbage and in human and animal excreta, they are proven mechanical transmitter of pathogens to human food (Getachew *et al* 2007). Because people use to defecate in an open area in Gwange ward, faecal matter attracted the flies feed on the faeces, after feeding and resting the flies travel to the metropolis to about 100 meters from the feeding sites (Gehad and Elshirbini 2010). Flies that had direct contact with the parasites infested faeces were efficient carriers because this research shows 6.3% of total flies caught in an open defecation area were contaminated with parasites eggs, in the defecation area positive flies after feeding they rest in the area and contaminated the environment with the pathogens in their foot pads, hairs bristle, and external mouth part at a transmission rate of 2%. In the flies captured from housing environment, 2.2% were positive for parasites eggs having eggs on their body surface that can transmit them to human food and households surrounding at transmission rate of 1.6%. From the total flies population caught in Maiduguri main market, 3.3% were found to be positive for parasites eggs and larvae and the transmission rates was 1.3%. This suggest that most food product sold in the market which are eaten raw such as salad, cabbage, tomatoes etc. may be contaminated by those positive flies if not clearly washed before consumption which could lead to serious gastrointestinal damage. For the flies collected from abattoir 3.5% were found to be positive and these positive flies will contaminate the meat sold there at transmission rate of 0.8% because numerous flies were seen feeding over the meat sold in the abattoir, if such meat is poorly cooked some heat resistant parasite eggs will establish the infection if such poorly cooked meat was consumed.

In the overall, total houseflies studied in Maiduguri metropolis *Ascaris lumbricoides* was found to be more prevalent which collaborates with findings of Gehad *et al* and El-Sherbini 2010) and Ajero (Wanna *et al* 2008) where they reported the presence of *Ascaris lumbricoides* at high prevalence rate. *Ascaris lumbricoides, Trichuris trichiura, Hookworm* etc. are causative agents of helminthiasis. Also, synanthropic flies are reported as major epidemiologic factors responsible for the spread of acute trachoma amongst infants and young children in predominantly in developing countries (Graczyk *et al* 2001). Nevertheless, many researchers have reported higher parasites detection rates in the gastrointestinal lumen of housefly (Gehad and El-Sherbini 2010 and Graczyk *et al* 2005)].

4.2 Conclusion

In conclusion, housefly was found to be a potential mechanical transmitter of parasitic infection and significantly contribute to the spread of food borne parasitic diseases, since this research detected the presence of four gastrointestinal parasites in flies' exoskeleton and therefore its role in disease transmission should not be under rated. Other microorganisms causing bacterial and viral infection have been reported to be transmitted by housefly. Therefore, it becomes imperative to urgently institute control measures of these flies through mass education on improving the existing standard of environmental sanitary condition

4.3 Recommendation

The control and eradication of houseflies should be implemented to stop gastrointestinal parasites transmission in addition to drugs administration. In high risk areas health education, personal and environmental hygiene should be emphasized, in areas where open defecation is common food must be strictly protected from housefly. Further studies should be conducted to investigate the presence of parasites in housefly gut and also to determine other pathogenic microorganism (bacteria, viruses and fungi) that are mechanically transmitted by *Musca domestica.*

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