VECTOR POTENTIAL OF HOUSEFLIES (*MUSCA DOMESTICA*) FOR PATHOGENIC ORGANISMS IN JOS, NIGERIA

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Abstract: A study was carried out to identify the bacterial pathogens as well as parasites present on both the body surface and intestines of houseflies (*Musca domestica)* in Jos metropolis. A total of 200 houseflies were collected from six random locations within the study area, and analyzed for the presence of bacterial pathogens and parasites using standard microscopy and culture. Eight parasites: *Giardia lamblia* (34.62%), *Entamoeba histolytica* (19.22%), *Enterobius vermicularis* (7.70%), *Taenia solium* (15.39%), *Ascaris lumbricoides* (7.70%) *Trichiuris* trichiura (7.70%), *Hymenolepis nana* (3.84%) and *Strongyloides stercoralis* (3.84%) were detected. Also, eight (8) bacterial pathogens: *Escherichia coli* (34.48%), *Staphylococcus species* (18.39%), Streptococcus species (13.79%), *Shigella species* (14.94 %), *Salmonella species* (6.90%), *Klebsiella species* (4.60%) *Pseudomonas species* (4.60%) and *Proteus species* (2.30%) were isolated and identified. The intimacy in relationship between these insects and man implies a probable transmission of pathogens to man by the flies, causing disease outbreaks; hence the need to step up control measures against the insects.

Key words: *Musca domestica,* vector potential, Jos, Nigeria.

INTRODUCTION

Houseflies *(Musca domestica)* are constant inhabitants as well as visitors to several filthy areas like refuse dumps, toilets, human and animal wounds, domestic waste bins and other areas of poor sanitary conditions and have been associated with the transmission of disease (Greenberg, 1971., Fotedar, *et al.*, 1992). The role of houseflies in the transmission of pathogens that causes gastro intestinal disease such as Salmonellosis, Shigellosis, Cholera and yaws has already been established (West, 1951; Greenberg, 1971; Fotedar, *et al.*, 1992). Further studies by Esten and Mason (1988) showed that as many as 6 x 10^6 bacteria can be isolated from the exterior surface of a single feeding fly. Also, Harwood and James (1979) were able to isolate more than 100 different species of pathogenic organisms from the digestive tract of houseflies. In another study, Grubel et al (1996) confirmed that houseflies may possibly be the vector for *Helicobacter pylori* which is associated with gastric and duodenal ulceration in man. An added advantage of houseflies in the transmission of disease agents over a wide range is the fact that they are in active flight for most part of the day (Davies, 1988).

Despite the awareness of many about the dangers posed by houseflies, the inability to maintain a good sanitation leads to an increase in the population of

houseflies, especially in warm tropical countries. In Nigeria, in general and Jos in particular, poor sanitation is becoming a problem. Indiscriminate refuse dumping, little or no care of toilet facilities and drainage systems coupled with improper handling of food are daily on the increase. Hence, the aim of this study is to identify the bacterial pathogens as well as parasites present on both the external surface and the guts of houseflies in Jos metropolis, in order to assess the dominant type of transmissible infectious agents present in the community.

MATERIALS AND METHODS

Collection of houseflies;

Two hundred (200) individual houseflies were used for this study, and were collected randomly from six (6) different locations in the study area namely; The Jos Abattoir, Jos main market, Farin Gada, Jenta Adamu, Zik Avenue and The Jos University Teaching Hospital. The houseflies were collected using flytraps. Baits of fresh meat were placed in the traps which attracted the houseflies hence their entry and entrapment. The flies collected were then taken alive to the laboratory in the traps.

Identification of Houseflies

The specimens were identified at the Institute of Agricultural Research, Ahmadu Bello University Zaria as *Musca domestica.*

Killing and dissection

The flies were killed by exposure to chloroform for a few minutes in the traps. This was done in order not to alter the distribution of the microbial flora on their surfaces.

The flies were then picked up using a pair of forceps and placed in groups of five (5s) in pre arranged test tubes containing 1.0ml of normal saline (8.5g of sodium chloride in 1 litre of distilled water). The flies were gently rinsed by stirring with a glass rod in order to wash the microbial flora on the flies into the normal saline. Thereafter, a drop of the normal saline from each tube was aseptically cultured in three different bacteriological media (Chocolate agar, MacConkay agar and Cysteine Lactose Electrolyte Deficient (CLED) medium) all in triplicates. The remnant was centrifuged and decanted to obtain the concentrate, which was later used to make a wet mount and was examined for the presence of parasitic forms.

The wet flies were then collected from the test tubes and washed in ethyl alcohol to decontaminate their surfaces. They were afterwards washed in normal saline in order to wash off excess alcohol that may affect the internal microbial flora during dissection. The flies were incubated at 37^0C to dry for a few minutes and then placed one by one on a sterile watch glass where they were dissected under a dissecting microscope using the method of Snodgrass, (1935). The wings were clipped off and the mesothorax and head removed with a pair of forceps. The guts were obtained with a cutting forceps and placed in a test tube containing 1.0ml of normal saline (still maintaining the groups of 5s) and homogenized. The resulting mixture was cultured and incubated in the same way as the body surface washings.

Culture of the Samples

The samples were cultured aseptically in MacConkay agar, chocolate agar and CLED medium in triplicates and incubated under aerobic, anaerobic and microaerophilic conditions respectively at 37^0C for 24 hours (Frobisher *et al* 1974).

Identification of Parasites.

After the body washings were obtained, they were centrifuged and decanted. The deposits were then dropped on clean, grease – free glass slides and a cover slip

was placed upon the drop. Iodine was then pippetted from the side of the cover slip to enhance the elucidation of the parasitic forms. The slide was mounted on the microscope and viewed using the x10 objective first; and then x40 objective. The intestinal parts of the houseflies were not analysed for parasites because parasites do not survive for long in the flies before they are metabolised (Robaud 1918;Pipkin ;1949).

Identification of Bacterial Isolates

After 24 hours, the cultured specimens under incubation were brought out and examined for growth. Resultant colonies were identified using morphological and biological characteristics of the colonies namely; Colonial morphology, Gram reaction, Catalase test; Oxidase test; Indole test Coagulase test as described by Cheesbrough (2000).

RESULTS

The results obtained shows an association between houseflies and some pathogenic organisms specifically bacteria and parasites. A total of eight (8) parasites and eight (8) bacterial species were identified. *Giardia lamblia* (34.62 %) and *Entamoeba histolytica* (19.22 %) which are both protozoans are the most common among the parasites. Closely following these was the platyhelminth *Taenia solium* (15.39 %). On the other extreme, *Hymenolepis nana* (3.84 %),and *Strongyloides stercoralis* (3.84 %) were the least common. Other parasites detected were *Ascaris lumbricoides* (7.70 %) *Enterobius vermicularis* (7.70%) and *Trichurius trichiura* (7.70 %) as shown in Table 1.

Table 1: Types of Parasites and Frequency of Detection on *Musca domestica*

Serial No.	Parasites detected	Frequency of occurrence	Percentage Frequency of occurrence
1	*Giardia lamblia*	9	34.62%
2	*Entamoeba histolytica*	5	19.22%
3	*Taenia solium*	4	15.39%
4	*Ascaris lumbricoides*	2	7.70%
5	*Enterobius vermicularis*	2	7.70%
6	*Trichurius trichiura*	2	7.70%
7	*Hymenolepis nana*	1	3.84%
8	*Strongyloides stercoralis*	1	3.84%

The bacteria species isolated from the outer parts of the houseflies include *Escherichia coli* (36.58 %) which was the most frequently occurring, and *Salmonella species* (2.44 %) as well as Pseudomonas species (2.44 %) which were the least common. Others are *Staphylococcus species* (26.83 %), *Shigella species* (14.64 %), *Streptococcus species* (17.07 %).

From the intestinal parts, *Escherichia coli* (32.61 %) remained the most frequently occurring, with *Proteus species* (4.35 %) being the least frequently occurring as shown in Table 2. The overall spectrum of bacterial pathogens was similar for both the outer parts and the intestines of the flies, with higher frequencies of occurrence in

the intestinal parts except for *Klebsiella species* and Proteus *species* which were detected only in the intestinal parts of the houseflies.

TABLE 2: Bacterial Type Location and Frequency of Isolation from *Musca domestica*

Serial no.	Bacterial Isolates	Frequency of Isolation			
		Body surface	Intestinal parts	Total	Total Percentage Frequency
1	*Escherichia coli*	15 (36.58%)	15 (32.61%)	30	34.48%
2	*Staphylococcus Species*	11 (26.83%)	5 (10.87%)	16	18.39%
3	*Shigella species*	6 (14.64%)	7 (15.22%)	13	14.94%
4	*Streptococcus species*	7 (17.07%)	5 (10.87%)	12	13.79%
5	*Salmonella species*	1 (2.44%)	5 (10.87%)	6	6.90%
6	*Klebsiella species*	0 (0.00%)	4 (8.69%)	4	4.60%
7	*Pseudomonas species*	1 (2.44%)	3 (6.52%)	4	4.60%
8	*Proteus species*	0 (0.00%)	2 (4.35%)	2	2.30%

DISCUSSION

This study has shown that the houseflies in Jos metropolis can be both active and passive carriers of pathogenic micro-organisms. Historically, this has been reported in previous studies like that of Lamborn, (1939) who recorded *Musca sorbens* as harbouring and passing *Mycobacterium tuberculosis* for many days after feeding on infected sputum. Also, Roberts (1947) fed houseflies on a standard emulsion containing highly resistant cysts of *Entamoeba histolytica*. The cysts were found to be present in the faeces of the flies passed between five minutes and thirty-one hours from the time of ingestion. The detection of *Enterobius vermicularis, Ascaris lumbricoides* and *Trichurius trichiura* from the houseflies correlates with the work of Pipkin (1943) who studied the possibility that flies might transmit the ova of parasitic roundworms. He demonstrated the external carriage of *Enterobius vermicularis, Necator americanus, Trichurius trichiura* and *Ascaris lumbricoides* by houseflies. Also the active and passive carrier roles of houseflies were reflected in the works of Moorehead and Weisser, (1946) who proved the survival of *Staphylococcus* strains in the gut and excreta of houseflies; and the work of De Souza-arajo,(1943) who recorded *Musca domestica* as becoming "heavily burdened" with several bacterial species including acid-fast bacilli, *staphylococci, streptococci* and *salmonellae*.

The occurrence of bacteria and parasites in flies can be attributed to their contact with faeces or faecally-contaminated materials in the environment since most of the microorganisms associated with flies are known for gastro intestinal disorders and can be passed out in the faeces of infected persons. Kelly et al (1994) showed that *Helicobacter pylori* which is associated with gastric and duodenal ulcer can be passed out in faeces. This they did by isolating the organism from human faeces, hence

Grubel *et al*, (1996) demonstrated the potential role of houseflies in the transmission of this organism. Other arthropod pests which are associated with faecal materials have also been found to be capable of disease transmission. Mawak *et al*;(2005) reported the isolation of several parasites and pathogenic bacteria from cockroaches (*Periplaneta americana*) among which are *Ascaris lumbricoides, Strongyloides stercoralis, Trichiuris trichiura, Giardia lamblia, Enterobius vermicularis* for parasites, and *Staphylococcus species, Streptococcus species, Klebsiella species, Salmonella species, Shigella species* for bacteria. Resistant strains of pathogens where they exist in an environment can also be transmitted by houseflies as demonstrated by Boulesteix (2005). The occurrence of *Giardia lamblia* (34.62 %) and *Entamoeba histolytica* (19.22 %) in high frequencies among the parasites is in agreement with the report of WHO (1995) which stated that *Giardia lamblia* and *Entamoeba histolytica* infections are endemic in many parts of tropical and subtropical Africa.

The presence of all these pathogens in houseflies, coupled with their intimacy with man and also their highly motile nature implies a possible high risk of transmission of the pathogenic organisms to humans and subsequent outbreaks of gastro enteritis and enteric fever. To prevent this, control measures against the houseflies must be employed.

Normal hygiene is sufficient enough for fly control in temperate regions, but warm regions need more strategic control measures. (Davies, 1988). In this case, the control measures should include the setting of strict legislatory standards for the hygienic condition of places like schools, hospitals, market places, public toilets, slaughter houses and food processing outlets. As a parallel to this, the public should also be educated on the dangers of poor sanitation, which inevitably breeds flies. In the case of emergency control of flies, measures like insecticides, flytraps, and wire screens can be used.

Although, there are yet no absolute figures as to morbidities and mortalities attributed to the vector characteristics of houseflies in Jos, the recorded cases of gastrointestinal and related diseases may be a pointer to the "housefly at work". Therefore, minimizing the population of houseflies would go a long way in bringing about a reduction of such cases

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