

Bacteria and Parasites Pathogens Associated with the Houseflies (*Musca domestica*) in Lafia Metropolis of Nasarawa State, Nigeria

By
Alaku, A.I., Sani D. and Audu M.

ABSTRACT

Houseflies (*Musca domestica*) are common insects of the families muscidae, order Diptera. They are synanthropic insects that are widely distributed worldwide. They enter several places, including contaminated premises due to their own biological habit of feeding. This study identifies the pathogenic parasites and bacteria associated with the houseflies in Lafia, Nigeria. A total of 215 flies were collected from 5 locations (New market, Neighbourhood market, Kasuwan Turmatur, Kasuwan Karo and Yanlemu market) within the Lafia metropolis, from September, 2019 to March 2020. The fly specimens were analyzed for the presence of pathogenic parasites and bacteria using standard laboratory procedures. The results showed that the parasites: Entamoeba histolytica was most prevalence with (22.11%) Ascaris lumbricoides being (15.05%), Taenia species (14.70%) schistosoma mansoni (14.70%), Hookworm and Trichuris trichura recorded least prevalence accounting for (1.12%) respectively, pathogenic bacteria isolated and identify from the houseflies are; Staptylococcus sp (36.36%), Bacillus species (19.48%), Klebsiella sp (19.75%), Escherichia sp (6.49%), Protens sp (7.41%), Salmonella sp (6.49%) and Moraxella sp (2.47%). The result showed significant variation ($P < 0.05$) for both the parasites sp abundance and housefly abundance across the sampled location; however, there was no significant difference ($P > 0.05$) associated with the frequency of occurrence of bacteria species. It can be concluded that *Musca domestica* in Lafia harbor parasites and bacteria on their external and internal parts. The housefly have mechanical potential to transmit pathogens to man. Measures must be taken to control the fly population to avoid both present and future outbreaks of diseases condition emanating from the flies activities.

Keywords: Houseflies, parasites, bacteria and Lafia

INTRODUCTION

Houseflies (*Muscadomestica*) are common insects of the family muscidae, order Diptera. They are synanthropic insects that are widely distributed worldwide. They enter several places including contaminated premises due to their own biological habitats and other diseases causing organisms. As a result housefly, for instance, can spread diseases such as food poisoning and dysentery (Adebayo *et al* 2012). The behavioral characteristics of the housefly (*Musca domestica*), ensure its contact with food and wastes of man and animals and this manner are able to transport pathogenic organism from contaminated materials to man (Nazni, *et al.*, 2005).

These parasitic diseases are relatively common in the slum and rural areas of many country and their high prevalence is closely associated to poverty for environmental sanitation, poor hygiene, and impoverished health services (Montresor, A *et al.*, 1998). Defecation outside latrines by heavily infected persons have been recognized as the main sources of the pathogen.

Houseflies move around mostly during the day and like warm places showing preferences for direct sunshine, and as mechanical vectors, they pick up the infectious agent on the outside of its body and transmit it in a passive manner (Oghale, O.O. *et al.*, 2013). Flies can carry human pathogens on their sponging mouth parts, on their bodies and hairy legs (setae) or on the sticky pads of their feet (Tarsi).

More than 100 pathogens have been known to be associated with housefly and may cause diseases in human and animals, including typhoid, cholera, basically dysentery, tuberculosis, anthrax, ophthalmic and infantile diarrhea. The role of houseflies in the transmission of helminthes eggs: *A. lumbricoides*, *T. toichiura*, *E. vermicularia*, *T. caracanis* and *S. stercoralis*, protozoan cysts and *Trophozoites species*, *Diphufloborium species* and bacteria such as *Shrigella species*, *E. coli* is well documented (Oyeyemi, O.T. *et al.*, 2016, Oyenwe, E., *et al.*, 2016 and Vazirianzadeh, B. *et al.*, 2008).

The aim of this study is to identify the bacterial pathogens as well as parasites associated with house flies in Lafia, capital of Nasarawa State.

MATERIAL AND METHODS

This study was carried out in Lafia the capital city of Nasarawa State, Nigeria. It is located in the North Central of Nigeria. The climate of the area is tropical and the vegetation is predominantly guinea savannah with an annual rainfall of 1,090mm. there are two distinct seasons the rainy season and the dry season; the former last from April to October and latter from November to

March. The minimum temperature range of 27°C – 28°C and maximum of 32°C – 36°C. The population of Lafia is estimated to be 450, 683 Lafia, being in the guinea savanna is typified by very high temperature and low rainfall. The problem associated with the collection treatment and disposal of solid wastes has resulted to the pollution of the soil, water and air. This has created a breeding area for biological vectors as insects including houseflies and rodents, which could cause public health concern (Deutscher Wetter dients, 2016; (NOAA) 2016 and World Gazetteer, 2007).

The field investigations were carried out in five (5) sites including: New market, Neighborhood market, Kasuwan Tumatur, Kasuwan Koro, and Yanlemu market. Activities surrounding the markets and houses have aggravated the concentration of wastes and waste products, giving the fly a good breeding and feeding habitats.

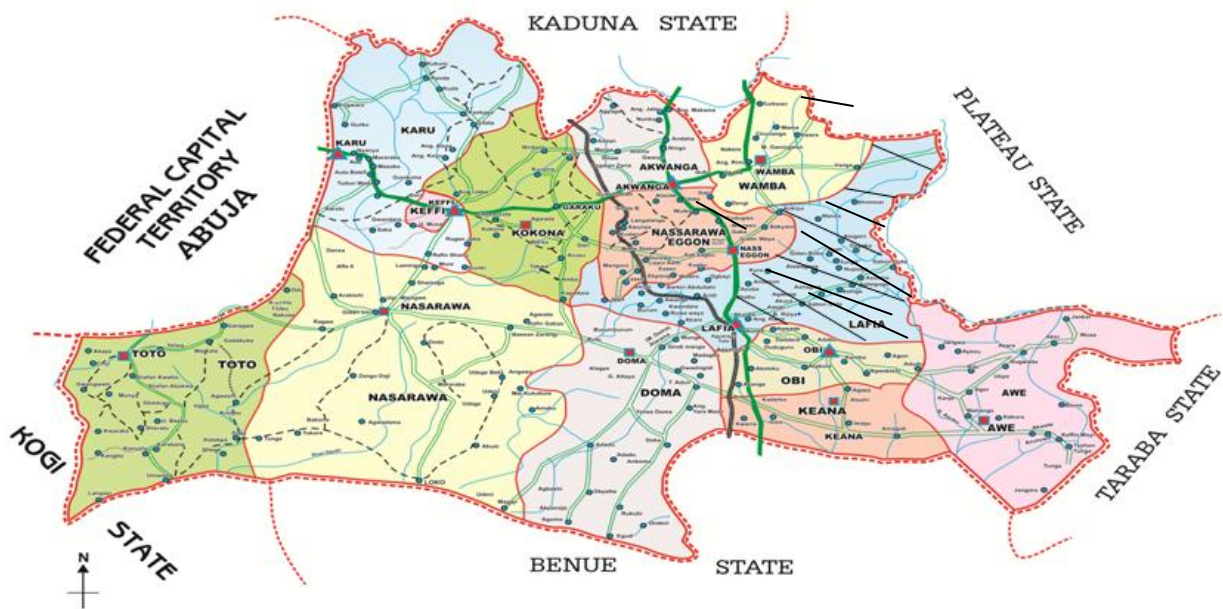


Fig 1: Map of Nasarawa State showing the selected study town

Housefly Specimen Collection

A total of two hundred and fifteen (215) houseflies were collected from this study, from September, 2019 to March 2020. In each of the location twelve (12) flies were collected from two (2) randomly selected sites including refuse duping, abattoir, locally brewed beer (burukutu). The houseflies were collected using fly traps, and sweep fly net made from mosquito net. Two (2) to ten (10) sweeps carried out in each site. The captured flies were transferred into meshy cages and taken alive to the laboratory. The specimens were identified and characterized as *Musca domestica* using key (Couri, M.S. (2007)).

Processing of Specimen

The flies were killed by exposure to chloro form for a few minutes in the mesh cage. This was done in order not to alter the distribution of the microbial flora and fauna on their body surfaces. The flies were then picked up using a pair of forceps and placed into test tube containing 2.0ml of normal saline arranged in groups according to their locations. The flies were gently rinsed by stirring with a glass rod in order to wash the microbial flora and fauna on the flies into normal saline. Hence, a drop of the normal saline from each tube was aseptically cultured in three different bacteriological media (Mac Conkey agar, chocolate agar, and cysteine lactose Electrolyte Deficient (CLED) medium all in triplicate and incubated at 37 °C for 24 hours. The remnant was centrifuged and decanted to obtain the concentrate, was later used to make wet mount and examined under the microscope (Adeleke, M.A. *et al.*, 2017).

The wet flies were then collected from the test tubes and washed in ethanol to decontaminate their surfaces. They were later washed in normal saline in order to wash off excess alcohol that may affect internal microbial flora during dissection. The flies were exposed to air to dry and there after pounded in the mortar using pestle. The resulting mixture was cultured and incubated

in the same way as the body surface washing according to the methods of (Adeleke, M.A. *et al.*, 2017 and Muhammad, H.M., *et al.*, 2014).

Parasitological Examination

The washing of houseflies bodies were obtained separately centrifuged and decanted. The deposits were then dropped on clean grease freglabs slides and a cover slip was placed upon the drop iodine was then pipette from the side of the cover slip to give a clear view of the parasite forms. The slide was mounted on the microscope and viewer using the ^x10 objective of the microscope first then ^x40 objective to confirm. The internal parts were not analyzed for parasites because parasites do not survive for long in the flies before they are metabolized (Mawak and Olukose, 2006).

Bacterial Isolation of Pathogens

24 hours after incubation, the cultured specimen were brought out and examined from growth. Result and colonies were identified using morphological characteristics of the colonies namely; Gram reaction, colonial morphology catalane test, as described by Cheesbrough, M. (2000) and as adopted by (Mawak and Olukose, 2006).

Data Analysis

Simple percentages were used to explain frequencies and chi-squared test for homogeneity across sample parameters, significances difference considered at p-value of 0.05.

RESULT

Table 1 result showed an association between houseflies and some pathogenic organisms, specifically bacteria and parasites. A total of 11 parasites and 7 bacteria species were discovered and the results obtained are presented in the tables below:

Table 1: Prevalence of Intestinal Parasites isolated from Houseflies in Lafia

Pasites dictated	Frequency of occurrence	Prevalence (%)
<i>Entamoeba histolytica</i>	13	22.11
<i>Ascaris lumbricoides</i>	9	15.5
<i>Taenia sp</i>	8	14.70
<i>Enterobiun vermicularies</i>	4	6.49
<i>Schistosoma mansoni</i>	8	14.70
<i>Hymeno lepisnana</i>	5	8.62
<i>Schistosoma haematobium</i>	3	5.17
<i>Giardia lumblia</i>	4	6.49
<i>Trichostrongylus spp</i>	2	3.44
<i>Hookworm</i>	1	1.12
<i>Trichuris trichiura</i>	1	1.12
Total	58	100

($X^2 = 12.02$, $p < 0.5$)

Table 2: Intestinal bacteria species isolated from the external and internal washing of *M. domestica*

Bacteria distated	Occurrence	Prevalence (%)
Staphylococcus sp	28	36.36
Bacillus sp	15	19.48
Klebsiella sp	16	19.75
Escherichia sp	5	6.49
Proteus sp	6	7.41

Salnionella sp	5	6.49
Moraxella sp	2	2.47
Total	77	100

Table 3: Distribution of Housefly (*Musca domestica*) according to sites of collection in Lafia

Location	No of flies collected	Percentage (%)
New market	64	24.75
Neighborhood market	44	20.48
Kasuwan Tumatur	43	20
Kasuwan Koro	36	16.74
Yanlemu market	28	13.02
Total	215	100

($X^2 = 0.62, p < 0.05$)

Table 1 showed the prevalence of intestinal parasites isolated from houseflies (*Musca domestica*) sampled from the study location. Eleven (11) different types of parasites were isolated from the guts of the houseflies. This consist of (*Entamoeba histolytica* cysts, *Ascaris lumbricoides* eggs, *Taenia solium* and *Taenia saginata* cysts, *Enterobius vernicularis*, eggs, *Schistosoma haematobium* and *Schistosoma mansoni* eggs, *Hymenolepis nana* cysts, *Giardia lamblia*, *Trichostionglylus sp* eggs, *Hookworm* eggs, and *Trichuris trichiuria* eggs respectively).

Individually, *Entamoeba histolytica* was most prevalent with (22.11%) of the total parasites isolated, followed by *Ascaris lumbricoides* (15.05%), then *Taenia speciu* (14.70%) *Schistosoma mansoni* (14.70%) whereas Hookworm and *Trichuris trichiura* recorded the least prevalence accounting for (1.12%) respectively of the total parasites isolated.

Table 2; Pathogenic bacteria isolated and identified from the houseflies are: staphylococcus sp (36.36%), Bacillus sp (19.48%), Klebsiella sp (19.75%), Escherichia sp (6.49%), proteus sp (7.41%) salmonella sp (6.49%), Moraxella (2.47%). The result showed significant variation ($P < 0.05$).

Table 3; A comparison of the houseflies sampled from different locations indicated that houseflies from new market recorded the highest percentage prevalence of intestinal parasites being (24.75%), followed by houseflies collected from Neighborhood market recording (20.48%), then those from Kasuwan Koro and Yanlemu market recorded the least prevalence of (16.74%) and (13.02%) respectively. The percentage prevalence differences was (X^2 16.02, $P < 0.05$).

DISCUSSION

The study research revealed that houseflies play important role in transmission diseases as shown from the parasite carried in their intestinal parts. Houseflies have been reported to have a negative psychological impacts as they are considered as nuisance and a sign of unhygienic conditions (Oyenwe, E. *et al.*, 2016). The researched town (Lafia) is a filthy environment where houseflies are abundant and are suspected to spread diseases because they feed freely on human food and filthy matter alike. The flies pick up disease causing organisms while crawling, feeding. This contaminates food materials cause bacteria diseases like typhoid cholera, dysentery and virus diseases like viral hepatitis (Oyenwe, *et al.*, 2016). The vector potential of *Musca domestica* for pathogenic bacteria and parasites can be attributed to their contact with faeces or feacally contaminated materials in the environment since most of the microorganism associated with flies are known for gastrointestinal disorders and can be passed out in the faeces of infected

persons. Foods-borne infections are major causes of illness and death worldwide (Rosek, M. *et al.*, 2003 and WHO 2002).

The result recorded in the present research agree with the report of (Suleiman, S. *et al.*, 1988) in Malaysia where they isolated *Acinetebacter species*, *Bacillus species*, *Enterobacter species*, proteins species and *Escharichia species*. The finding by (Potedar, R, *et al.*, 1992) agree with the study that *M domestica* harbor pathogenic bacteria species in its internal parts and can transmit them to man mechanically of great importance is revelation that both the external and internal parts of the flies carried the same type of pathogens such as *Entamoeba histolytica*, *Giardia lamblia*, *Taenia sp*, *Ascaris lumbricoides*, *Trichoris trichiura* and *Hymenolepis nana* and that the hind gut carried most of these parasites than the others.

This result agree with the findings reported by Adeyeb O.A and Okpola N. (2000) in Ibadan Nigeria and (Mohammad *et al.*, 2014) in Shira² southern Iran where their individual studies reported *Musca domestica* as mechanical vectors for transmission of some parasite species.

The flies caught from new market incidentally had the highest form of contamination with parasites which agrees with the reports of by Akogun and Badaki in Adamawa and Oghale *et al* (2013) in Umuahia who conducted as study to assess the level of parasitic load of parasitic load in dry and rainy seasons from different in their metropolis of study and uncovered that houseflies caught in pit latrine had the highest form of contamination with parasites as compared to those from eateries (Dipelu O.O 1997, Akogun and Badaki 1998).

CONCLUSION

The presence of houseflies in this study indicates sanitary deficiency and unhygienic conditions. Adult houseflies are not only a nuisance to animals; they carry many pathogens which may be transmitted to man and animals resulting in outbreaks of diseases of both parasitic and bacterial

origin causing a reduction in animals production, human work hours and financial losses through the treatment and loss of infected animals by death.

RECOMMENDATION

It is thus, recommended that normal hygiene is sufficient enough for fly control in temperate regions, but warm regions need more strategic control measures. The control measures should include strict legislator standards for the hygienic conditions of places like schools, hospitals, market places, public toilets, slaughter houses and food processing outlet. The public should also be educated on the dangers of poor sanitation, which inevitably breeds flies. In emergency case, measures, like insecticides, flytraps, and wire screens can be used.

REFERENCES

- Adebayo, T.B., Ekanem, M.S. Odu, N.N., Igwllloh, N.J. Okonkwo I.O (2012). Pathogen microorganisms associated with houseflies within Uyo metropolis during the wet season. *Researcher*: 2,4: 37-41.
- Adeleke, M.A., Oyewole, V.O., Olabiyi, K.O., Oforka, L.C. (2017). Parasites and pathogenic bacteria associated with houseflies and the public health implications in Osogbo, South wet Nigeria. *Munis Entomology and Zoology*, 12(1):94-98.
- Adeyeba O.A., Okpala, N. (2000). Intestinal parasites and bacterial pathogens carried by common filth houseflies in Ibadan, Nigeria *African J. Med. Pharma Sci* 4:53-63.
- Akogun, O.B., Badak, J. (1998). Intestinal helminthes infection in two communities along the Benue River Valley, Adamawa State, Nig. *J. Parasitol*, 19:67-72.
- Cheesbrogh, M. (2000). District Laboratory in Tropical Countries (Part 2). *Cambridge University Press-India*.

- Couri, M.S. (2007). A key to the Afrotropical Genera of Muscidae (Diptera), *Revista Brasileira de Zoologia*, 24(1): 175-184.
- Deutscher Wetterdienst (DWD), (2016). Klimatafel von Makurdi, Nigeria, Baseline means (1961-1990) from stations all over the world (in German). Retrieved from <http://www.dwd.de/DE/Home/home-mode.html> on 10 January, 2016.
- Dipeolu, O.O. (1997). Field and Laboratory Investigations into the role of the Musca species in the transmission of intestinal parasitic cysts and eggs in Nigeria. *JHyg Epidemiol Microbiol Immunol*. 21: 209-214.
- Fotedar, R., Banerjee, U., Singh, S. and Verma, A.K. (1992). The (Musca domestica) as a carrier of pathogenic microorganisms in a hospital environment, *9th Edition Journal of Hospital Infections*, 20:209-215.
- Mawak and Olukose (2006). Vector potential of houseflies (*Musca domestica*) for pathogenic organisms in Jos, Nigeria. *Journal of Pest, Disease and Vector Management*, 7:418-423.
- Mohammad, H.M. Davood, M., Golnoush, M. (2014). The role of *Musca domestica* as a carrier of parasites in Shiraz, Southern Iran. *Academy Journal for Entomology*, 7(3):84-87
- Montresor, A., Crompton, D.W.T., Hall, A. Bundy D.A.P. and Savioli, L. (1998). Guidelines for the evaluation of soil-transmitted helminthiasis and schistosomiasis of community level. WHO/CTD/SIP/98.1
- National Oceanic and Atmospheric Administration (NOAA), (2016). Makurdi Climate Normals 1961-1990, Retrieved from <ftp://ftp.atdd.noaa.gov/pub/GCOS/WHO.Normals/TABLES/REG.-I/NI/65271.TXT> on 10 January, 2016.
- Nazni, W.A., Seleena B., Lee HL Jeffery, J.T., Rogayah, T.A. Sofian M.A. (2005). Bacteria fauna from the house fly, *Musca domestica* (L) Trop Biomed 22:225-31.

- Oghale O.O. Amaechi, C.E., Obike, U.O. (2013). Parasite load on *Musca domestica* (Diptera: Muscidae) from different synanthropic environments in Umuahia Metropolis, *J. Public Health Epidemiol* 5:309-312.
- Onyenwe, E., Okore, O.O., Ubiaru, P.C. and Abel, C. (2016). Housefly-borne helminth parasites of Mouau and its public health implication for the university community. *Animal Research International* 13(1): 2352-2358. ISSN: 1597-3115.
- Oyeyemi, O.T., Agbaje, M.O. and Okelue, U.B. (2016). Food-borne human parasitic pathogens associated with household cockroaches and houseflies in Nigeria *Parasite Epidemiology and Control* 1: 10-13.
- Rosek, M. Bern, and Guerrant, R.L. (2003). The global burden of diseases as estimated from studies published between 1992 and 2002. *Bulletin of the World Health Organization*, 81:137-2003.
- Sulaiman, S. Aziz, A.H. Hashim, Y. Abdul Rahim, S. (1988). Isolation of entero-pathogenic bacteria from some cybercorrhaphan flies in Malaysia. *Malaysia Applied Biology*, 17: 129-133.
- The World Gazetteer, (2007). <http://www.world-gazetteer.com/wg.php?men=gpro&des=gamelan&geo=351846853>.
- Vazirianzadeh, B., Solary, S.S., Rahdar, M. Hajhossien, R. and Mehdinejad, M. (2008). Identification of bacteria which possible transmitted by *Musca domestica* (Diptera Muscidae) in the region of Ahvaz, South-West Iran. *Jundishapur, Journal of Microbiology*, 1 (1): 28-31.
- WHO (2002). WHO Global Strategy for Food Safety Safer food for better health. *World Health Organization, Geneva*.