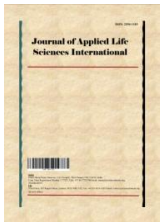

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Bacteria and Parasites Pathogens Associated with the Houseflies (*Musca domestica*) in Lafia Metropolis of Nasarawa State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Houseflies (*Musa domestica*) are common insects of the families muscidae, order Dipthera. 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, Neigbourhood 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 hietolytic was most prevalence with (22.11%) Ascaris lumbricoides being (15.05%), Taenia species (14.70%) schistosoma mansoni (14.70%), Hookworm and Trichnris trichura recorded least prevalence accounting for (1.12%) respectively, pathogenic bacteria isolated and identify from the houseflies are; *Staplyloccus* 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

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harbor parasites and bacteria on their external and internal parts. The housefly have mechanical potential to transmit pathogens to man. Measures most 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; Lafia.

1. 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 [1-7]. As a result housefly, for instance, can spread diseases such as food poisoning and dysentery [8]. 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 [9].

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 [10]. 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 [11]. Flies can carry human pathogens on their sponging month 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 [12] (Oyenwe, E., *et al*., 2016) [13].

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.

2. MATERIALS 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 $27^{o}C$ – $28^{o}C$ and maximum of $32^{o}C$ – $36^{o}C$. 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 breading area for biological vectors as insects including houseflies and rodents, which could cause public health concern [14,15,16].

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.

2.1 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 not 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 [17].

2.2 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 for ups and placed into test tube containing 2.0ml of normal saline arranged in groups according to their locations. The flies were gently rinsed by starring 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 Conkeyagar, chocolate agar, and cysterine lactose Electrolyte Deficient (CLED) medium all in triplicate and incubated at 37 UC 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 [18].

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 pistil. The resulting mixture was cultured and incubated in the same way as the body surface washing according to the methods of [18], and Muhammad, H.M., *et al*., 2014).

2.3 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 $^{x}10$ objective of the microscope first then $^{x}40$ 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 [19].

2.4 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 [19].

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

2.5 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.

3. RESULTS

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 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 haematobuim* and *Schuitosoma mansoni* eggs*, Hymenolepis nana cysts, Giardia lamblia, Trichostiongylus sp* eggs*, Hookworm* eggs, and *Trichuris trichiuria* eggs respectively).

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

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

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; Pathonic bacteria isolated and identified from the houseflies are: staphyloccus sp (36.36%), Bacillus sp (19.48%), Klebsiella sp (19.75%), Escherichria 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 comparism 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, $P<0.05$).

4. 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 feaces 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 [20,21].

The result recorded in the present research agree with the report of (Sulaiman, 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 Adeyeba O.A and Okpola N. [22] 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 O.B. and Badaki J. [1] in Adamawa and Oghale et al. [11] 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 (Dipeolu O.O 1997, [3].

5. 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.

6. 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.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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