Journal of Sustainable Veterinary & Allied Sciences
P-ISSN-2695-2661 e-ISSN: 2811-1346
JoSVAS 2025 March Vol 7 Issue 1: 144-149

Original Research Article

Evaluation of Parasitic Load of M*usca domestica* on Three Selected Food Items Obtained from Different Markets in Umudike and Environs

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ABSTRACT

Musca domestica, the common house fly transmits a number of pathogenic organisms from humans or animals to humans. This study identified the common intestinal parasites associated with *M. domestica* obtained from three food items; meat, fish and tomatoes in three selected markets in Abia State, Nigeria. Five Hundred and Seventy Nine (579) house flywere captured during the study from which parasites were isolated using the floatation and sedimentation methods.Four intestinal parasites belonging to the protozoan and helminthes groups were isolated. The protozoans were *Entamoeba* sp., (52.00%) and *Giardia* sp., (20.00%) while the helminths included Hookworm (12.00%) and *Ascaris* sp. (16.00%). Infection did not differ significantly between sample sites; however, samples collected from Umudike market had a higher prevalence of contamination while the least was observed from Ahiaeke market with 59.8% and 18.82% respectively. Sources of samples revealed that flies collected from tomatoes had a higher parasite load with 40.00% while meat sources share the least prevalence of infection of 28.00%. However, there was no significant difference in the prevalence of infection among samples with respect to sample sources (*P>0.05*). Contamination of *M. domestica* with more than one parasite species was encountered during the study. *Entamoeba* sp was the most frequently encountered parasites (52.00%) while the least was hookworm (12.00%). The findings of the present study reveals a high prevalence of contamination of *M. domestica* in the study area which suggest public health intervention in order to curb the transmission of these parasites to man.

Keywords: fish, parasites, meat, *Musca domestica*, pathogens, tomatoes

INTRODUCTION

Houseflies (*Musca domestica*) are the most common of all domestic flies; they account for about 90% of all flies in human habitation all over the earth (Mike, 2014, Nmorsi *et al*., 2016). *M. domestica* are of the family Muscidae, order Diptera and they are one of the most synanthropic and cosmopolitan flies found in the tropics (Balla *et al.,* 2014). They are indeed one of the most widely distributed insects, found all over the world. *M. domestica* acts as vector of parasitic, bacterial, viral and protozoan infections (Issa, 2019). They are also a major source of distraction constituting nuisance and confusion to man especially with their buzzing sound. Their mode of feeding and body aid in the transmission of pathogens of diseases to man through perching on food and body surfaces. The presence of *M. domestica* in a place presents such a place as being dirty since they are attracted to dirt and untidy environment. Thus, to avoid contamination, high level of personal hygiene and environmental sanitation is needed to keep the fly population in check since they proliferate in large number.

In developing countries, intestinal parasitic infections and malnutrition are recorded to be among the most serious health issues (Debash *et al.*, 2023). They affect people causing complications which may result to death. Agbalaka *et al.* (2020) identified the parasites of public health importance on *M. domestica;* the parasites recorded in the study and theirprevalence include Hookworm (32.9%), *Strongyloides stercoralis* (21.1%), *Entamoeba histolytica* (16.8%), *Ascaris lumbricoides* (13.2%), *Fasciola* spp (7.5%), *Teania* spp (5.7%), and *Balantidium coli* (2.9%). Archie & Alene (2022) listed *Necator americana* and *Ancyclostoma duodenales* as two species of hookworms

http://doi.org/10.54328/covm.josvas.2025.274

infecting humans and that these two species are globally distributed.

Ebenezer *et al.* (2020) conducted a study to determine the parasite and microbial load of housefly in Bayelsa, Nigeria. The authors reported a 16.7% contamination of housefly with intestinal parasites. The parasites includes; *Entamoeba histolytica, Trichiuris trichuira, Ascaris lumbricoides*, Hook worm and *Enterobius vermicularis* with prevalence of 33.3%, 26.7%, 20%, 13.3% and 6.7% respectively.

Nwankwo *et al.* (2019) in Umuahia metropolis, reported the prevalence of microbiota and parasite on housefly from different sites. *Entamoeba histolytica* (32.7%), and *Endolimax nana* (30.9%) were the only parasite species encountered by the researchers during their study. Parasitic load on *M. domestica* (Dipthera: Muscidae) from different synanthropic environments in Umuahia was conducted by Okore *et al.* (2013). The authors noted that the result of their study was affected by inadequate personal hygiene and environmental sanitation. They reported that six different parasites were isolated from both the exoskeleton and the gut of the *M. domestica* captured in the different synanthropic sites. The pit latrines had the highest parasite prevalence (57.60%), while the eateries had the lowest prevalence (30.92%). *Entamoeba histolytica* was the parasite with the highest prevalence (25%), while *Haemenolypes nana* had the lowest prevalence (11.36%). Other parasites reportedly recovered by the researchers in the study included; *Giardia lamblia, Ascaris lumbricoides, Trichiris trichuira and Enterobius vermicularis.* Onyenwe *et al.* (2016) conducted a study in the same study area as this present study (Umudike) to identify the intestinal parasite load present on housefly in the study area. The authors reported that all parasites recovered from the flies were all eggs of helminths represented by *Ascaris lumbricoides* (54.54%), *Necator americanus* (42.42%) and *Fasciola hepatica* (3.03%).

Similar works have been carried out in some African countries. Ibrahim *et al.* (2018) investigated the prevalence of intestinal parasites on housefly from three slaughter houses within Khartoum State, Sudan. The researchers reported an overall contamination of flies with parasite as 2.9% with central market of Khartoum (4.7%), Khartoum North (2.3%) and Omdurman slaughter houses (18.1%). The identified intestinal parasites were *Entamoeba coli* cyst, *Entamoeba histolytica/dispar* cyst, *Giardia lamblia* flagellate, *Giardia lamblia* cyst, *Hymenolepis nana* egg and *Taenia species* egg with infectivity rates of 33.3%, 19%, 19%, 14.3%, 9.5% and 4.8% respectively of the total house flies collected. Debash *et al.*, 2023 investigated the overall prevalence of intestinal parasites among school-age children and recorded 44.3% (178/402). The report had seven species of intestinal parasites identified. The predominant parasite identified was *E. histolytica/dispar* (11.2%), followed by *H. nana* (9.2%) and *G. lamblia* (6.7%).

The fact that there are abundance of documented evidence on the role of *M. domestica* in transmitting parasite to man, little has been done in investigating the parasitic load of houseflies on Meat, Fish, and Tomatoes around markets in Umudike metropolis,. This research was therefore carried out to ascertain the prevalence of parasites on these foodstuffs sold on daily basis in the markets.

MATERIALS AND METHODS

The present study was carried out in Umudike, Ahiaeke and Amawom commuinities. Ahiake is in the Umuahia North Local Government Area while Umudike and Amawom are in Ikwuano LGA, Abia State, Nigeria.. The study area is located in the South-Eastern region of the country and lies within longitude $5^0$47’27’’ N and latitude $7^0$54’08’’E. The climatic condition of the study area is that of a typical tropical region. The annual rainfall is about 2500 mm with a mean annual temperature of 32°C and a relative humidity of 75%.

INFORMED CONSENT

Prior to sampling, permission was obtained from the sellers in the randomly selected markets. Information on the sellers and buyers around the study sites were treated with utmost confidentially.

SAMPLE COLLECTION

M. domestica were sampled for two weeks around 11am to 12pm daily using sweep net at Ahiaeke, Amawom and Umudike markets. Date of capture was recorded in each sterile collection tubes accordingly. Forceps were used to pick flies collected with each sweep of the net from the meat, fish and tomato stands into labeled sterile collection tubes and 7ml of normal saline was added to each tube. The labeled tubes were transported to the laboratory at the Department of Zoology and Environmental Biology, Michael Okpara University of Agriculture, Umudike for further analysis.

ISOLATION OF PARASITES FROM EXTERNAL SURFACES OF *M. DOMESTICA*

M. domestica in the collection tubes were shaken vigorously inside the wash fluid (normal saline) to dislodge parasites from external surfaces of the flies. The washed fluids were then transferred into a conical glass test tube and centrifuged at 3000 rpm for 3 minutes.

Sediments were examined under light microscope using 10X for examination of parasite and 40X for identification (Nmorsi *et al.*, 2006).

IDENTIFICATION OF PARASITES

Diagnosis was based on the identification of parasite ova and protozoan cyst and trophozoite in the sample during microscopic analysis. Identification was done with the aid of parasitological atlas (John, 2009).

STATISTICAL ANALYSIS

Data analyzed using Microsoft excel version 2007. Summary statistics (frequencies, proportions) in the form of tables, texts and figures were used to express the findings. Simple percentages were used to explain frequencies and were determined by chi square test ($\chi 2$) from the contingency tables. Level of significant was determined at $P<0.05$.

RESULTS

PARASITIC LOAD ON *M. DOMESTICA*

Four (4) different parasites were isolated from a total of 579 *M. domestica* caught in the course of this study. The parasites include *Entamoeba spp, Ascaris Lumbricoides*, Hookworm and *Gardia* spp. The parasites are listed in Table I with some details on their classifications.

(*p-value*>0.05)

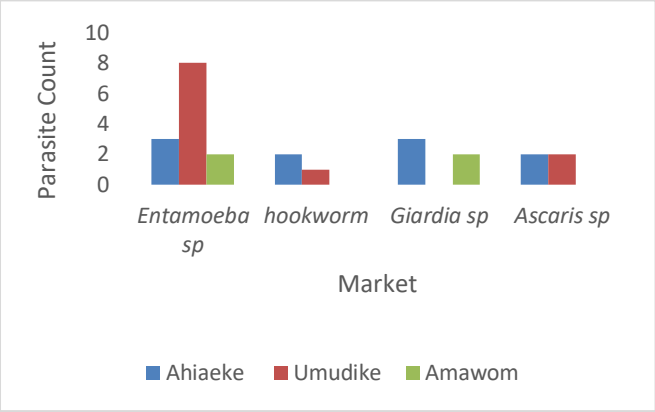

Figure I: Prevalence of the isolated parasites based on study area

PREVALENCE OF INTESTINAL PARASITES ISOLATED FROM THE STUDY AREA

Entamoeba spp. had the highest prevalence of 52.00%, closely followed by *Giardia spp* with 20.00%, *Ascaris lumbricoides* had the prevalence rate of 16.00% while Hookworm spp recorded the least prevalence with 12.00%.

TABLE I: LIST OF PARASITES ISOLATED

Parasite	Phylum	Class	Order	Family	Species
1	Protozoa	Lobosa	Amoebida	Entamoebidae	*Entamoeba spp*
2	Nematoda	Chromadorea	Ascaridida	Ascarididae	*Ascaris lumbricoides*
3	Protozoa	Zoomastigophora	Diplomonadida	Hexamitidae	*Giardia lamblia*
4	Nematoda	Chromadorea	Rhabditida	Ancylostomatidae	*Ancyclostoma duodenale*

PREVALENCE OF *M. DOMESTICA* AND PARASITES ACCORDING TO STUDY AREA

The prevalence (in percentages) of the flies and parasites according to the study area is shown in Table II and Figure I. Umudike market had the highest number of *M. domestica* collected (59.8%) closely followed by Amawom 21.41% while the least was obtained from *M. domestica* collected in Ahiaeke market with 18.82%. The numbers were not statistically significant ($p > 0.05$) when compared with the number of parasites isolated; these are shown in Figure I.

TABLE II: DISTRIBUTION OF *M. DOMESTICA* ACCORDING TO SITES OF COLLECTION IN UMUDIKE

Location	No. of *M. domestica* Collected	Percentage (%)
Ahiaeke	109	18.82
Umudike	346	59.8
Amawom	124	21.41
Total	**579**	**100**

P-value = 0.22337 Result is not statistically significant

Although there were variability in the number of parasite recovered from *M. domestica* from various sampling sites, the results were not statistically significant as ($p > 0.05$).

TABLE III: PREVALENCE OF PARASITES ISOLATED

Parasites Isolated	Frequency of Occurrence	Percentage (%)
Entamoeba spp.	13	52
Hookworm spp	3	12
Giardia spp.	5	20
Ascaris spp.	4	16
Total	**25**	**100**

***P-value* = 0.1814**

PREVALENCE OF ISOLATED PARASITES IN RESPECT TO SOURCE OF SAMPLE

Among the three (3) source samples: tomatoes, meat and fish; there was little or no variation in the number of parasites recorded. However, *M. domestica* collected from tomatoes had the highest prevalence for parasite recorded followed by meat while the least was from fish with 40.00%,

32% and 26.00% respectively (see Table IV). There was no statistical difference in the prevalence of parasite recovered from housefly with respect to source of sample ($p>0.05$). The occurrences of these parasites in each of the sourced samples are shown in Figure II.

TABLE IV: PREVALENCE OF PARASITES ACCORDING TO SOURCE OF SAMPLE

Source of Sample	Frequency of Occurrence	Percentage (%)
Tomato	10	40
Meat	8	32
Fish	7	26
Total	**25**	**100**

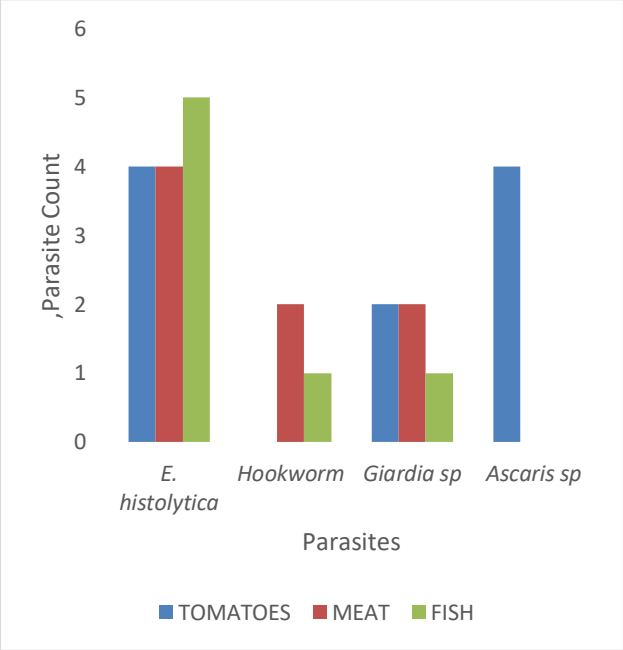

Figure II: Prevalence of the isolated parasites with respect to source of samples

PREVALENCE OF SINGLE AND MIXED PARASITIC LOAD OF *M. DOMESTICA* COLLECTED FROM THREE DIFFERENT MARKETS

The results from the three (3) markets showed either mixed or single harbor of the parasites (see Figure III). For single infection prevalence, *Entamoeba* sp was the most frequently observed parasite which accounted for 47% followed by hookworm 11% while *Ascaris* and *Giardia spp* accounted for 5% prevalence each. For mixed infection, the result had *Entamoeba* and hookworm co-infection and *Entamoeba* and *Giardia* co-infection with each recording 5% and 11%. *Ascaris* and *Giardia* co-infection and *Entamoeba* and *Ascaris* co-infection accounted for 11% and 5% prevalence each. This is shown in a pie chart in Figure III.

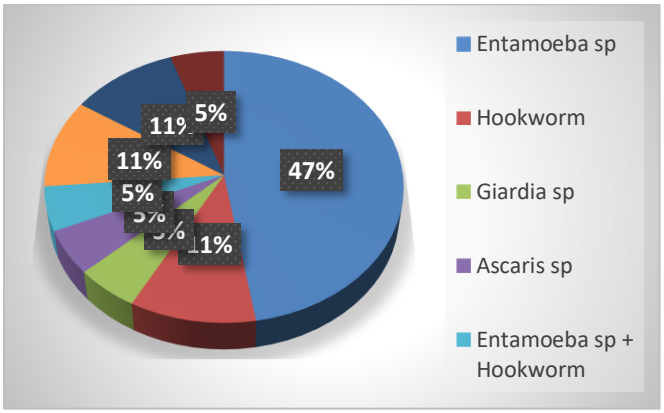

Figure III: Prevalence of mixed and single infection

DISCUSSION

Musca domestica has long been established as a notable vector of diseases. They are common around households, garbage, human, and animal excreta (Okore *et al.*, 2013). In this study, Four(4) genera of intestinal parasites consisting two (2) protozoans and two (2) helminth were isolated from the external surface of *M. domestica* collected from the various sampling sites, indicating that the external organs of *M. domestica* (legs, wings, and mouthparts) constitute a large source of parasites which are in agreement with the report of Okore *et al.* (2013), Onyenwe *et al.* (2016), Nwankwo *et al.* (2019), Agbalaka *et al.* (2020) and Ebenezer *et al.* (2020).

This study is consistent with the reports of Okore *et al.* (2013) who reported a prevalence of 57.60%, somewhere closer to the study area. However the reports of this study differs from the findings of Ebenezer *et al.* (2020) who reported a lower prevalence of 16.7% contamination of *M. domestica* with intestinal parasites in Bayelsa, Nigeria. Also, the prevalence observed in the present study is higher when compared to 2.9% reported by Ibrahim *et al.* (2018).

The implication of this observation opined that, the factors which favours transmission and contamination of parasite which include; inadequate water and toilet facilities, low level of environmental sanitation, lack of knowledge of parasites, among others (Worknel *et al.*, 2014; Usip & Matthew, 2015) may be in abundance in the Umudike market consequently resulting in high contamination of *M. domestica* in that site. *M. domestica* require a suitable substrate to thrive on, of which they have preference for decomposed organic matter.

The parasites isolated in the study include *Entamoeba* sp 52.00%, hookworm 12.00 %, *Giardia sp* 20.00% and *Ascaris sp* 16.00 %. This implies that *Entamoeba* species were the frequently recorded species among the type of parasites obtained from the *M. domestica* in the study. However, this result was not statistically significant ($P>0.05$). The implication of this is that, contamination of

M. domestica with parasites ova, cyst or trophozoite in the study sites was not dependent on the parasite type.

This observation is in accordance with the findings of other researchers (Ebenezer *et al*., 2020). Nwankwo *et al.* (2019) observed that *Entamoeba* species were higher in prevalence than other type of parasite but differs from the findings of Agbalaka *et al.* (2020) and Onyenwe *et al.* (2016) who reported otherwise that hookworm and *Ascaris* sp were the most prevalent parasites associated with *M. domestica* respectively.

The prevalence of contamination based on source of samples were also evaluated. Samples were gotten from three sources within the study sites; tomatoes, meat and fish. There was little or no variation in the number of parasites recovered from each of the type of source. However, *M. domestica* obtained from tomatoes had the highest prevalence for isolated parasites while the least was among samples obtained from fish 40.00% and 28.00% respectively. The high contamination of *M. domestica* from tomato source might be due to the fact that tomato is cultivated on soil of which more than half of the parasite are soil transmitted. Also, tomato has a low shelf life which means they are prone to microbial invasion and mechanical spoilage leading to deterioration in quality and thus serving as a good attractant of *M. domestica*.

In areas of high contamination, there is possibility for infection with more than one parasite species, *M. domestica*collected from the three markets were found to be contaminated with more than one parasite species. For mixed infection, *Entamoeba* and *Giardia* co-infection and *Ascaris* and *Giardia* co-infection each accounted for 11% which ranked them as the most frequently observed parasites while *Entamoeba* and hookworm co-infection and *Entamoeba* and *Ascaris* co-infection each accounted for 5% prevalence.

The discrepancies existing among the report of the present study and those of previous researchers might be due to the differences in geographical locations of study, timing, seasonal difference, differences in sample size, differences in parasitological techniques used, among others. Mazigo *et al.* (2021) suggested that differences in geographical location and sample size are among the determinant factors for infection prevalence.

The high prevalence of contamination of *M. domestica* with parasites observed in the present study may be attributed to the status of environmental sanitation in the study sites. It has been reported that low or poor level of environmental sanitation, lack of amenities such as water and toilet facilities, climatic conditions favours the contamination and transmission of parasite mostly in tropical Africa such as Nigeria.

The role of *M. domestica*in the spreading of gastrointestinal infections is dependent on their habit of visiting faecal material for oviposition. *M. domestica*may drop these parasites on unprotected food and utensils, thereby facilitating the entry of these parasites in human body (Manandhar & Gokhale, 2017) The spread of such infectious agents is directly dependent on the seasonal abundance of *M. domestica*, availability of faeces, presence of pathogens in the faecal material, pathogen carrying capacity of each *M. domestica*, and access of *M. domestica*to unprotected food and utensils (Okore *et al.*, 2013).

CONCLUSION

CDC's (2020) report that Parasites are transmitted to human through contaminated food items is confirmed by the result of this study. Also, the impact of *M. domestica* in the environment especially in an unhygienic conditions calls for concern. The parasites associated with *M. domestica* in this study can cause serious public health implications in Umudike Metropolis. Through community and individuals efforts to keep the environment clean will help to reduce houseflies and inadvertently prevent the transmission of these parasites to man.

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