INVESTIGATION OF HELMINTH PARASITES ON THE EXTERNAL BODY OF HOUSEFLY (*Musca domestica*) IN FEDERAL UNIVERSIITY WUKARI TARABA STATE, NIGERIA

Supported by tetfund

Mohammed, K[1]., and Biyabra, M. I[2]
Department of Biological Sciences Federal University Wukari, Taraba State
Email: kasimumohammed34@yahoo.com

Received: September 14, 2023 **Accepted:** November 28, 2023

Abstract: Houseflies are the best known and most widely distributed insects accounting for 90% of all flies in human habitations. This study was carried out to identify the helminth parasites on the external body of housefly (*Musca domestica*) across Federal University Wukari community. A total of 200 houseflies were collected using the sweep net method, from four different locations (male hostel, cattle unit, poultry unit and cafeteria). The flies were examined for parasitic fauna using normal saline concentration technique, out of 200 flies that were examined 34 were found to be infected with at least one parasite, male hostel had the highest prevalence of infection with 14 flies infected with parasites, while cafeteria had the least prevalence of infection with 3 flies infected with parasites. Parasite species isolated from the external body surfaces of the flies were all helminthes; *Ascaris lumbricoides*, *Necator americanus* (hookworm) and *Taenia saginata*, all in ova form. *Ascaris lumbricoides* had the highest percentage prevalence of 32(47.06%), followed by *Necator americanus* with 25(36.76%), while *Taenia saginata* had the least prevalence of infection with 11(16.18). Chi square test showed no significant association between the rate of infection and locations. It can be concluded that houseflies in Federal University Wukari harbor pathogenic parasites on their body. The fact that houseflies have been incriminated to be mechanical transmitters of pathogenic diseases to man because of their ubiquitous lifestyles, measures must be taken to control fly population in order to avert the future outbreak of diseases.

Keywords: External Body, Helminth, House fly, Investigation, *Musca domestica*, Parasites

Introduction

Housefly, *Musca domestical* (Diptera:*Muscidae*), is the most common and wide spread species of fly in the world. It is said to have originated from the savannahs of Central Asia and spread throughout the world, and can be found in both rural and urban areas of the tropical and temperate climates (Hussein, 2014, Ommi *et al*., 2015). It belongs to a group of flies often referred to as "filth flies"; the members belong to the families *Calliphoridae* and *Fanniidae* (Szalanski *et al*., 2004). Housefly has been in existence since the origin of human life and well adapted to life in human habitations (Waheeda *et al.*, 2014). *Musca .domestica* is a eusynanthropic and endophilic species, i.e. it lives closely in association with human sand is able to complete its entire life cycle with inhabitations of human sand, domestic animals (Smallegange and Otter, 2007).

Houseflies are often found in abundance in areas of human activities such as hospitals, food, markets, slaughter houses, food centers or restaurants, poultry and livestock farms where they constitute a nuisance to humans, poultry, livestock and other farm animals, and also act as potential vector of diseases (Awahe and Farouk, 2016). The housefly is known to carry pathogens that can cause serious and life threatening diseases in humans and animals. Over 100 pathogens including bacteria, viruses, fungi and parasites (protozoans and metazoans) have been associated with the insect (Tsagaan *et al*., 2015; Nasiri *et al*., 2015).

Molecular analysis revealed that houseflies carry very diverse groups of microorganisms (Bahrndorf *et al.*, 2017). Evidence supporting the role of the house fly in transmission of diseases is mostly circumsantial, with the strongest evidence pointing to the correlation between the rise in incidence of diarrhoe and an increase in the fly population (Levine and Levine, 1991; Nichols, 2005; Farag *et al*., 2013; Ahaan and Akram, 2014). The characteristics of the pathogens carried by houseflies depend on the area where the insect is collected; houseflies captured from the hospital environment or animal farms (where there is extensive use of antibiotics as growth promoters) commonly carry antimicrobial resistant bacteria and fungi (Davari *et al*., 2010). More so, houseflies presenting in the hospital environment may also be associated with the transmission of nosocomial infections (Nassiri *et al*., 2015; Zurek, 2014). Housefly causes mechanical transmission of pathogens, which is the most widely recognized mechanism (Sarwar, 2015; Pava-Ripoll *et al*., 2015; Fisher *et al*., 2017). This occurs when pathogens are transmitted from one vertebrate hosts to another without amplification or development of the organism within the vector (Sarwa, 2015). Houseflies usually feed and reproduce in feces, animal manure, carrion and other decaying organic substances, and thus live in intimate association with various microorganisms include the human pathogens, which may stick to body surfaces of the fly. The constant back and forth movement of houseflies between their breeding sites and human dwellings can lead to the transmission of pathogens to humans and animals (Fisher *et al*., 2017).

Houseflies are of human and veterinary concern, because it acts as a mechanical vector for a range of pathogens (Vazirianzadeh *et al*., 2008). 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 (WHO,2017). The filthy breeding habit, feeding mechanism and in discriminate travel between filth and food make house flies efficient vectors and transmitters of human enteric protozoan and helminth parasites such as cysts of *Entamoeba histolytica ,Entamoeba coli ,Giardia intestinalis* and oocyts of *Toxoplasma gondii, Isospora spp* and eggs or larvae of *Ascaris lumbricoides, Trichuris trichuria* (Szalanski *et al*., 2004). The transmission of these human protozoan and helminth parasites by houseflies is predominantly mechanical, which occurs through mechanical dislodgement from external body, fecal deposition and regurgitation (Szalanski *et al*., 2004).

Housefly (*Muscadomestica*) 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 worksite or in rest places causing disturbances to them (Howard, 2011). 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 farm animals (Service, 2008). Houseflies move around mostly during the day and like warm places and showing reference for direct sunshine. Their filthy habits, culminating in their indiscriminate movements between filth and food and defecation while feeding, make houseflies efficient transmitters of germs (Olsen, 1998).

Houseflies are always found in association with humans and human activities (Bursell, 1988). They are also one of the most serious pests with animal production facilities worldwide (Ostrolenk *et al*., 1942).

Houseflies have biological properties that make them potential mechanical vectors. They lives in close association with bacteria, they enter farm buildings and homes and adults disperse from one area to another. Houseflies are termed synanthropic because they lives in close proximity to humans and domestic animals, and they use the human environment for shelter and food. Adult flies and larvae are associated with the human environment and feed on excreta of humans or domestic animals, decaying organic matter, and possibly on vertebrate blood. They share the human environment because of its buildings or farm yards, which satisfy their requirements for shelter better than natural environments. The setrophic and ecological requirements are also used to evaluate the epidemiological significance of flies (WHO, 2017).

Mechanical transmission of parasitic pathogens by arthropods including houseflies is often over looked because too much importance is given to biologically transmitted diseases such as malaria, yellow fever, *trypanosomiasis* etc. Nevertheless, there is enough evidence to show that house flies can carry pathogens capable of causing serious diseases in humans and domestic animals and therefore should be controlled.

Despite the awareness so far 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 Wukari, in general and Federal University Wukari 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 Helminth parasitic Fauna found on external body of houseflies (*Musca domestica*) across Federal University Wukari in order to assess the dominant type of transmissible infectious agents in the community.

Materials and Methods

Study Area

This investigation was carried out in Federal University Wukari which is located in Wukari town, Wukari Local Government Area Taraba state North-east Nigeria, located on the latitude 8.89213^0North and longitude 11.3672^0 East and it is situated at elevation of 198.14 meters above sea level. Wukari's climate is classified as tropical. In dry season, there is much less rainfall than in rainy season. .According to Lane and Crosskey, (1993), this climate is classified as Aw (tropical wet-dry climate).The average annual temperature in Wukari is 28.2°C (82.7°F). Precipitation here is about 986mm (38.8 inch) per year. Precipitation is the lowest in January, with an average of 1mm (0.0 inch). Most precipitation falls in August, with an average of 209 mm (8.2 inch). At an average temperature of 31.7°C (89.0°F), March is the hottest month of the year. In August, the average temperature is 25.4°C (77.8°F) which is the lowest average temperature of the whole year. Between the driest and wettest months, the difference in precipitation is 208 mm (8 inch). The average temperatures vary during the year by 6.2°C (11.2°F). The month with the highest relative humidity is August (80.30%). The month with the lowest relative humidity is January (22.01%). The month with the highest number of rainy days is August (25.03 days). The month with the lowest number of rainy days is December (0.27days) (https://en.climatedata.org/africa/nigeria/taraba/wukari-371/).

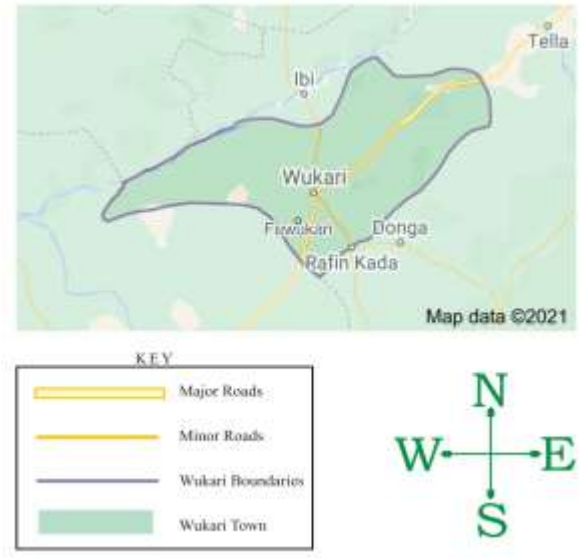

Figure1; map of FUWUKARI study area (source;-www.researchgate.net)

Study sites

The study was conducted in four selected sites in Federal University Wukari namely; male hostel cattle unit, cafeteria and Poultry unit. These sites were chosen because of the activities carried out on the sites, such as animal waste accumulation, food waste, poor sanitary conditions of students and garbage etc. attracts the activities of houseflies.

Sample collection

A total of 200 houseflies were captured from four selected sites within the university. These sites include the male hostel, cattle unit, cafeteria and poultry unit. Houseflies were captured using the 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 surfaces where flies visit from Garbage dumps, animal waste heaps, latrines and road side carrions as described by Nichols (2005). A purposive sampling technique of 50 flies per location was adopted in the research design for ease. The collection was carried out between 8-11am. This time was chosen because extreme temperatures of the day do not favours the activities of houseflies as reported by ((Miller *et al*., 1974). The captured flies were placed in well sterilized plastic containers and transported to the Department of Biological Sciences laboratory, Federal University Wukari for further procession as described by (Lane and Crosskey, 1993).

Parasitological examination in the Laboratory

About 2ml of normal saline was added in to each universal bottle containing the houseflies and shaken vigorously using manual technique to dislodge the parasites from the body surface especially hairs of the houseflies. The fluid was then transferred into a test tube and centrifuged at 300rpm for about 5 minutes. The tube was tilted and all supernatant fluid discarded. A drop of Lugol's iodine was added to the sediment and then re-suspended by tapping the bottom of the tube gently. A drop of the re-suspended deposit was placed on a clean free slide and covered with cover slip. The preparation was examined under the microscope using×10 and ×40 objectives. Identifications were made using color atlas of Parasitology by (Sullivan, 2009; Cheesbrough, 2005).

Statistical Analysis

Data collected were analyzed using Microsoft excel version 2016. Descriptive statistics using cross-tabulations of variables were employed to generate tables. A simple chi-square test was carried out to test if there was a significant difference in the prevalence of the parasites species on housefly based on locations.

Results and Discussion

The results gotten from the research incriminate *Musca domestica* as the carrier of some pathogens within the university. A total of 200 flies were captured from four different locations (50 flies each per location). The overall percentage abundance of parasites on vectors according to study sites was recorded as follows: male hostel had the highest prevalence of infected flies as well as highest percentage prevalence of parasites infection of 28(41.18%), followed by cattle unit with 18(26.47%), and the poultry unit had 16(23.53%), while cafeteria had the least prevalence of infection of 6(8.82%) as shown in Table 1.

Table1; Prevalence of Parasites on Vectors according to study Sites

Sites	No of flies	No. of flies infected	No. of Parasites	% infected
Male Hostel	50	14	28	41.18
Cattle Unite	50	9	18	26.47
Cafeteria	50	3	6	8.82
Poultry Unit	50	8	16	23.53
Total	200	34	68	100

A total of 3 species of parasites were obtained on examination of the flies, parasites obtained from the examination includes; *Ascaris lumbricoides*, hookworm (*Necator americanus*), and *Taenia saginata, all the parasites* were observed in the eggs stages and no adult stages were recovered as shown in Table 2.

Table 2; Parasites nature/stages recovered from Houseflies in the study sites

Paraites organisms	**Phylum**	**Form seen**
Ascaris lumbricoides	Nematoda	Ova
Necatar americanus	Nematoda	Ova
Taenia saginata	Platyhelminthes	Ova

The results obtained showed that *Ascaris lumbricoides* had the highest percentage prevalence with parasitic load of 32(47.06%), followed by Hookworm (*Necator americanus*) 13(38.24%) and least infection was seen in *Taenia saginata* 5(14.70%) as shown in Table 3

Table 3; Prevalence of Parasites Infection according to Species in the study Sites

Sites	*Ascaris lumbricoides*	*Necatar americanus*	*Teania saginata*	Total % infection
Male Hostel	12(17.65%)	11(16.18%)	4(5.89%)	28(41.18%)
Cattle Unite	8(11.76%)	6(8.82%)	5(7.35)	18(26.47%)
Cafeteria	4(5.89%)	0(0.00%)	2(2.94%)	6(8.82%)
Poultry Unit	8(11.76%)	8(11.76%)	0(0.00%)	16(23.83%)
Total	32(47.06%)	25(36.76%)	11(16.18%)	68(100%)

The percentage abundance of each parasite on vector per study site were obtained, *Ascaris lumbricoides* had the highest percentage prevalence of 16(32.00%), followed by *Necatar americanus* with 13(26.00%), the least percentage prevalence was obtained in *Teania saginata* with 5(10.00%). Chi-square test showed no significant association between the rate of parasites infection on each fly in the study sites (X^2=9.32;p>0.05) as shown in table 4. It appeared that the transmission of helminth parasites by houseflies depend on their habit of visiting faecal material for oviposition as shown in table 4.

Table 4; Prevalence of Parasites Infection on each fly according to the study Sites

Sites	*No of flies Examined*	*No of flies infected*	*% Ascaris saginata* Lumbricoides	% Necatar americanus	% Teania saginata
Male Hostel	50	14	7(14.00%)	6(12.00%)	1(2.00%)
Cattle Unite	50	9	4(8.00%)	3(6.00%)	2(4.00%)
Cafeteria	50	3	1(2.00%)	0(0.00%)	2(4.00%)
Poultry Unit	50	8	4(8.00%)	4(8.00%)	0(0.00%)
Total	200	34	16(32.00%)	13(26.00%)	5(10.00%)

The study confirmed that houseflies carry some parasites on their body, out of 200 flies examined 34 were found to be infected with parasites and 68 parasites were found in their body surfaces which are in agreement with the similar study conducted by (Amaechi *et al*., 2017), infection was significantly higher in houseflies collected in refuse dump sites and toilets. Ova of *Ascaris lumbricoides*, hookworm(*Necator americanus*) and *Taenia sa.ginata* found associated with housefly, which was in agreement with earlier reports of (Ajero and Nwoke, 2007) and (Wanna *et al*., 2008), where they reported the presence of these parasites on houseflies. The implication of the role of houseflies in the transmission of intestinal parasites is of serious public health concern to the University community, since houseflies are known to live in close association with human beings. Houseflies are common around the household, in garbage and in human and animal excreta; they are vectors of pathogens (Getachery *et al*, 2007).

Among the parasites that were recovered from captured flies, *Ascaris lumbricoides* had the highest percentage prevalence of 47.06%, followed by hookworm (*Necator americanus*) 38.24% and *Taenia saginata*14.70%. *Ascaris lumbricoides* is a species of roundworm associated with *ascariasis. Ascarisis is* the most common roundworm infection. According to the WHO (2012), as many as one billion people were infected by *Ascaris lumbricoides* worldwide, this figure was alarming and confirmed the large number seen in this study. *Ascariasis* is highly prevalent in places without modern sanitation like the sites where this study was carried out. According to the Center for Disease Control, Hookworm infections occur in an estimated 576 to 740 million people worldwide. It mainly affects people in developing nations in the tropics and subtropics due to poor sanitation (CDC, 2010). The poor sanitary conditions of the hostel and poultry unit which yielded the highest number of hookworm is confirmed with earlier reports of (Getachery *et al*., 2007; CDC, 2010; WHO, 2012). *Taenia saginata* which causes *Taeniasis* is now recognized as an emerging human disease. WHO (2009), had estimated 2.4 million people infected with *Taenia*, and a further 180 million were at risk of infection. This number was comparatively low and is in line with the small number of *Taenia saginata* (14.70%) obtained in this study.

These parasites are mostly associated with flies and cockroaches that thrive in areas with faecal matter and relative food availability (Maria and Belo, 2002). Most of these vector also patronize dirty refuse are as a sit was observed in the study. It is assume therefore that the parasites adhere to their body surfaces when they leave those sites and come to feed in the open areas there by transferring their parasitic load to any surface they come in contact with.

The result of the study revealed a high incidence of pathogennic intestinal parasites recovered from the flies in the study areas. This shows that students and staff in the study locations are predisposed to being infected easily with these pathogenic parasites carried by the flies. This also revealed the risk level of exposure to disease carrying parasites by humans. Comparing the results from the four study sites, It was observed that the results were similar, given the fact that there was no significant association in the number of infectious flies. The similarity of results as observed in the different sites can be attributed to the fact that these areas have similar unhygienic conditions and have same anthropogenic activities relating to unruly refuse disposal and same climatic condition that promotes the occurrence of flies species and parasites. These results are in agreement with the work of (Deapke *et al.,* 2018), who reasoned that pathogenic parasites and bacteria associated with housefly were undermined or promoted by sanitation practices by the surrounding environment.

Conclusion

Houseflies (*Musca domestica*) have a negative psychological impact as they are considered as nuisance and a sign of unhygienic conditions. The findings of this study have demonstrated that houseflies are potential vectors of intestinal parasites in Federal University Wukari and possibly other parts of Nigeria. Houseflies spread diseases because they feed freely on human food and filthy matter alike. The flies pick up disease causing organisms while crawling, feeding and there by contaminates food and drinks while feeding. These contaminated food materials caused bacteria disease like typhoid, cholera, dysentery and viral diseases like viral hepatitis. Therefore, it becomes imperative to urgently institute control measures of this flies through mass education on improving environmental sanitary condition. There is a need of public awareness and education regarding the possibility of houseflies to be potential vectors of many food borne diseases in Wukari, Taraba State and Nigeria at large.

Acknowledgements
We wish to express our profound gratitude to Almighty Allah who in His infinite mercy has made this work a reality.

Conflict of Interest
There were not any conflicts of interest between the authors from beginning of the study to the end. Everything went well as design and agrees on the proposal

Disclosure of Funding Source(s)
This study was founded by Mohammed K, and also with some assistance from Biyabra, M. I,

References

Ahaan K & Akram W 2014. The Effect of Temperature on the Toxicity of Insecticides against *Musca donestica*: Implications for the Effective Management of Diarrhea. PLos One; 9(4): 95636.

Ajero BE & Nwoke BEB 2007. Human Nematode Ovaincyclonhaphan flies in Owerri town, Southeastern Nigeria. *Journal of Medical Sciences*, 2(13):110–112.

Amaechi AA, Ukaga CN, Iwunze JI, Nwachukwu MO & Anumudu B 2017. Epidemiological Implications of Houseflies (*Musca domestica*) in the Dessimination of Diseases in Owerri, South-east Nigeria. *NigerianJournal of Parasitology*,38(2):298-301

Awache I & Farouk A A 2016. Bacteria and Fungi associated with Houseflies collected from cafeteria and food Centres in Sokoto. FUW Trends *ScieTechnol J*;1(1):123–5.

Bahrndorff S, DeJonge N, Skovgård H & Nielsen JL 2017. Bacterial Communities Associated with House flies (*Musca domesticaL*.) Sampled within and between Farms .PLoS ONE;12(1):0169753.

Bursell E 1998. The Effect of Wind-borne odours on the direction of flight in Houseflies. Physiological Entomology,12:149–156.

CDC 2010. Health Awareness on Hookworm. Centre for Diseases and Control.

Cheesbrough M 2005. District Laboratory in Tropical Countries, Part1. 2nd Edition, Cambridge University Press, Cambridge. http://dx.doi.org/10.1017/CBO9780511581304

Davari B, Kalantar E, Zahirnia A & Moosa-Kazemi SH 2010. Frequency of Resistance and Susceptible Bacteria Isolated from Houseflies. Iran J Arthropod Borne Dis; 4(2):50–5.

Deakpe TE, Manyi MM & Utume LN 2018. Pathogenic Parasites and Gacteria associated with the Housefly (*Musca domestica*) in Markurdi; a fly-infested area in central Nigeria. *Nigerian journal of parasitology*,39 (1):111-115.

Farag TH, Faruque AS, Wu Y, Das SK, Hossain A, Ahmed S, Ahmed D, Nasrin D, Kotlof .KL, Panchilangam S, Nataro JP, Cohen D, Black welder WC & Levine MM 2013. Housefly Population Density Correlates with *Shigellosis* among Children inMirzapur,

Fisher ML, Fowler FE, Denning SS & Watson DW 2017. Survival of the HouseFly (Diptera:*Muscidae*) on Truvia and Other Sweeteners. *J Med Entomol*;54(4):999–1005.

Getachery S, Gebra M & Erko B 2007. Non biting Cyclone haphan flies (Diptera) as a carrier of parasites in slumare as of Addis Ababa Ethiopia. Acta Tropica,103:186–194.

Howard J.J (2011). Nuisance flies around a Land fill: Patterns of Abundance and Distribution.

Hussein SA & John LC 2014. Housefly, *Musca domestica* L innaeus (Insecta: Diptera:*Muscidae*).InstFoodAgricScie.;47:1–7.

Lane RP & Crosskey RW 1993. Medical Insects and Arachnids. Chapman and Hall, London.723ppISBN0-412-40000-6.

Levine OS & Levine MM 1991. Houseflies (*Musca domestica*) as Mechanical Vectors of *shigellosis*".Reviews of Infectious Diseases. 13(4):688–696. doi: 10. 1093/clinids/13.4.688. PMID1925289.

Maria AS & Belo M 2002. Morphometric Variations in the Housefly, *Musca Domestica*(L.)withLatitude.*Genetica*115:243251. https://doi.org/10.1023/A:1020685727460

Miller BF, Teotia JS & Thatcher TO 1974."Digestion of Poultry Manure by *Musca domestica* "British Poultry Science. 15(2): 2311. doi:10. 1080/00071667 408416100. PMID4447887.

Nassiri H, Zarrin M, VeysBehbahani R & Faramarzi A 201. Isolation and identification of pathogenic filamentous fungi and yeasts from adult housefly (Diptera: *Muscidae*) captured from the hospital environments in Alivaz city, Southwestern Iran. *JMed Entomol;* 52(6):1351–6.

Nichols G.L 2005. Fly Transmission of Campylobacter. Emerged Infectious Diseases; 11(3):361–4.

Olsen AR 1998. Regulatory Action Criteria for Filt hand other Extraneousmaterials III. Review of flies and food borne enteric disease. Regulatory Toxicology and Pharmacology, 28:199–211.

Ommi D, Hashemian SM, Tajbakhsh E & Khamesipour F 2015. Molecular Detection and Antimicrobial Resistance of *Aeromonas* from Houseflies (*Musca domestica*) in Iran.RevistaMVZCórdoba.;20(Suppl):4929–36

Ostrolenk M & Welch H 1942. The Housefly as a Vector of Food Poisoning Organisms in Food Producing Establishments "*American Journal of Public Health and the Nation's Health*. 32 (5): 487494. doi:10.2105/ajph. 32.5.487. PMC1526899. PMID18015612

PavaRipoll M, Grep Miller AK, Tall BD, Keys CE & Ziobro GC 2015. Ingested *Salmonella Enterica, Cronobactersakazakii, Escherichia coli* O157:H7,and *Listeriamonocytogenes* :Transmission Dynamics from Adult Houseflies to the eggs and first filial (F1) generation adults BMCMicrobiol;15:150.

Sarwar M 2015. Insect Vectors Involving in Mechanical Transmission of Human Pathogens for Serious Diseases. *Int J Bioinformatics Biomed Engineering*;1(3):300–6.

Service MW 2008. Medical Entomology for Students. Cambridge University Press.pp. 140–141.ISBN978-0-521-70928-6

Smallegange RC & Otter CJ (2007. Houseflies, Annoying and Dangerous in Emerging Pests and Vector-borne Diseases in EuropeVol1.

Sullivan JT 2009. A Color Atlas of Parasitology. University of SanFrancisco.

Szalanski AL, Owens CB, McKay T & Steelman CD 2004."Detection of *Campylobacter* and *Escherichia col i*O157:H7from filth flies by polymerase chain reaction".*Medica land Veterinary Entomology*.18 (3):241–246.

Tsagaan A, Kanuka I & Okado K 2015. Study of Pathogenic Bacteria Detected in fly Samples using Universal Primer-multiplex PCR. Mongolian. *J Agricultural Scie*; 15(2):27–32.

Vazirianzadeh B, Solary SS, Rahdar M, Hajhossien R & Mehdinejad M 2008. Identification of Bacteria which possible Transmitted by *Musca domestica* in the region of Ahvaz, South-west Iran J undishaper *journal of Microbiology*,1(1):28-31.

Waheeda I, Muhammad FM, Muhammad KS, Iqra A, Iram N & Aqsad R 2014. Role of Housefly (*Musca domestica*, Diptera;*Muscidae*) as a Disease Vector. *J. Entomol.* and *Zool*; 2(2):159–63.

Wanna M, Surapol S & Pubampen S 2008. Houseflies: Potential Transmitters of Soil Transmitted Helminth Infections in Unsanitary Community.*Journal of Tropical Medicine*, 1(1): 32-11

WHO 2009. The Housefly Intermediate Level Training and Information Guide. World Health Organization, Geneva, Switzerland.

WHO 2012. Helminth Control in School-age Children: a Guide for Managers of Control Programmes. World Health Organization, Geneva, Switzerland.

WHO 2017. "Houseflies "(PDF). Retrieved 25 September 2017. (24.6cm). Brooklyn Museum, Charles Edwin Wilbour Fund, 08.480.198".

Zurek L & Ghosh A 2014. Insects Representalink between Food animal farms and the Urban Environment for Antibiotic Resistance traits. *Appl Environ Microbiol*; 80(12):3562–7.