
PUBLIC HEALTH AWARENESS ON FLEA INFESTATIONS OF DOMESTICATED GOATS IN OTAPHA, RIVERS STATE, NIGERIA

EKINE, Emmanuel Green and EZENWAKA, Chinonye Oluchi

Department of Biology, Faculty of Science, Federal University, Otuoke, Bayelsa State, Nigeria.

Corresponding Author: Ekine, E. G. Department of Biology, Faculty of Science, Federal University Otuoke, Bayelsa State, Nigeria. **Email:** emmanuelgreen95@gmail.com **Phone:** +234 8063643958

Received November 21, 2023; Revised December 13, 2023; Accepted January 01, 2024

ABSTRACT

*This study investigated flea infestation on domesticated goats in Otapha, Rivers State, Nigeria. A total of 100 domesticated goats reared in Otapha were subjected to flea screening and 61% were reported positive. Fleas were removed from the skin of goats by hand picking and by the use of forceps. The detected fleas were stored in 50% alcohol and conveyed to the laboratory for bioassay. The recovered fleas were identified to species level using flea pictorial key. Flea infestation was noticed in all the settlements where goats were sampled. The encountered flea species in this study were *Ctenocephalides canis* (24.4%), *Ctenocephalides felis* (25.6%) and *Pulex irritans* (50.0%). The high manifestation of flea species in this study suggests that the environmental conditions in Otapha were favourable for rapid growth and survival of flea among goats in the settlements. The result further implied that the inhabitants of Otapha lack the basic diary methods to adequately domesticate goats hence can be highly vulnerable to flea-borne infections such as murine typhus. The response, the attitude and habit of animal owners indicated that they had zero idea concerning the necessity for veterinary visit for the purpose of disease diagnosis, animal treatment and care. Hence, they employ no precautionary measures to mitigate flea populations on the animal skin, thereby putting the animals at high risk of infestation and making goat owners more vulnerable to flea-borne infections.*

Keywords: Public health issues, Flea infestation, Goats, Flea-borne infections, Otapha Rivers State

INTRODUCTION

Considering the significance of goat rearing as a means of livelihood, the animal is largely domesticated in Otapha with diverse management system, including extensive, semi intensive and intensive management systems. Animals including goats constitute a significant target of arthropods pests with flea not excluded (Soundararajan *et al.*, 2018). The close associations between fleas and goats which facilitate the spread of several zoonotic diseases of public health importance have often been noticed among the inhabitants of Otapha. Therefore, a clear understanding on the

relationship between fleas and goats in the spread of vector-borne diseases of public health concern will be beneficial.

Flea has been considered as an important agent in veterinary and human health globally (Pawelczyk *et al.*, 2016; Dahm *et al.*, 2021). Fleas are ectoparasites inhabiting the outer skin of mammals including goats. They are active in disease transmission among animals and human (Ekine *et al.*, 2022). Fleas have often been reported on the skin of animals especially goats, dogs, pigs and cat (Bryson *et al.*, 2000). According to Natala *et al.* (2009) more than 45% of animal skin injuries can be traceable to flea infestation. The association

between fleas and goats put human, especially animal owners, at risk of Zoonoses. This is because fleas harbour many pathogenic organisms which can be transmitted to human. Agu *et al.* (2020) reported that flea-borne infections in human can lead to the establishment of dermatitis. According to Ekine *et al.* (2022), two significant factors predisposing goat owners to zoonotic infections are lack of awareness on the potentials of the animal to facilitate the spread of diseases, and the act of keeping close association with the animals. Fleas, alongside ticks, have been implicated as vectors of important diseases of human such as murine typhus and plague (Nuchjangreed and Somprasong, 2007; Bekele *et al.*, 2011; Tamerat *et al.*, 2016; Dahm *et al.*, 2021; Ekine *et al.*, 2021).

Close attention for goats alongside pest management impacts on the rate of infestation with outer body parasite including flea. The Otapha people largely domesticate goat which in many places maintain proximity with minimal or no care for the animal, thereby making themselves vulnerable to flea-borne infections. Therefore, this study is aimed at assessing the prevalence of flea infestations on domesticated goats and the awareness of owners on zoonosis.

MATERIALS AND METHODS

Study Area: This survey was carried out in Otapha (Latitude 4°25'40" N Longitude 5° 28'48"E). The area is constituted of six settlements; it is located about 48 km away from Ayama, the head quarter of Abua/Odual Local Government Area, Rivers State (Otto, 2000). The inhabitants of Otapha are mostly fishermen. They largely domesticate goats, the highest in Abua. Among the six settlements that make up Otapha, four (Dighiriga, Emeleswe, Serebia and Ogbokuma) were randomly selected for goat sampling.

Collection of Flea: Twenty households each from the selected settlements in Otapha who rear/ domesticate goats were visited and goats examined between December 2022 and April 2023. A total of 100 goats were screened for

the presence of fleas. The sampled goats were grouped into young (0 – 12 months) and old (< 12 months). Fleas on the skin of goats were hand-picked by employing the use of forceps. Care was taken to prevent breakage of any part. The recovered fleas were preserved in 50% alcohol for laboratory assay.

Identification of Flea: The fleas collected from goats in Otapha were emptied into Petri dishes in the laboratory and later placed on glass slides and viewed under a dissecting microscope using x4 and x10 objective lens. The identification was done based on their morphological features using a pictorial key (Soulsby, 1982).

Goat Age and Flea Infestation: The ages of the goats examined were as given by their owners, and confirmed using the goats' dentition (Oltenacu and Stanton, 2023). The goats were grouped into two; those between 0 – 12 months were classified as young, while those above 12 months of age were classified as old.

Sex Variation and Flea Infestation of Goats: The sexes of goats examined were determined on physical observation of the sex organs. Out of the 100 goats examined, 47 were male goats while 53 were female goats.

Seasonal Variation and Flea Infestation of Goats: Seasonal variation of flea infestation was out of duration for this study, as the study was carried out during the dry season.

Zoonotic Awareness: A closed ended questionnaire was employed to test zoonotic awareness of animal owners in Otapha. The questionnaire addressed issue of regular check of goats for flea, visitation/invitation of veterinary treatment for goats, Vaccination of goats, Awareness of flea-borne disease, Goat feeding pattern (extensive system, semi-intensive and intensive system) and sanitation of goat housing. The questionnaire was face validated, pretested and tested for reliability before administration (Roopa and Rani, 2012).

Data Analysis: Simple percentage was employed for result presentation. Chi-square (χ^2) test was used to test for significance of the prevalence of flea infestation in relation to age and sex of the goats examined at 0.05 level of significance using SPSS version 23.

RESULTS

Flea Infestation of Goats in Otapha: A total of 100 goats were subjected to screening for ectoparasites and 61(61.0%) were found positive for flea infestation. The flea infestation was notice in goats across the four settlements surveyed. The prevalence of infestation among settlements was 27.9, 34.4, 14.7 and 23.0% for Dighiriga, Emeleswe, Serebia and Ogbokuma respectively (Table 1).

Table 1: Flea infestation of goats in Otapha

Settlement	Number of goats sampled	Number infested	% infested
Dighiriga	25	17	27.9
Emeleswe	25	21	34.4
Ogbokuma	25	14	23.0
Serebia	25	9	14.7
Total	100	61	100

Flea Species Prevalence on Goats in Otapha: The overall flea occurrence identified in this survey was 172 from two genera and three species. The species of flea detected on goats in this survey were *Pulex irritans* Linnaeus, 1758 (Siphonaptera: Pulicidae), *Ctenocephalides felis* Bouché, 1835 (Siphonaptera: Pulicidae) and *Ctenocephalides canis* Curtis, 1826 (Siphonaptera: Pulicidae). The highest flea occurrence was found in Ogbokuma (34.5%), while Emeleswe (12.8%) had the least assemblage of fleas (Table 2). However, the most prevalent flea species identified was *P. irritans* (53.4%).

Age Related Infestation of Flea on Goats in Otapha: Observation in this survey revealed that flea infestation was higher among young goats (55.7%) when compare with the result on old or adult goats (44.3%).

Infestation rate between young and adult goats was statistically significant ($p < 0.05$) (Table 3).

Sex Variation and Flea Infestation of Goats: Sex-related prevalence of flea infestation of goats examined showed more prevalence of infestation in the male goats, 33(54.1%) than in the females, 28(45.9%). There was however a significant difference in the infestation rates between the two sexes ($p < 0.05$). In Dighiriga settlement, male goats 11(64.7%) were more infested than females 6(35.3%). The observation in Emeleswe showed 9(42.9%) male goats and 12(51.1%) female goats infested. The female goats 6(66.7%) were more infested than the males 3(33.3%) in Serebia settlement. However, Ogbokuma settlement recorded flea prevalence of 10(71.4%) for male goats and 4(28.6%) for females (Table 4).

Zoonotic Awareness of Goat Owners in Otapha: Responses from the questionnaires showed 86% of the goat owners in Otapha have no time to check goats for flea infestation, while 92% did not see the necessity for goat veterinary treatment. Further analysis showed that goats live in the compound with owners (90%) although in different rooms. About 59% of goat owners in Otapha take their goats to the field for feeding, and while 11% bring feed for the goats and 30% feed the goats anyhow. The result also revealed that 89% of the inhabitants of Otapha have no idea of the ability of fleas to aid disease dispersal. On the area of care and management for the animals, 29.3% of the goat owners swept the goat houses daily, while 40.2 and 30.5% of them swept the goat houses once and twice in a week respectively. Majority of the people (92%) kept young goats in intensive manner unlike the observation for adult goats where 62% were fed/managed extensively (Table 5).

DISCUSSION

The result of this survey depicted that goats reared/domesticated in Otapha were vulnerable to flea infestation.

Table 2: Flea species prevalence on goats in Otapha, Rivers State, Nigeria

Settlement	<i>Ctenocephalides canis</i> (%)	<i>Ctenocephalides felis</i> (%)	<i>Pulex irritans</i> (%)	Total (%)
Dighiriga	12(7.0)	9(5.2)	25(14.5)	46(26.7)
Emeleswe	4(2.3)	11(6.4)	7(4.1)	22(12.8)
Ogbokuma	20(11.6)	8(4.7)	33(19.2)	61(34.5)
Serebia	6(3.5)	16(9.3)	21(12.2)	43(26.0)
Total	42(24.4)	44(25.6)	86(50.0)	172(100)

Table 3: Age related prevalence of flea on goat in Otapha, Rivers State, Nigeria

Settlement	Number of goats sampled	Young goat (%)	Adult (%)	Total (%)
Dighiriga	25	7(20.6)	10(37.0)	17(27.9)
Emeleswe	25	17(50.2)	4(14.8)	21(34.4)
Ogbokuma	25	6(17.4)	3(11.1)	9(14.7)
Serebia	25	4(11.8)	10(37.0)	14(23.0)
Total	100	34(55.7)	27(44.3)	61(100)

Table 4: Sex-related prevalence of flea infestation of goats in Otapha, Rivers State, Nigeria

Settlement	Number of goats surveyed			Number infested (%)		
	Total	Males	Females	Males	Females	Total
Dighiriga	25	12	13	11(64.7)	6(35.3)	17(27.9)
Emeleswe	25	10	15	9(42.9)	12(57.1)	21(34.4)
Serebia	25	10	15	3(33.3)	6(66.7)	9(14.7)
Ogbokuma	25	15	10	10(71.4)	4(28.6)	14(23.0)
Total	100	47	53	33(54.1)	28(45.9)	100

Table 5: Zoonotic awareness of goat owners in Otapha, Rivers State, Nigeria

Attitude	Responses (%)		
	Yes	No	Anyhow
Regular check of goats for flea	4	86	10
Visitation/invitation of veterinary treatment for goats	0	92	8
Vaccination of goats	6	90	4
Awareness on flea born disease	9	89	2
Goat feeding pattern (extensive system)	60	35	5
Goat feeding pattern (intensive system)	35	60	5
Are goat houses swept	82	0	18
	Once per week	Twice per week	Daily
How many times per week	40.2	30.5	29.3

According to Nizamov (2023), domestic goats are common target of infestation with ectoparasitic insects. The infestation rate here was relatively higher compared to the result in central India where Bisen *et al.* (2022) reported 35% flea infestation on Osmanabadi goats. The disparity in these results could be attributed to the difference in care method and management system employed. The high infestation rate observed in this survey may be ascribed to the relatively low standard of living observed among

the inhabitants across the settlements in Otapha. In this survey, there were varied level of goats' infestation in Dighiriga, Emeleswe, Ogbokuma and Serebia settlements respectively. However, settlement-related infestation was not statistically significant ($p > 0.05$). This result implied that the inhabitants of Otapha were at risk of murine typhus, a significant flea-borne infection reported among human (CDC, 2023). The uneven distribution of flea infestation reported

in this study implied that parasite distribution was unpredictable not minding the predisposing factors within the study environment.

From the skin of goats in Otapha, three species of flea from two genera were detected. The actual incidence of flea in this survey was 172. In a similar study, Natała *et al.* (2009) reported 36 fleas in domestic animals from Northern Nigeria. The variations in the prevalence of fleas in these researches may be ascribed to the animal species investigated and the difference in the research location which may be attributed to the disparity in the environmental conditions that could have influenced infestation rate of flea. The flea species encountered most often were *P. irritans* (50%), *C. felis* (25.6%) and *C. canis* (24.4%). The high manifestation of flea species in Otapha suggested that the environmental conditions in the study area were favourable for rapid growth and survival of flea among goats (Dahm *et al.*, 2021). The result further implied that the inhabitants of Otapha lack the basic diary methods to adequately domesticate goats to minimise flea infestation hence can be highly vulnerable to flea-borne infection such as murine typhus. The higher prevalence of *P. irritans* compared to the other two flea species as recorded in the study suggests that *P. irritans* was better adapted for survival in the study area. Similarly, Gracia *et al.* (2008) reported higher prevalence of *P. irritans* among fleas parasitizing domestic dogs in Spain.

Fleas occurred most in young (0 – 12 months) goats (55.7%) than in adult (>12 months) goats (44.3%). The high infestation rate observed among young goats may be ascribed to the management system employed by animal's owners for adult goats as against the young goats. Ekine *et al.* (2021) reported that the adoption of extensive system in the management of goats increases the risk of ectoparasites infestation among the animals, while intensive care strategy supports minimal infestation among animals. Wama *et al.* (2021) stated that field feeding of diary or domestic animals increases the rate at which they encounter ectoparasites of public health concern. However, Agu *et al.* (2020) reported high prevalence of ectoparasites on adult

animals as against the observation in this study. The difference may be attributed to the animals species sampled.

Flea infestation on the examined goats in Otapha varied with sexes. The result depicted that male goats were more vulnerable to flea infestation than the females. This scenario concurred with Ekine *et al.* (2022) that reported high vulnerability of male goats to ectoparasites. Greater exposure of the male goats to flea infestation in the study area may be attributed to the practice of hiring them out by their owners to households with only female goats for mating purposes. This practice that has constituted a source of income to households with male goats predisposes the male goats to intense ectoparasites infestation.

The response of animal owners toward goats indicated that the respondents had zero ideas concerning the necessity for veterinary visit for animal treatment and care, therefore take no precautionary measures to mitigate flea populations on the animal skin; hence putting the animals at high risk of infestation. Similarly, Hernández-Jover *et al.* (2019) reported the unconcern attitude of animal owners towards veterinarian visit, diagnosis, care and treatment of disease animals. The respondents also showed that both human and goats live in the same compound but in different rooms; and that animal houses were not swept daily rather on interval of twice per week (30.5%), while 40.2% swept the animal houses once a week. This observation implied that the inhabitants of the study area live below diary care and possess the wrong attitude for goat management. According to Nuchjangreed and Somprasong (2007), Soundararajan *et al.* (2018), Wama *et al.* (2021) and Ekine *et al.* (2022), lack of proper care for diary and domestic animals may be the best explained reasons for high prevalence of ectoparasites of animals in every society.

Conclusion: The result of this study showed male goats were more vulnerable to flea infestation than the females in Otapha. Seasonal variation of flea infestation was not studied; however, the study was carried out during the dry season. From the data gathered in this survey, it can be concluded that extensive

management of animals enhanced their vulnerability to flea and other ectoparasites infestations. The study further observed that rural inhabitants were at high risk of flea-borne infections because they were uninformed and lacked ideas on the potentials of fleas and other related ectoparasites in disease dispersal. The study therefore recommended that intervention measures such as public health education on animal health and management be made available for the rural inhabitants.

ACKNOWLEDGEMENTS

The authors immensely appreciate the animal owners in the households visited for their acceptance and responses. Dr. L. B. Gboeloh is sincerely appreciated for his support and encouragement. Also, the team of technicians in the Department of Biology, Ignatius Ajuru University of Education, Port Harcourt, Rivers State, Nigeria, are immensely appreciated for their various contributions.

REFERENCES

- AGU, N. G., OKOYE, I. C., NWOSU, C. G., ONYEMA, I., IHEAGWAM, C. N. and ANUNOBI, T. J. (2020). Prevalence of ectoparasites infestation among companion animals in Nsukka cultural zone. *Annals of Medical and Health Sciences Research*, 10(5): 1050 – 1057.
- BEKELE, J., TARIKU, M. and ABEBE, R. (2011). External parasite infestations in small ruminants in Wolmera district of Oromiya region, central Ethiopia. *Journal of Animal and Veterinary Advances*, 10(4): 518 – 523.
- BISEN, S., GIRI, D. K., MISHRA, G. K., GHOSH, R. C. and PAL, S. (2022). Report on severe oriental cat flea (*Ctenocephalides orientis*) infestation in Osmanabadi goats of central India. *International Journal of Tropical Insect Science*, 42(4): 2819 – 2825.
- BRYSON, N. R., HORAK, I. G., HOHN, E. W. and LOUW, J. P. (2000). Ectoparasites of dogs belonging to people in resource-poor communities in North West Province, South Africa. *Journal of the South African Veterinary Association*, 71(3): 175 – 179.
- CDC (2023). *Flea-Borne (Murine) Typhus*. Division of Vector-Borne Diseases (DVBD), National Center for Emerging and Zoonotic Infectious Diseases (NCEZID), Centers for Disease Control and Prevention, Atlanta, Georgia, United States. <https://www.cdc.gov/typhus/murine/index.html#>
- DAHM, J. R., BAILEY, J. B., KELLY, R. F., CHIKUNGWA, P., CHULU, J., JUNIOR, L. C., FREEMAN, E. J., MAYER, D., MAZERI, S. and SARGISON, N. D. (2021). Risk factors associated with *Ctenocephalides felis* flea infestation of peri-urban goats: a neglected parasite in an under-appreciated host. *Tropical Animal Health and Production*, 53(1): 181. <https://doi.org/10.1007/s11250-021-02620-7>
- EKINE, E. G., MORO, K. K., ORLUOMA, C., ROBERTS, C. L. and DIRIME, J. T. (2022). Assessment of ectoparasites of domesticated goats and associated zoonotic risk factors in Abua/Odual Local Government Area, Rivers State. *Faculty of Natural and Applied Sciences Journal of Scientific Innovations*, 3(2): 53 – 59.
- EKINE, E. G., ORLUOMA, C., UDUGBO, M. C. and DIRIME, J. T. (2021). Evaluating the surface body parasites of domesticated goats and dogs and their associated zoonotic risk factor in Emughan. *African Social and Educational Journal*, 10(1): 7 – 15.
- GRACIA, M. J., CALVETE, C., ESTRADA, R., CASTILLO, J. A., PERIBANEZ, M. A. and LUCIENTES, J. (2008). Fleas parasitizing domestic dogs in Spain. *Veterinary Parasitology*, 151(2-4): 312 – 319.
- HERNÁNDEZ-JOVER, M., HAYES, L., WOODGATE, R., RAST, L. and TORIBIO, J. A. L. (2019). Animal health management practices among smallholder livestock producers in Australia and their contribution to the surveillance system. *Frontiers in Veterinary Science*, 6: 191.

- <https://doi.org/10.3389/fvets.2019.00191>
- NATALA, A. J., OKUBANJO, O. O., ULAYI, B. M., OWOLABI, Y. N., JATAU, I. D. and YUSUF, K. H. (2009). Ectoparasites of domestic animals in Northern Nigeria. *Journal of Animal and Plant Sciences*, 3(3): 238 – 242.
- NIZAMOV, N. S. (2023). Identification of ectoparasitic insects among domestic goats in Bulgaria. *Veterinary World*, 16(4): 728 – 734.
- NUCHJANGREED, C., and SOMPRASONG, W. (2007). Ectoparasite species found on domestic dogs from Pattaya district, Chon Buri province, Thailand. *Southeast Asian Journal of Tropical Medicine and Public Health*, 38(1): 203 – 297.
- OLTENACU, E. A. B. and STANTON, T. (2023). *Teeth and Age of the Goat*. Cornell University College of Agriculture and Life Sciences, 215 Garden Ave, Ithaca, New York 14850, United States. <https://cals.cornell.edu/nys-4-h-animal-science-programs/livestock/goats/goat-fact-sheets/teeth-and-age-goat>
- PAWELCZYK, O., PAJAK, C. and SOLARZ, K. (2016). The risk of exposure to parasitic mites and insects occurring on pets in Southern Poland. *Annals of Parasitology*, 62(4): 337 – 344.
- OTTO, G. (2000). *Abua in Socio-Economic Perspectives*. Emhai Books, Port Harcourt, Nigeria.
- ROOPA, S. and RANI, M. S. (2012). Questionnaire designing for a survey. *Journal of Indian Orthodontic Society*, 46(4 Suppl. 1): 273 – 277.
- SOULSBY, E. J. L. (1982). *Helminths, Arthropods and Protozoa of Domesticated Animals*. 7th Edition, Baillière Tindall, London.
- SOUNDARARAJAN, C., NAGARAJAN, K. and PRAKASH, M. A. (2018). Occurrence of flea infestation on goats under stall fed condition and its control. *Journal of Parasitic Diseases*, 42(3): 444 – 448.
- TAMERAT, N., KORSO, L., MENGISTU, S., MUKTAR, Y. and KEFFALE, M. (2016). Prevalence and identification of ectoparasites fauna in small ruminants in and around Adami Tulu, East Shawa zone of Oromia, Ethiopia. *Livestock Research for Rural Development*, 28(11): 203. <http://www.lrrd.org/lrrd28/11/mukt2811cit.htm>
- WAMA, B. E., JONATHAN, J., GARBA, L. C., NJILMAH, J. A. and AGUZIE, I. O. (2021). Survey of tick infestations on pet dogs in Jalingo Local Government Area, Taraba State. *Nigerian Journal of Parasitology*, 42(2): 228 – 233.



This article and articles in *Animal Research International* are Freely Distributed Online and Licensed under a [Creative Commons Attribution 4.0 International License \(CC-BY 4.0\)](https://creativecommons.org/licenses/by/4.0/) <https://creativecommons.org/licenses/by/4.0/>