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Ecto-and intestinal parasitic fauna of domestic dogs in two rural areas of Ebonyi State, Nigeria: Public Health Zoonotic Jeopardy

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Abstract

Parasitic zoonoses are of public health importance and can be maintained in a community through anthroponoses, zooanthroponoses and amphixenoses. A total of 100 domestic dogs from two areas (Ikwo and Ezza) of Ebonyi State, Nigeria, were examined for ecto-and intestinal parasites between October 2014 and February 2015, using systematic random sampling technique. The ectoparasites were collected by careful examination of the body surfaces and by combing and scraping of the skin. Prior to laboratory analysis, the recovered ectoparasites were preserved in 70% alcohol while the faecal specimens were collected and preserved in 5% formalin. Hand lenses and microscopes were used to carefully examine the morphological features of the ectoparasites for proper identification. The collected skin scrapings were put in 10% potassium hydroxide (KOH), cleared in xylene and DPX was applied for mounting. Flootation methods and formol ether concentration techniques were used to analyse the faecal specimens. Sixty eight (68.00%) of the dogs were infested with ectoparasites of different taxa while 55 (55.00%) of them were infected with 12 different species of intestinal parasites, with *Ancylostoma caninum* being the most prevalent. The prevalence of both ectoparasites and intestinal parasites were higher in Ezza than in Ikwo. In the two areas, the mean intensity and mean abundance of the ectoparasites were higher than those of the intestinal parasites. Female dogs were infected more than the males by both the ectoparasites and intestinal parasites. Dogs more than 1 year old were infested and infected more than the younger ones. There was high prevalence of parasites of great zoonotic importance. Public health enlightenment and establishment of veterinary clinics in the study area are recommended. Extension of the parasitological examinations to household members of the pet owners in the study area is highly advocated for further study.

Keywords: Parasites, Zoonoses, Dogs, Rural Areas, Public Health.

Introduction

Parasitism is an intimate and obligatory relationship between two organisms of different species, in which the parasite, usually the smaller of the two, depends metabolically on the host for survival [1]. Parasites derive benefits from the hosts while the hosts offer some resistance and tolerance to the injury inflicted by the invasion of the parasites [2]. A parasite is an organism that lives inside or on the body of a different kind of animal/organism (the host) to derive metabolic benefits. Ectoparasites live on the surface of their hosts and they include ticks, mites fleas and lice while endoparasites inhabit the inside organs, body cavities or body fluids of their hosts. Intestinal parasites are endoparasites that live in the small and large intestines of their hosts and they include many of the helminthes and the protozoans. Zoonoses are infections that are transmissible under natural conditions from vertebrate animals to man and they include anthroponoses, Zooanthroponoses and amphixenoses [3, 4].

Transmission of zoonosis could be maintained in an enzootic or epizootic pattern. These patterns of transmission are being shaped by some factors including over population, disruptions due to military actions, mass migration of population due to man-made disasters, rural-urban migrations and inadequate food and water supplies. Deforestation, displacement and stress on wild life can lead to epidemics of wild life diseases with consequent overflow of infections into domestic animals and humans [5, 6].

Domestication of dogs dates back to as early as the settlement of man. Domesticated dogs belong to a group of animals that are generally classified as pets. They are kept in homes primarily for the purposes of companionship and protection. They immensely contribute to physical, social and emotional well-being of their owners [7].

In most cases dogs' aesthetic values and loyalty with playful attitudes maintained great intimacy with their owners. Dogs and cats are in fact the most commonly recognized pet animals worldwide^[8].

Dogs are host to many parasites that could be transmitted to humans and other close domestic animals and this parasitic zoonotic potential is of great disadvantage to their ownership. To be able to perform the duties and fulfill the purpose of acquiring them, dogs should be alert and agile. Parasitic infestations and or infections of the dogs render them dull, weak and may even be fatal, thereby taking them away from their intended duties. Direct contact, exposure to faecally-contaminated environments and immunocompromisation are among the factors that maintain transmission of parasites between dogs and man.

Many reviews on and reports of the prevalence of diverse ecto- and intestinal parasites in dogs have been published^[9]. Such reports on parasites of dogs include those of overgaauw *et al.*^[10] Kumsa and Mekonnen,^[11] and Livio *et al.*^[12]

Transmission of ectoparasites such as ticks, mites, lice and fleas from dogs to man could result from prolonged close contacts between humans and dogs. Intestinal parasite transmission from dogs to other animals is maintained through ingestion, per cutaneous penetration, and through transplantation and transmammmary routes^[13, 14]. Intestinal parasite transmission to man is maintained faecal-orally and transdermally. Poor sanitation, poor personal hygiene, and some unwholesome behavioural practices are responsible for the transmission^[10, 15].

Creation of public health awareness on possible dog-borne zoonotic infestations and infections and enforcement of preventive and control measures are panacea to halting the transmission and forestalling of possible epizootics and subsequent epidemics of zoonoses.

Materials and Methods

The study Area: The study was carried out in two rural areas – Ikwo and Ezza Communities in Ebonyi State, Nigeria. Ebonyi State lies approximately within longitude 7°30' and 8°30'E and latitude 5°40' and 6°45'N and it is located in south eastern region of Nigeria^[16]. The state has boundaries in the north with Benue State, in the east with Cross River State, in the South with Abia State and in the west with Enugu State. The vegetation of the State is characterized predominantly by tropical rainforest with high rainfall and intense sunlight with high relative humidity.

The two communities that were used for the study were highly underdeveloped with poor levels of sanitation and health enlightenment. Educational development of the study communities were below 50%. There were few health centres but there were no veterinary clinics in the communities. The only veterinary clinic was the State Government Veterinary Clinic that is located in Abakaliki Metropolis, the state capital. Farming, fishing and hunting form the mainstay of economic livelihood of the inhabitants of the study areas. Dogs were maintained in the households mainly for hunting and security purposes. The dogs were not always kept within the compounds but were left to wander about sometimes straying and mixing up with wild animals in the surrounding bushes.

Sampling and Specimen Collection Techniques: A systematic random sampling technique was adopted in conducting the study. House-to-house screening of 100 dogs was carried out in households that reared domestic dogs between October, 2014 and February, 2015.

The age, sex, and behavioural patterns of the dogs were obtained by interviewing the owners.

Specimen collection and preservation followed the methods described by Bhatia *et al.*^[4] The entire body surface of each dog was thoroughly examined for ectoparasites.

The entire body surfaces of the dogs were combed and brushed and the recovered parasites were collected on a clean white sheet of paper. Forceps were used to carefully detach the ticks. The recovered parasites were preserved in 70% alcohol. Skin scrapings were made with the use of blunt knives. The scrapings were collected in petri dishes with the edges smeared in Vaseline. Parts of freshly- passed faecal specimens that had not touched the soil were collected into screw capped containers and the specimens were preserved with 5% formalin. All the collected specimens were transported to the laboratory for analysis.

Laboratory Analysis

In the laboratory, hand lens was used to examine the dorsal and ventral morphological features of the ectoparasites recovered by combing. Further examinations were performed using the microscope for clarifications. The skin scrapings were put in 10% KOH to dissolve debris and hair.

Thereafter, it was centrifuged four (4) times and was dehydrated in ascending grades of alcohol. Xylene was added and DPX was applied to a portion of the sediment and it was examined under the microscope.

Each faecal specimen was divided into three (3) portions. Flootation methods using sodium chloride solution and zinc sulphate solution was used to analyse 2 portions. Formol ether concentration technique was used to analyse the third portion of the faeces.

Identification of Parasites: The recovered parasites were identified with guides provided by CDC,^[17] Wall and Shearer,^[18] and Bhatia *et al.*^[4] All the identified parasites were recorded in the data notebook.

Statistical Analysis: Data collected were analysed using infection statistics by Bush *et al.*^[19] which states that:

$$\text{Prevalence} = \frac{\text{Number of hosts infected}}{\text{Number of hosts examined}} \times 100$$

$$\text{Mean intensity} = \frac{\text{No of a parasite species in all infected hosts}}{\text{Number of hosts infected by the parasites}}$$

Mean abundance =

$$\frac{\text{Number of a parasite species in all infected hosts}}{\text{Number of hosts examined (infected and uninfected)}}$$

Results

A total of 100 dogs were examined for ectoparasite infestations in two rural areas of Ebonyi State, Nigeria. Sixty eight (68.00%) of them were infested with four (4) tick species, two (2) fleas species and one (1) mite species (Table 1). *Rhipicephalus sanguineus* and *Amblyomma species* ranked first and second in order of prevalence respectively with values of 39.00% and 12.00% respectively.

R. sanguineus had the highest mean abundance (0.78). *Ctenocephalides felis felis* and *Demodex species* were the least infested with prevalence of 1.00% each.

Table 1: Species-specific distribution of ectoparasitic fauna among domestic dogs in two rural areas of Ebonyi State, Nigeria

Parasites species	Number Examined	Number Infected	Number of Parasites	Prevalence (%)	Mean Intensity	Mean Abundance
<i>Rhipicephalus sanguineus</i>	100	39	78	39.00	2.00	0.78
<i>Amblyomma species</i>	100	12	24	12.00	2.00	0.24
<i>Ctenocephalides canis</i>	100	7	9	7.00	1.29	0.09
<i>Ctenocephalides felis</i>	100	1	1	1.00	1.00	0.01
<i>Ornithodoros spp</i>	100	6	10	6.00	1.67	0.01
<i>Otobius spp</i>	100	2	2	2.00	1.00	0.02
<i>Demodex spp</i>	100	1	1	1.00	1.00	0.01

Out of the 100 dogs examined for intestinal parasitic infections, 55(55.00%) of them were infected with twelve (12) different species of intestinal parasites, from which nine (9) and three (3) were helminthes and protozoans respectively (Table 2). *Ancylostoma caninum* had the highest infection of

23 (23.00%) while the lowest infections 2(1.00%) were recovered for each of *Toxocara cati* and *Gnathostoma species*. *Strongyloides stercoralis* had the highest mean intensity (2.67) and highest mean abundance (0.08).

Table 2: Species-specific distribution of intestinal parasitic fauna among domestic dogs in two rural areas of Ebonyi State, Nigeria

Parasites species	Number Examined	Number Infected	Number of Parasites	Prevalence (%)	Mean Intensity	Mean Abundance
<i>A. caninum</i>	100	23	30	23.00	1.30	0.30
<i>Trichuris vulpis</i>	100	2	3	2.00	1.50	0.03
<i>Dipylidium caninum</i>	100	4	4	4.00	1.00	0.04
<i>Toxocara canis</i>	100	8	10	8.00	1.25	0.10
<i>Toxocara cati</i>	100	1	2	1.00	2.00	0.02
<i>Giardia spp</i>	100	2	2	2.00	1.00	0.02
<i>Isospora canis</i>	100	3	5	3.00	1.67	0.05
<i>Ascaris lumbricoides</i>	100	3	3	3.00	1.00	0.03
<i>Strongyloides stercoralis</i>	100	3	8	3.00	2.67	0.08
<i>Taenia spp</i>	100	3	4	3.00	1.33	0.04
<i>Entamoeba spp</i>	100	2	5	2.00	2.50	0.05
<i>Gnathostoma spp</i>	100	1	2	1.00	2.00	0.02

Table 3 depicts the locality-related distribution of ecto- and intestinal parasitic fauna among domestic dogs in two rural areas of Ebonyi State, Nigeria. The prevalence of both ectoparasites and intestinal parasites were higher in Ezza than

in Ikwo, with values of 76.00% and 62.00% as compared to 56.00% and 48.00% respectively. The mean intensity and mean abundance of ectoparasites were higher than those of the intestinal parasites in both of the study areas.

Table 3: Locality related distribution of ecto-and intestinal parasitic fauna among domestic dogs in two rural areas of Ebonyi State, Nigeria

Parasites species	Number Examined	Number Infected	Number of Parasites	Prevalence (%)	Mean Intensity	Mean Abundance
Ectoparasites						
Ikwo	50	28	58	56.00	2.07	1.16
Ezza	50	38	66	76.00	1.74	1.32
Intestinal Parasites						
Ikwo	50	24	34	48.00	1.42	0.68
Ezza	50	31	44	62.00	1.42	0.88

Female dogs were infested and infected more by both ecto parasites and intestinal parasites, with prevalence of 75.81% and 62.90% in comparison with the males with 55.26% and

42.11% respectively. The mean abundance of both types of parasite was also higher in females than in males (Table 4).

Table 4: Sex- related distribution of ecto-and intestinal parasitic fauna among domestic dogs in two rural areas of Ebonyi State, Nigeria

Sex	Number Examined	Number Infected	Number of Parasites	Prevalence (%)	Mean Intensity	Mean Abundance
Ectoparasites						
Male	38	21	40	55.26	1.91	1.05
Female	62	47	85	75.81	1.82	1.37
Intestinal Parasites						
Male	38	16	21	42.11	1.31	0.55
Female	62	39	57	62.90	1.46	0.92

Table 5 shows the age- related distribution of ecto-and intestinal parasitic fauna among domestic dogs in two rural areas of Ebonyi State, Nigeria. Dogs that were more than one (1) year old were more infested and infected than those that

were one or less than (\leq) 1 year. The mean abundance of parasites in older dogs was also higher in comparison with that of the younger ones.

Table 5: Age-related distribution of ecto-and intestinal parasitic fauna among domestic dogs in two rural areas of Ebonyi State

Age (years)	Number Examined	Number Infected	Number of Parasites	Prevalence (%)	Mean Intensity	Mean Abundance
			Ectoparasites			
≤ 1	42	17	30	40.48	1.77	0.71
> 1	58	51	95	87.93	1.86	1.64
			Intestinal Parasites			
≤ 1	42	13	19	30.95	1.46	0.45
> 1	58	42	59	72.41	1.41	1.01

Discussion

Fifty-five (55) of the 100 examined dogs were infected with 12 different species of intestinal parasites of both helminthes and protozoa. *Ancylostoma caninum* had the highest prevalence of 23.00%. This is a significant prevalence level and an indicator of the level of pollution of the soils of the study areas. *A. caninum* is a parasite with high zoonotic potential.

Ctenocephalides felis was among the least abundant and least prevalent species. This is in contrast with the findings of Durden *et al.* [20] Gracia *et al.* [21] and Tavassoli *et al.* [22] who reported *C. felis* as the most abundant fleas in their studies in the USA, Spain and Iran respectively. The existing differences in abundance could be attributed to prevailing environmental factors in the regions of study, as the earlier studies were carried out in temperate zones while the present study took place in the tropical region. Ectoparasite abundance depends on the availability of food in the ecosystem and on availability of hosts. The use of dogs as pets is more in the temperate areas than in the tropical areas, hence, could have accounted for higher dog population density, leading to the higher prevalence and abundance of *C. felis* observed in the previous studies.

The abundance of ectoparasites was more in the female dogs than in the males. The higher frequencies of ectoparasites in female dogs is in disagreement with the findings of Chee *et al.* [23] who reported higher prevalence of ectoparasites among males but agrees with the reports of Torres *et al.* [24] The higher prevalence of ectoparasites among the female dogs could be attributed to the fact that the females maintain sedentary lifestyle as they remain in most times, taking care and feeding the puppies while the males move around.

Host location by most ectoparasites could be enhanced more when an animal is sedentary than when the animal is very actively mobile.

Although high prevalence and mean abundance of both ectoparasites and intestinal parasites were recorded in both of the study areas, the parameters were higher in Ezza than in Ikwu. The observed higher values of the parameters remains a puzzle and inexplicable as the two areas were similar in all respects especially with respect to the prevailing environmental and veterinary public health consciousness.

Dogs older than one year were more infested and infected than the younger ones. This is in agreement with Kamani *et al.* [25] who reported higher incidence of haemoparasitism among older dogs than among the younger ones. However, this does not conform to the reports of Torres *et al.* [24] and Tesfaye and Chanie [26] who reported higher prevalence of ectoparasites among the younger dogs.

There was high prevalence of the parasites among examined dogs in the two study areas and most of the parasites were of high zoonotic values. There is therefore a need for public health enlightenment for the inhabitants of the areas. Veterinary centres should be established in the study areas to enable pets have access to regular veterinary diagnosis and treatments.

Further study advocates that members of households of pet owners should also be parasitologically examined for such recovered parasites.

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