Prevalence of ecto-, endo- and haemoparasites in slaughtered dogsin Maiduguri, Nigeria

N.B. ADAMU[1], J.Y. ADAMU[2]*, L. SALISU[1]

[1]*Department of Veterinary Public Health and Preventive Medicine, Faculty of Veterinary Medicine, University of Maiduguri, PMB 1069, Maiduguri, Borno State, NIGERIA.*
[2]*Department of Veterinary Microbiology and Parasitology, Faculty of Veterinary Medicine, University of Maiduguri, PMB 1069, Maiduguri, Borno State, NIGERIA.*

**Corresponding author: adamuyaz@yahoo.com*

SUMMARY

A cross sectional study on prevalence of ecto, endo and haemoparasites among slaughtered dogs in two different areas (Artillery area and Maimalari Barrack) of Maiduguri metropolis was conducted. Five hundred and forty three samples from 181 randomly selected dogs were collected and examined for ectoparasites, endoparasites and haemoparasites using standard techniques. Among slaughtered dogs, 85 (47.0%) were positive for ectoparasites, 25 (13.8%) for intestinal helminths and 10 (5.5%) for haemoparasites. Co-infections were seen in 19 (10.5%) dogs. Ectoparasites detected included mainly *Rhipicephalus sanguineus* (24.3%) then *Boophilus* spp. (13.3%) and *Amblyomma* spp. (9.4%), endoparasites included *Toxocara canis* (5.0%), *Dipylidium caninum* (2.8%) and *Ancylostoma caninum* (6.1%) and the blood parasites encountered were *Ehrlichia canis* and *Babesia canis* with the same frequency (2.8%). Although the ectoparasite frequency appeared slightly increased in the Artillery area (*P = 0.05*), location, sex and age have exerted no significant effect on the dog susceptibility for parasite infections. It was concluded that ectoparasites, intestinal helminths and haemoparasites (for which some species represent a risk for public health) are prevalent in the study area and that regular antiparasite treatments would be proposed.

Keywords: Dog, Ectoparasite, Endoparasite, Haemoparasite, Prevalence, Public health risk, Nigeria.

RÉSUMÉ

Prévalence des ecto-, endo- et hémoparasites chez les chiens abattus à Maiduguri, Nigeria

Une étude transversale sur la prévalence des ecto-, endo- et hémoparasites des chiens abattus dans deux zones différentes (Artillerie et Maimalari Barrack) de la métropole Maiduguri a été menée. Cinq cent quarante-trois échantillons provenant de 181 chiens sélectionnés au hasard ont été prélevés et analysés pour les ectoparasites, endoparasites et hémoparasites en utilisant des techniques standard. Parmi ces chiens abattus, 85 (47,0 %) étaient positifs pour les ectoparasites, 25 (13,8 %) pour les helminthes intestinaux et 10 (5,5 %) pour les hémoparasites. Des cas de co-infections ont été observés dans 19 cas (10,5 %). Les ectoparasites détectés ont été principalement *Rhipicephalus sanguineus* (24,3 %), puis *Boophilus* spp. (13,3 %) et *Amblyomma* spp. (9.4%), parmi les endoparasites ont été retrouvés *Toxocara canis* (5,0 %), *Dipylidium caninum* (2,8 %) et *Ancylostoma caninum* (6,1 %) et parmi les hémoparasites, *Ehrlichia canis* et *Babesia canis* avec une fréquence identique (2,8 %). Bien que la fréquence des ectoparasites soit apparue faiblement augmentée dans la zone de l'Artillerie (*P = 0.05*), la localisation géographique, le sexe ou l'âge n'ont pas exercé d'effet significatif sur la susceptibilité des chiens envers les infections parasitaires. On peut en conclure que les ecto-, endo- et hémoparasites (dont certains constituent un risque de santé publique) sont fréquents dans la zone explorée et des traitements antiparasitaires réguliers devraient être proposés.

Mots clés : Chien, Ectoparasite, Endoparasite, Haemoparasite, Prévalence, risque de santé publique, Nigeria.

Introduction

Dogs are the most successful canides, adapted to human habitation worldwide [37]. Recent genetic fossil and DNA evidence shows that dogs were as early as 100000 years ago [24, 33]. They have contributed to physical, social and emotional well-being of their owners, particularly children where they are associated with a higher level of self-esteem [15, 23, 32] and have been used for hunting, as guards, draught animals, and for food [36]. However, in spite of their beneficial effects, dogs remain major threat to public health, as most of them harbour a bewildering number of infective stages of parasites transmissible to man and other domestic animals [11, 25, 32, 39]. Some of these parasites cause cutaneous and visceral larva migrans, mange, hydatidosis and tungiasis [2, 5, 21, 26].

In several parts of Nigeria, despite their role as companion animals, dogs provide an important source of proteins to man. Dog meat is a delicacy and highly sought for in many parts of the country [39]. According to Volk [40] there are common beliefs concerning canine cuisines in Nigeria which include protection against witchcraft, cure for malaria, prevention of poisoning and that eating dog meat can improve the sex life. As a result of these unfounded claims, dogs often get missing especially if they are left to stray. Several epidemiological studies conducted in Nigeria and other parts of the world to assess the prevalence of parasite infections in canines have shown dogs to harbour ectoparasites such as *Sarcoptes* spp., *Ctenocephalides* spp., *Pulex irritans, Rhipicephalus sanguineus* [6]; endoparasites such as *Taenia* spp., *Echinococcus granulosus, Ancylostoma caninum, Toxocara canis, Dipylidium caninum* and *Isospora* spp. [7, 13, 14, 17, 28, 31, 35, 36] and haemoparasites such as *Babesia* spp., *Hepatozoan canis*, and *Dirofilaria* spp. [4, 8].

The clinical signs of parasite infections in dogs vary and occasionally some infected animals may present no symptoms [31]. These factors, coupled with inadequate information by dog keepers on the risks of disease transmission, control of zoonoses transmitted by domestic animals, control of stray dogs and poor level of hygiene has resulted in an increased risk of exposure to zoonotic diseases transmitted by these animals [28, 35].

There is paucity of information on parasites of domestic dogs in Maiduguri. The aim of the study is to determine the prevalence of ecto-, endo- and haemoparasites of slaughtered dogs in Maiduguri, Nigeria. The findings of this study will provide some insight on the level of parasite infestation in dogs being slaughtered for food in Maiduguri in order to proffer some basic control and prevention methods which could be of productivity and zoonotic importance.

Material and Methods

STUDY AREA

The study was conducted in the city of Maiduguri the capital of Borno State, Nigeria located on latitude 11°40'N and longitude 13°05'E in the arid Sahel [1]. Maiduguri is characterized by a long dry season (November to June) and a short wet season (July to October). Temperature ranges from less than 20°C during the dry harmattan period (November-February) to over 45°C during the late dry season. The city covers an area of about 70,898 sq. km with a population of 4,588,668 based on the 2006 census. Borno State is the largest among the 36 states in Nigeria in terms of land mass. The state occupies the greatest part of the Chad Basin and shares borders with the Republic of Chad to the Northeast, Niger to the North and Cameroon to the East.

SAMPLE COLLECTIONS

A cross sectional study was conducted from June to August 2010, to determine the prevalence of ectoparasites, endoparasites and haemoparasites in dogs slaughtered for human consumption in Maiduguri. A total of 543 samples from 181 randomly selected dogs were collected. Among the 181 slaughtered dogs, 102 came from the Artillery area and 79 were from Maimalari Barrack. The dog population was formed by 118 males and 63 females and 107 were adults whereas 74 were young dogs.

During the survey information on the dog's locality, breed, age and sex were recorded. Prior to slaughter, about 5 mL of blood samples were collected from the cephalic vein using sterile vacutainer tubes containing ethylene diamine tetra-acetic acid (EDTA). For collection and removal of ectoparasites, each dog was thoroughly examined by combing the entire body surface on a clear white paper. To facilitate the extraction of ectoparasites, the dogs were rubbed with a piece of cotton-wool soaked in ether. The ectoparasites recovered were preserved in 70% alcohol for identification. For the diagnosis of endoparasites, gastrointestinal tracts of the slaughtered dogs were collected into sterile nylon bags and placed in ice-packed containers. Samples were then transported to the Veterinary Parasitology Laboratory of the University of Maiduguri for examination.

PARASITOLOGICAL PROCEDURES

Blood smears were obtained from blood samples which were then fixed in absolute methanol, stained for 30 minutes with 10% Giemsa stain and examined under light microscope using 100X magnification.

The ectoparasites were dehydrated in first 80%, then 90% and finally 100% alcohol before being cleared in xylene and mounted on a slide for final identification with a light microscope [29].

For identification of the endoparasites, the gastrointestinal tracts were opened with a pair of scissors and their contents washed in a 63 μm sieve. The washed intestinal tracts were scraped gently with scalpel blade to remove any worm adhering to the lining membrane. Worms were picked from the washings with forceps under a dissecting microscope. All helminths were counted and stored in 70% alcohol. Faecal samples were taken from the rectum and examined using the simple McMaster technique as described by PERMIN and HANSEN [30]. All parasites were identified using SOULSBY [34] and KAUFMANN [22].

STATISTICAL ANALYSIS

Data were compiled in a spreadsheet (Microsoft Excel, Version 2007) and analyzed as appropriate using descriptive statistics. *P*-value was calculated using Chi-square test. A *P*-value less than 0.05 was considered as statistically significant.

Results

Out of the total dogs sampled, the overall parasite infection rate was 22.1%: 85 dogs (47.0%) were positive for ectoparasites, 25 (13.8%) for intestinal helminths and 10 (5.5%) for haemoparasites (Table I). Moreover, 11 (6.1%) and 8 (4.4%) dogs were both positive for ectoparasites and endoparasites or haemoparasites, respectively. As shown in Table I, the ectoparasite frequency appeared significantly more elevated in the Artillery than in the Maimalari Barrack area ($P = 0.05$) whereas the prevalences of endoparasites and haemoparasites have not significantly differed. Additionally, the parasite (ecto-, endo- and haemoparasite) prevalences were similar according to the sex and to the age of dogs although haemoparasites tended to be more frequently found in males than in females ($P < 0.10$).

The distribution of the identified parasites is shown in Table II. Among ectoparasites, 3 species (*Rhipicephalus sanguineus, Boophilus* spp., and *Amblyomma* spp.) were recorded and *Rhipicephalus sanguineus* was detected significantly more often than the other ectoparasites (vs. *Boophilus* spp.: $P = 0.01$ and vs. *Amblyomma* spp.: $P < 0.001$). The endoparasites identified with a similar frequency ($P > 0.05$) were *Toxocara canis, Dipylidium caninum* and *Ancylostoma caninum*. For haemoparasites, *Ehrlichia canis* and *Babesia canis* were found with the same low frequency (2.8%) in slaughtered dogs. Co-infections were seen in 19 dogs (10.5%).

Discussion

In the present study, 47% of the sampled dogs were positive for ectoparasites, including *Rhipicephalus sanguineus, Boophilus*

	Ectoparasites	Endoparasites	Haemoparasites
Total sampling area	**85 (47.0%)**	**25 (13.8%)**	**10 (5.5%)**
Artillery (n = 102)	55 (53.9%)	15 (14.7%)	5 (4.9%)
Maimalari Barrack (n = 79)	30 (38.0%)	10 (12.7%)	5 (6.3%)
Odds ratio (95% CI)	0.52 (0.29-0.95)	0.84 (0.36-1.99)	1.31 (0.37-4.69)
P value	0.05	0.86	0.45
Sex			
Males (n = 118)	50 (42.4%)	19 (16.1%)	9 (7.6%)
Females (n = 63)	35 (55.6%)	6 (9.5%)	1 (1.6%)
Odds ratio (95% CI)	1.70 (0.92-3.15)	0.55 (0.21-1.45)	0.20 (0.02-1.58)
P value	0.12	0.32	0.08
Age			
Young[1] (n = 74)	35 (47.3%)	8 (10.8%)	3 (4.1%)
Adult[2] (n = 107)	50 (46.7%)	17 (15.9%)	7 (6.5%)
Odds ratio (95% CI)	0.98 (0.54-1.77)	1.56 (0.63-3.83)	1.66 (0.41-6.63)
P value	0.92	0.45	0.36

[1]dogs were considered as young when they were less than 1 year old; [2]dogs were considered as adult when they were more than 1 year old.

TABLE I: Prevalence of ecto-, endo- and haemoparasites in dogs (n = 181) slaughtered in Maiduguri, Nigeria.

Parasite types		Positive cases (prevalence %)	Odds ratio (95% CI)	*P* value
Ectoparasites	*Rhipicephalus sanguineus*	44 (24.3%)	1.00	
	Boophilus spp.	24 (13.3%)	0.48 (0.28-0.82)	0.01
	Amblyomma spp.	17 (9.4%)	0.32 (0.18-0.59)	0.0002
	Co-infection	19 (10.5%)	0.37 (0.20-0.66)	0.0009
	Total	85		
Endoparasites	*Toxocara canis*	9 (5.0%)	1.00	
	Dipylidium caninum	5 (2.8%)	0.54 (0.18-1.65)	0.413
	Ancylostoma caninum	11 (6.1%)	1.24 (0.49-3.06)	0.823
	Co-infection	11 (6.1%)	1.24 (0.49-3.06)	0.823
	Total	25		
Haemoparasites	*Ehrlichia canis*	5 (2.8%)		
	Babesia canis	5 (2.8%)	1.00 (0.28-3.52)	0.750
	Co-infection	8 (4.4%)	1.65 (0.53-5.07)	0.572
	Total	10		

TABLE II: Distribution of the species of ecto, endo and haemoparasites identified in dogs (n = 181) slaughtered in Maiduguri, Nigeria.

spp. and *Amblyomma* spp. in 24.3%, 13.3% and 9.4%, respectively. *Rhipicephalus sanguineus* was the most abundant tick species found here in agreement with other reports [3, 16, 19, 20, 27, 41] and was commonly found in dogs from Africa and other countries in the world [6, 19, 27]. Whereas *Amblyomma* ticks are less common in dogs and would be transmitted from ruminants [9] mainly in shepherd dogs, *Rhipicephalus* ticks have been described to parasitize humans [12] and may transmit rickettsia diseases and visceral leishmaniosis [10] and *Rhipicephalus sanguineus* and *Boophilus* spp have been shown to transmit *Babesia canis* and *Ehrlichia canis* in dogs [9]. Indeed, among the 5.5% (10 cases) of dogs infected with haemoparasites, the only 2 species of haemoparasites encountered with the same frequency (2.8%) were *Babesia canis* and *Ehrlichia canis. Babesia canis* parasitize and multiply in the erythrocytes leading to anaemia and loss of body condition. Dogs that recover from babesiosis are immuned but remain infective for more than 12 months [9]. *Ehrlichia canis* in dogs can also lead to anaemia and thrombocytopenia.

Intestinal helminths were found in 25 sampled dogs (13.8%) out of the 181 slaughtered in Maiduguri, Nigeria. *Ancylostoma caninum* was isolated in 11 dogs (6.1%) in the current study while DEGEFU *et al*. [14], GINGRICH *et al*. [18] and Swai et al. [36] reported prevalences around 57%-58% for this parasite in Ethiopia, Galapagos Islands and Tanzania, respectively. YACOB *et al*. [42] in Ethiopia and UGBOMOIKO *et al.* [38] in Nigeria also recorded different *Ancylostoma caninum* prevalences, 32% and 16.9% respectively, compared to the present study. Differences in frequency of gastrointestinal helminth infection between countries is possible due to the differences in climatic factors required for the biology of the parasites, veterinary facilities and public awareness to take care of dogs [38, 42]. *Ancylostoma caninum* and *Toxocara canis* in dogs can cause anaemia, diarrhoea, and slow growth.

Toxocara canis may cause death of puppies due to migrating larvae in lungs leading to pneumonia. Infective larvae of *Ancylostoma caninum* and *Toxocara canis* could cause creeping eruption and visceral larval migrans respectively, and these constitute an important public health problem [42]. *Dipylidium caninum* gravid proglottids were found in faeces but no dog flea was found. The dog fleas- *Ctenocephalides canis* or *Pulex irritans* serve as the intermediate host for *D. caninum*. These dog fleas when present can transmit the infection to man by accidental ingestion of the infected fleas while playing with the pets [9]. Only 2.8% of *D. caninum* was found among the endoparasites. Co-infections were seen in 10.5% of the dogs. Eleven (6.1%) and 8 (4.4%) dogs were both positive for ectoparasites and endoparasites or haemoparasites, respectively. Canine vector-borne diseases are globally distributed and seem to spread rapidly. They are caused by various pathogens transmitted by arthropods including ticks, fleas, mosquitoes and sandflies [20] such as the case of *Rhipicephalus sanguineus* and *Boophilus* spp. in transmitting *Babesia canis* and *Ehrlichia canis* in dogs [9].

Except for ectoparasites which were found slightly more frequently in the Artillery area, there was no significant difference in the prevalence rates of ectoparasites, endoparasites and haemoparasites based on location, age and sex of dogs in the present study. Although canine cuisines seem to be taboo in many religions and cultures in the world, they still thrive in many parts of the world including Nigeria and the potential for transmitting zoonotic diseases to human population is present. Many dogs used for food usually scavenge for food, with the attendant poor veterinary services.

As a conclusion, dogs in north-eastern Nigeria are potential reservoirs of ecto-, endo- and haemoparasites of zoonotic significance. There is, therefore, the need for health education to dog breeders and owners, vaccination of all stray dogs and proper use at least of acaricides and routine vermifuges.

References

1. - ADAMU J.Y., AMEH J.A., EGWU G.O.: Prevalence and biotyping of *Pasteurella haemolytica* isolates from sahel sheep and goats in Maiduguri. *Anim. Prod. Res. Adv*., 2010, **6**, 161-166.
2. - ADAMU N.B., ALI E.G., ADAMU J.Y.: Bacterial and parasitic zoonoses encountered at slaughter in Maiduguri, Northeastern, Nigeria. *Vet. World*, 2011, **4**, 97-101.
3. - AGBOLADE O.M., SOETAN E.O., AWESU A., OJO J.A., SOMOYE O.J., RAUFU S.T.: Ectoparasites of domestic dogs in some Ijebu communities, southwest Nigeria. *World Appl. Sci. J.*, 2008, **3**, 916-920.
4. - AHMED M.I., BASU A.K., EL-YUGUDA A.D.: Prevalence of canine haemoparasitic infection in Maiduguri, Borno State, Nigeria. *Ind. J. Anim. Health,* 1994, **33**, 131-132.
5. - AKAO N., OHTA N.: Toxocariasis in Japan. *Parasitol. Int*., 2007, **56**, 87-93.
6. - ALDEMIR O.S.: Epidemiological study of ectoparasites in dogs from Erzurum region in Turkey. *Rev. Méd. Vét*., 2007, **158**, 148-151.
7. - ANOSIKE J.C., NWOKE B.E., UKAGA C.N., MADU N.G., DOZIE I.N.: Aspects of intestinal helminth parasites of dogs in World-Bank assisted housing estate, New Owerri, Nigeria. *Afr. J. Appl. Zool. Envt. Biol*., 2004, **6**, 26-30.
8. - BEUGNET F., EDDERAI D.: Enquête sur les helminthes parasites digestifs et sanguins chez les chiens à Libreville, Gabon. *Rev. Méd. Vét*., 1998, **149**, 327-330.
9. - BHATIA B.B., PATHAK K.M.L., BANERJEE D.P.: Textbook of veterinary Parasitology, 2nd edition, Kalyani Publishers, New Delhi, India. 2007, pp.: 188-340.
10. - COUTINHO M.T., BUENO L.L., STERZIK A., FUJIWARA R.T., BOTELHO J.R., DE MARIA M., GENARO O., LINARDI P.M.: Participation of *Rhipicephalus sanguineus* (Acari: Ixodidae) in the epidemiology of canine visceral leishmaniasis. *Vet. Parasitol*., 2005, **128**, 149-155.
11. - DAKKAK A.: *Echinococcus*-hydatidiosis in North Africa: geographical distribution of species and strains and prevalence in man and animals. *In*: Guidelines for diagnosis, surveillance and control of echinococcosis. Veterinary Public Health, World Health Organization, Geneva Switzerland, 1992, 147 pages.
12. - DANTAS-TORRES F., FIGUEREDO L.A., BRANDAO-FILHO S.P.: *Rhipicephalus sanguineus* (Acari: ixodidae), the brown dog tick, parasitizing humans in Brasil. *Rev. Soc. Bras. Med. Trop*., 2006, **39**, 64-67.
13. - DAVOUST B., NORMAND T., BOURRY O., DANG H., LEROY E., BOURDOISEAU G.: Epidemiological survey on gastrointestinal and blood-borne helminths of dogs in north-east Gabon. *Onderstepoort J. Vet. Res.*, 2008, **75**, 359-364.
14. - DEGEFU H., TEFERA A., YOHANNES M.: Zoonotic helminth parasites in faecal samples of household dogs in Jimma town, Ethiopia. *J. Pub. Health Epidemiol*., 2011, **3**, 138-143.
15. - DOHOO I.R., Mc DONELL W.N., RHODES C.S., ELAZHARY Y.L.: Veterinary research and human health. *Can. Vet. J*., 1998, **39**, 549-556.
16. - EKANEM M.S., MBAGWU H.O.C., OPARA K.N., AGBATA Q.C.: Ticks infestation of domestic dogs (*Canis familiaris lupus*) in Uyo, Akwa Ibom State, Nigeria. *World J. Appl. Sci. Tech*., 2010, **2**, 191-196.
17. - FERREIRA F.S., PEREIRA-BALTASAR P., PARREIRA R., PADRE L., VILHENA M., TAVORA TAVIRA L., ATOUGUIA J., CENTENO-LIMA S.: Intestinal parasites in dogs and cats from the district of Évora, Portugal. *Vet. Parasitol*., 2011, **179**, 242-245.
18. - GINGRICH E.N., SCORZA A.V., CLIFFORD E.L., OLEA-POPELKA E.J., LAPPIN M.R.: Intestinal parasites of dogs on the Galapagos Islands. *Vet. Parasitol.*, 2010, **169**, 404-407.
19. - GONZÁLEZ A., CASTRO D.C., GONZÁLEZ S.: Ectoparasite species from Canis familiaris (Linné) in Buenos Aires province, Argentina. *Vet. Parasitol*., 2004, **120**, 123-129.
20. - GÖTSCH S., LESCHNIK M., DUSCHER G., BURGSTALLER J.P., WILLIE-PIAZZAI W., JOACHIM A.: Ticks and haemoparasites of dogs from Praia, Cape Verde. *Vet. Parasitol*., 2009, **166**, 171-174.
21. - IRWIN P.J.: Companion animal parasitology: a clinical perspective. *Int. J. Parasitol*., 2002, **32**, 581-593.
22. - KAUFMANN J.: Parasitic infections of domestic animals: a diagnostic manual, 1st Edition, Birkhauser, Basel, 1996, 423 pages.
23. - KNOBEL D.L., LAURENSON M.K., KAZWALA R.R., BODEN L.A., CLEAVELAND S.: A cross-sectional study of factors associated with dog ownership in Tanzania. BMC Vet. Res., 2008, 4, 5.
24. - LINDBLAD-TOH K., WADE C.M., MIKKELSEN T.S. *et al*: Genome sequence, comparative analysis and haplotype structure of the domestic dog. *Nature*, 2005, **438**, 803-819.
25. - MOLYNEUX D.H.: 'Neglected' Diseases but unrecognized successes-challenges and opportunities for infectious disease control. *Lancet*, 2004, **364**, 380-383.
26. - MORRISON G.: Zoonotic infection from pets. Understanding the risks and treatment. Postgrad. Med., 2001, 110, 24-26.
27. - NUCHJANGREED C., SOMPRASONG W.: Ectoparasite species found on domestic dogs from Pattaya district, Chon Buri province, Thailand. *Southeast Asian J. Trop. Med. Public Health*., 2007, **38** (suppl 1), 203-207.
28. - OLIVEIRA-SEQUEIRA T.C., AMARANTE A.F., FERRARI T.B., NUNES L.C.: Prevalence of intestinal parasites in dogs from Sao Paulo State, Brazil. *Vet. Parasitol*., 2002, **103**, 19-27.
29. - PERMIN A., ESMANN J.B., HOJ C.H., HOVE T., MUKARATIRWA S.: Ecto-, endo- and haemoparasites in free-range chickens in the Goromonzi district in Zimbabwe. *Prev. Vet. Med*., 2002, **54**, 213-224.
30. - PERMIN A., HANSEN J.: The epidemiology, diagnosis and control of poultry parasites. FAO, Rome, Italy, 1998.

31. - RAMIREZ-BARRIOS R.A., BARBOZA-MENA G., MUNOZ J., ANGULO-CUBILLAN F., HERNANDEZ E., GONZALEZ F., ESCALONA F.: Prevalence of intestinal parasites in dogs under veterinary care in Maracaibo, Venezuela. *Vet. Parasitol*., 2004, **121**, 11-20.

32. - ROBERTSON I.D., IRWIN P.J., LYMBERY A.J., THOMPSON R.C.: The role of companion animals in the emergence of parasitic disease. *Int. J. Parasitol*., 2000, **30**, 1369-1377.

33. - SAVOLAINEN P., ZANG Y.P., LUO J., LUNDEBERG J., LEITNER T.: Genetic evidence for an East Asian origin of domestic dogs. *Science*, 2002, **298**, 1610-1613.

34. - SOULSBY E.J.L.: Helminths, arthropods and protozoa of domesticated animals, SOULSBY E.J.L. (Ed), 7th edition, Bailliere indall, East Sussex, UK, 1982, pp.: 119-127.

35. - SOWEMIMO O.A., ASAOLU S.O.: Epidemiology of intestinal helminth parasites of dogs in Ibadan, Nigeria. *J. Helminthol*., 2008, **82**, 89-93.

36. - SWAI E.S., KAAYA E.J., MSHANGA D.A., MBISE E.W.: A survey on gastro-intestinal parasites of non-descript dogs in and around Arusha municipality, Tanzania. *Internatl. J. Anim. Vet. Adv*., 2010, **3**, 63-67.

37. - TANNEN D.: Talking the dog: framing pets as interactional resources in family discourse. *Res. Lang. Soc. Interac*., 2004, **37**, 399-420.

38. - UGBOMOIKO U.S., ARIZA L., HEUKELBACH J.: Parasites of importance for human health in Nigerian dogs: high prevalence and limited knowledge of pet owners. *BMC Vet. Res*., 2008, **4**, 49.

39. - UMAR Y.A.: Intestinal helminthoses in dogs in Kaduna Metropolis, Kaduna state, Nigeria. *Iran. J. Parasitol.*, 2009, **4**, 34-39.

40. - VOLK W.: ''Man bites dog''. Dining on dog meat in Nigeria. Gadling. 2007, www.gadling.com/2007/03/07/man-bites-dog-dining-on-do-meat-in-nigeria/ Assessed on 16th June, 2011.

41. - XHAXHIU D., KUSI I., RAPTI D., VISSER M., KNAUS M., LINDNER T., REHBEIN S.: Ectoparasites of dogs and cats in Albania. *Parasitol. Res.*, 2009, **105**, 1577-1587.

42. - YACOB H.T, AYELE T., FIKRU R., BASU A.K.: Gastrointestinal nematodes in dogs from Zeit, Ethiopia. *Vet. Parasitol.*, 2007, **148**, 144-148.