PREVALENCE OF *CYSTOISOSPORA* OOCYSTS INFECTION IN LOCAL BREED OF DOGS IN ENUGU STATE, NIGERIA.

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Abstract
Cystoisospora are apicomplexan protozoan parasites that cause diarrheoa, and even death in severe cases especially in puppies. This study was aimed at determining the prevalence of *Cystoisospora* oocysts in faeces of dogs presented in veterinary hospitals, clinics and dogs at home in rural areas in Enugu State, Nigeria. A total of 203 fresh faecal samples were collected from domestic dogs in 6 local government area of Enugu State from February to August 2015. All the samples were processed for detection of *Cystoisospora* oocysts using flotation technique and examined under light microscopy. Results showed that 21 % (*n = 44*) of the faecal samples were positive for *Cystoisospora* oocysts. There was no significant association ($p > 0.05$) between the presence of the *Cystoisospora* oocysts and age, sex and faecal consistency distribution. The findings of this work showed that domestic dogs in Enugu State harbour and shed *Cystoisospora* oocysts in the environment. This faecal shedding is particularly so in those animals not showing clinical signs of enteritis and therefore poses greater health risk to immunocompromised adult dogs and puppies. Awareness creation amongst dog owners and breeders is therefore of paramount importance in Enugu State in particular and Nigeria in general, to educate them on the potential economic loss this protozoan can cause to puppy farms.
Key Words: Dogs, *Cystoisospora*, Oocysts, Enugu State, Prevalence

Introduction

*Cystoisospora species (*Formely known as *Isospora)* are apicomplexan protozoa of the order Eucocidiorida, subclass coccidiansina and class sporozoasida (Gajadhar *et al*., 2015). These intracellular parasites affect the epithelial cell linings of the digestive tract of wide variety of mammalian hosts including domestic dogs where they cause severe diarrhoea and even deaths (O'Dongue; 1995; Fayer, 2010). Canine intestinal coccidiosis can result in serious or even fatal enteritis and colitis especially in puppies and immunocompromised adult dogs (Dunbar and Foreyt, 1985; Cynthia, 2005). Clinical infection of dogs with *Cystoisospora* species is severe in pups less than 4 months of age (Buehl *et al*., 2006; Dubey *et al*., 2009) where it causes enteritis with diarrhoea which can be haemorrhagic, tenesmus, vomiting, abdominal pain and inappetence with resultant poor health and impaired development. Death could result from excessive loss of electrolyte and dehydration (Daugschies *et al*., 2000; Lappin., 2010). In Nigeria, especially in rural areas, most dog owners have little commitment towards the health of their pet. This attitude results in domestic dogs harbouring parasitic infections including zoonoses; thus posing public health risks to humans especially children who play around in the environment contaminated with dog faeces (Robertson *et al*., 2002).
Despite the high prevalence of the disease in domestic animals, it is not usually seen as a possible cause of gastroenteritis and therefore not included in routine diagnosis of gastroenteritis in domestic dogs.

The importance of enteric protozoan infections in dogs and their public health implications cannot be overemphasized. However, there is dearth of information and research on Cystoisosporiasis in domestic dogs in Enugu State, Nigeria. This study was therefore designed to determine the occurrence of shedding of *Cystoisospora* oocysts in faeces of dogs in Enugu State, Nigeria.

Materials and Methods

Ethics

Animal owners were contacted and permission obtained to include their animals in the study. The animal experimental protocol was approved by the Experimental Animal Ethics Committiee of the Faculty of Veterinary Medicine, University of Nigeria, Nsukka

Study Area

The study was undertaken in Enugu State which covers approximately 7617.82 km^2 and is located between latitude 6^o 45^l and 7^oN and longitude $7^o12.5^l$ and 7^o 36^l W in the Southeast geopolitical zone of Nigeria. It has three Senatorial zones and 17 local government areas. Simple random sampling technique was used to select two senatorial zones- Enugu West and Enugu North out of the three senatorial zones in Enugu State. Samples were then collected in 3 local governments from each senatorial zone.

Sample collection

Fresh faecal samples were collected from January to August 2015 from homes of dog owners, small animal hospitals and clinics. A total of 203 dogs were included in this study. Faecal samples were collected *par rectum* from each dog using well lubricated disposable gloves into pre-labelled plastic containers. Field identity, including sex, age and source were recorded for each dog. The faeces were examined visually and their consistencies categorized into formed, semi-formed, and watery. The samples were analyzed immediately after collection.

Faecal examination

Faecal examination was done using simple faecal centrifugation flotation technique (Foryet, 2001). Briefly, 2 g of faeces was mixed with 60 ml of sugar solution; the sample was strained through a coffee strainer into test tubes and single-step centrifugation was carried out at 3000 rpm for 10 minutes (Weber, 1992). A plastic pipette was used to pick few drops from the top layer for a wet mount. Identification of *Cystoisospora* oocysts was carried out as described by Kassai, (1999).

Statistical Analysis

Results were analysed descriptively and presented in percentages using tables. Chi square (χ^2) test was used to determine the association between the presence of the parasites and age, sex, faecal consistency distribution. Significance was accepted at $P < 0.05$.

Results

Frequency of *Cystoisospora* oocysts in faecal samples of dogs and their associated risk factors

Of the 203 faecal samples examined, 44 (21.7%) contained oocysts of *Cystoisospora*. Statistical analysis showed that there was no significant association ($P > 0.05$) between the presence of parasites and age, sex and faecal consistency (Table 1).

Table 1: Age, Sex and faecal consistency distribution of *Cystoisospora* oocysts in dogs in Enugu State (n=203)

Variable	Number examined	*Cystoisospora* oocysts	
		Number positive (%)	χ^2
Age			
Puppy	55	13 (23.6)	0.81
Adult	148	31 (20.9)	

Total	**203**	**44 (21.7)**	
Sex			
Male	102	20 (23.5)	0.41
Female	101	24 (19.8)	
Total	**203**	**44 (21.7)**	
Faecal consistency			
Formed	125	33 (26.4)	3.2
Semi-formed	56	8 (14.3)	
Watery	22	3 (13.6)	
Total	**203**	**44 (21.7)**	

P-value > 0.05

Discussion

The shedding of *Cystoisospora* oocysts in faeces of dogs in Enugu State was determined in this study, with a high prevalence rate of 21%. The prevalence recorded in this study was in agreement with a the prevalence of 32.9 observed in Ibadan Nigeria (Ayinmode *et al*., 2016), but in contrast with the results of Mirzaei (2010), who got a prevalence of 5.1% in Iran; Vanparijs *et al*., (1991), who observed a prevalence of 5.2% in dogs in Belgium, also a low prevalence was observed in Venezuela by Ramirez-Barrios *et al.,* (2004) and in Sao Paulo State, Brazil by Oliveira-Sequeira *et al.,* (2002) who found 8.1% and 8.5% prevalence, respectively. This may be due to the fact that we sampled dogs in rural areas were some of the dogs are allowed to roam the streets with little attention paid to their health care and welfare, hence the high prevalence.

In this study we observed no statistical significant association between the presence of *Cystoisospora* oocysts and the age of dogs. However, a higher prevalence of the parasites was seen in puppies than in adult dogs. *Cystoisospora* spps have been reported to be higher in puppies as a result of undeveloped immunity (Buehl *et al*., 2006; Dubey *et al*., 2009).

Sex had no influence on gastrointestinal protozoan infection as there were no significant associations (P > 0.05) between them. However, there is a higher prevalence of *Cystoisospora* oocysts in male than female dogs which could be attributed to the fact that males move around more often than females in search of mating partners and also establishing territory. However, other workers reported higher infection in females than in males and attributed it to reduced immunity at certain periods in the female's physiologic cycle (Wang *et al.,* 2008; Zelalem *et al*., 2012; Olabanji *et al*., 2016).

Oocysts were seen more in apparently healthy dogs (26.4%) than those having signs of enteritis (diarrhoea) – 13.6% (watery faeces) and 14.3% (semi-solid faeces). It appeared that the more formed the faeces, the more chances of seeing oocysts. Therefore it may be that the oocysts were less concentrated in diarrhoeic faeces and therefore chances of missing the oocysts are high.

Conclusion,

This study has established that there is faecal shedding of *Cystoisospora* oocysts by domestic dogs in Enugu State Nigeria. This study has also shown that faecal shedding is higher in apparently healthy dogs, thus posing health risk to immunocompromised adult dogs and puppies.

Recommendation

Health education and awareness on the economic importance of this enteric protozoan parasite should be created among dog owners and dog breeders. The infection should also be included in the list of routinely diagnosed diseases in veterinary hospitals and clinics as a possible cause of enteritis and diarrhoea as seen in this study.

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