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Full Length Research Paper

Seroprevalence and risk factors of neosporosis in women attending antenatal care and in domestic carnivores in Dakar city, Senegal

COULIBALY Fatoumata[1], NDIAYE Jean Louis[2*], NDOUR Andree Prisca[3], Aka N'da A; David[4] KONE S. Philippe[3], ADJE Koffi Jean François[3], ALLANONTO Victor[3], TOMO Effoua Natacha[3], KAMGA-WALADJO Alain[3], GBATI Oubri Bassa[3], BAKOU Serge N.[5], BONFOH Bassirou[6]

[1]University Peleforo Gon Coulibaly – Ivory Coast; [2]University of Thies Senegal; [3]EISMV: Inter-State School of Sciences and Veterinary Medicine of Dakar-Senegal; [4]University Felix-Houphouët-Boigny-Ivory Coast; [5]University Nagui Abrogua Ivory Coast; [6]AfriqueOne / CSRS - Abidjan, Ivory Coast.

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The objective of the study was to estimate the seroprevalence of neosporosis due to *Neospora caninum* as well as the associated risk factors in women attending antenatal consultations and in domestic carnivore in the Dakar region, Senegal. For this purpose, 100 blood samples among women in Ante Natal Clinics (ANC), 141 in the dog's group, and 113 among the cats were collected and were examined by using ELISA. Regarding risk factors acquisition, a questionnaire was associated with each sample, and obtained data were compiled. The R Commander software was used for statistical analysis. In women attending ANC, overall seroprevalence rate was 17 ± 7.3%. Forty-three percent (43%) had reported an abortion and 14% of them were positive of neosporosis. In multivariate analysis, only the consumption of grilled meat predisposed to neosporosis (OR = 3.38 and p = 0.021). Among the animals' group, the serological test showed a prevalence rate of 42.55 ± 8% in dogs and 60.1 ± 9% in cat's groups. More research on *Neospora caninum* need to be explored and its relationships with pregnant women particularly those with repetitive miscarriages.

Keywords: Neosporosis, seroprevalence, risk factors, pregnant women, domestic carnivores, Senegal.

LIST OF ABBREVIATIONS

ANC: Ante Natal Clinics
CI: Confidence Intervals
ELISA: Enzyme Linked Immuno Sorbent Assay
OR: Odds ratios
p : p value
Pa: apparent prevalence

INTRODUCTION

Neosporosis is a cosmopolitan disease caused by *Neospora caninum* (Dubey et al., 2007) and its definitive host is canine. It was described for the first time by Bjerkas in 1984 in puppies with progressive paralysis following encephalopathy and myositis in Norway. Essentially abortive in cattle, it causes severe neurological disorders and often fatalities in dogs. It is also suspected of causing abortions in other domestic and

Corresponding author E-mail: jlndiaye@univ-thies.sn

wild ruminants, as well as in the equine species (Pitel *et al*., 2010). Neosporosis is a recently identified protozoa disease in dogs and cattle (Dubey *et al*., 1988). At its discovery, it is first confused with toxoplasmosis because of the likeliness of their structures and life cycles, until 1988 when Dubey *et al.,* (1988*)* differentiated them on the ultra-structural and antigenic level. The prevalence observed in various dog populations is around 20% worldwide. In Dakar (Senegal), the prevalence is estimated at 14.2% (Kamga-Waladjo *et al*., 2009).

Despite its high morbidity with economic and health repercussions (Kamga-Waladjo *et al*., 2008), this protozoa disease is phylogenetically very closed to toxoplasmosis but remains neglected because of its mild symptoms. In Dakar, there is very limited information on its prevalence. As a result, this study was carried out to determine the seroprevalence of neosporosis and to identify the risk factors associated both in pregnant women attending Ante Natal Clinics (ANC) and domestic carnivores.

MATERIALS AND METHODS

Type of study

A cross-sectional study was conducted in 2012 at Abass Ndao Hospital in Dakar.

Study population

Human population

In this study, women of various origins who came to antenatal care and registered at the Abass N'Dao hospital were investigated. The questionnaire on the potential risk factors of neosporosis was administrated only to those who consented to participate in the study. The questionnaire included the following topics: sociodemographic factors (ethnic group, age, profession, schooling, origin), obstetrical history, possession of domestic carnivores as well as cooking and eating habits (in particular the consumption of unpasteurized fresh milk and / or local grilled meat '' dibiterie', the type of water and meat consumed. For an expected prevalence of 10% and a risk of error of 6%, the sample size required was 100 women (Win Episcope 2.0 software). Blood sample was taken at the median vein of the elbow crease.

All sera were tested by the indirect Enzyme Linked Immuno Sorbent Assay (ELISA) technique for IgG titration for all species. The LSIVET N. caninum Blocking Kit ELISA [Ref.: 5-Vetneo-001 Se = 89% and Sp = 99%] and ELISA Thermo Scientific Multiskan © type reader were used for the treatment and analysis of samples taken according to the LSIVET laboratories prescriptions. All analysis was performed in accordance with LSIVET laboratory requirements.

Population of domestic carnivore

For an expected prevalence of 10% and a risk of error of 6%, 100 of each domestic carnivore were sufficient for the study (Win Episcope 2. 0 software). One hundred and thirteen (113) cats and 141 dogs were captured in different quarters of Dakar and from which blood samples were collected. Samples were collected from saphenous vein. A questionnaire was filled for each animal. It consisted of two parts: the first relating to the animal's identification and the second part to the animal health status. As for women, the diagnostic test used was ELISA. After getting the samples, all the animals were released.

Data Management and Statistical Analysis

Epidata © software was used for data entry. Statistical analysis were performed using R commander © version 2 and SAS version 9.2 software. In descriptive analysis, percentages with 95% confidence intervals (CI) were estimated. Univariate and multivariate analysis were performed in order to determine factors associated with neosporosis seroprevalence. Odds ratios (OR) were seek to determine association with 95% CI.

RESULTS

Prevalence and factors of variation of neosporosis in women attending antenatal care

A total of 100 women were surveyed and blood samples were collected from all of them. The apparent and real prevalence of neosporosis were 17 ± 7.3% and 18.1 ± 7.5%, respectively (Table 1). This prevalence varies with age, occupation, consumption of meat, fresh milk and / or local grilled meat "dibiterie". The bivariate analysis of risk factors showed that consumption of local grilled meat "dibiterie" predisposes women to be infected with neosporosis (Table 2).

Prevalence and risk factors of neosporosis in domestic carnivores

In dogs, the apparent prevalence of neosporosis is 42.5 ± 8% while the real prevalence was 47.21 ± 8.21%. No factor was statistically associated to neosporosis in multivariate analysis. The apparent and real prevalence of neosporosis were 60.1 ± 9% and 67.25 ± 8.6%, respectively for cats. Sex, deworming and vaccination were considered as associated risk factors after various analyses (Table 3).

DISCUSSION

In women

The overall prevalence of neosporosis in this study was 17%. It is higher than the one obtained in Egypt (7.5%) (Hany *et al*., 2009).This difference could be explained by climatic conditions that influence the survival of the parasite in the environment (Dubey and Schares, 2011).

Table 1. Seroprevalence of neosporosis and abortion prevalence among pregnant women by age group.

Age range	Numbers	abortions		Seropositive to *N. caninum*				
				All women		Women having aborted		p
(years)	Total	P	Pa± CI(%)	P	Pa± CI(%)	P	Pa± CI(%)	
< 25	25	5	**20±15.7**	3	**12±12.73**	0	**0**	
25-39	51	19	**37.2±13.2**	9	**17.6±10.4**	2	**10.5±8.41**	0.7
≥ 40	24	19	**79.1±16.2**	5	**20.8±16.2**	4	**21.1±16.3**	
Total	100	43	**43±9.7**	17	**17±7.3**	6	**14±7.3**	

CI = Confidence Interval P = Positive.
Real prevalence (Pr) = 18.1 ± 7.5%.

Table 2. Risk Factors of Neosporosis in Women attending ANC.

			Seroprevalence (Positive)				
Risk factors		**N**	**n**	**Pa%**	**p**	**OR**	**Clat 95%**
Cats in the house	Yes	73	12	**16.4**	0.80	0.86	0.24-3.50
	No	27	5	**18.5**			
Profession	Active	58	11	**19**	0.53	**1.399**	0.42-5.06
	Unemployed	42	6	**14.3**			
Level of Education	Illiterate	45	9	**20**	0.47	0.68	0.20-2.22
	Educated	55	8	**14.5**			
Maternity	Nulliparous	12	3	**25**	0.43	0.48	0.099-2.37
	F.p.deliveries	43	6	**14**	Ref.		
	multiparous	45	8	**17.8**	0.89	0.75	0.23-2.40
Dog in the house	Yes	3	1	**33.3**	0.44	0.39	0.02-24.75
	No	97	16	**16.5**			
Contact with cat	Yes	44	9	**20.4**	0.67	1.25	0.43-3.60
	No	47	8	**17**			
Presence of sheep	Yes	76	12	**15.8**	0.56	0.71	0.20-2.92
	No	24	5	**20.8**			
Water consumption	SDE water	77	14	**18.2**	0.56	**1.476**	0.35-8.81
	Mixed**	23	3	**13**			
Consumption of market garden products	Yes	98	17	**17.3**	0.51	-	0.03-Infinite
	No	2	0	**0**			
Consomption of fresh milk	Yes	72	15	**20.8**	0.10	**3.38**	0.7-32.68
	No	28	2	**7.1**			
Degree of cooking of the meat consumed	Well cooked Little cooked	56	12	**21.4**	0.18	0.473	0.12-1.60
		44	5	**11.3**			
Grill (oil)	Yes	84	14	**16.6**	0.83	0.86	0.19-5.36
	No	16	3	**18.7**			
Consumption of local grilled meat "**dibiterie"**	Yes	75	9	**12.0**	0.021*	3.45*	1.15-10.28
	No	25	8	**32.0**			

F.p. deliveries = few previous deliveries ** = water SDE + mineral water and / or well water * = Significant Ref = reference factor *N: Numbers, n: positive, Pa: apparent prevalence; p: p-value, CI: Confidence Interval.*

Of the 43% of women who had abortions, 14% were *Neospora caninum* positive. This was similar (13.5%) with a study conducted in Kaolack by Adje in 2012 (Adje, 2012). *Neospora caninum* might be one of the causes of unexplained abortions in antenatal clinic women in Dakar, although according to Dubey *et al.* (2007) its zoonotic character remains to be proven (McAllister, 2017)]. Moreover, anti-Neospora antibodies have been found in patients (Lobato *et al*., 2006). For Hany *et al*., (2009), investigations should be made to remove doubt. Consumption of "dibiterie" grilled meat was shown as a risk factor (p = 0.02, OR = 3.45 and CI = 1.15-10.28). "Dibiterie" is a local barbecue grilled meat that is very popular with Senegalese women, and one of the sources

Table 3. Risk factors for neosporosis and their prevalence in domestic carnivores.

			DOG						CAT					
Variables		**N**	**n Pa(%)**±CI		**P**	**OR**	**CI**	**N**	**n Pa (%)**±IC		**p**	**OR**	**CI**
Race	Local	47	20	**42.5**±14	Ref.0.4440.30	0.71 1.26	0.20-2.47 0.59-2.66	113	68	**60.1**±9	**-**	-	-
	crossed	15	8	**53.3**±25				-	-	**-**			
	exotic	79	32	**40.5**±11				-	-	**-**			
Sex	Females	60	29	**48.3**±13	0.23	**1.5**	0.7-2.9	71	50	**70.4**±10	**0.003***	**3.1***	1.4-7.0
	Males	81	31	**38.2**±10				42	18	**42.8**±15			
Age	Youth	31	12	**38.7**±17	0.71	**1.16**	0.51-2.61	14	11	**78.5**±21	0.15	0.37	0.09-1.43
	Adults	110	48	**43.6**9				99	57	**57.5**±10			
Way of life	P.Wanderers O.Wanderers	6 9	3 2	**50**±40 **22.2**±27	0.51 Ref.	0. 28	0.07-1.81	101	66	**65.3**±9	0.96	-	-
	household	126	55	**43.6**±9	0.41	0.36	0.03-2.69	12	2	**16.6**±21			
dewormed (internal)	Yes	99	42	**42.4**±10	0.15	0.92	0.42-1.98	6	0	**0** ±0	**0.003**	**0.04**	0.002-0.79
	No	36	16	**44.4**±16				103	68	**63.5**±9			
	Unknown	06	02	**33.3**				04	0	**0 ±0**			
Vaccinated (rabies)	Yes	99	42	**42.4**±10	0.14	0.84	0.39-1.81	4	2	**50** ±49	**0.001**	**0.03**	0.002-0.65
	No	37	17	**45.9**±16				102	66	**64.7**±9			
	unknown	05	01	2				07	0	**0 ±0**			
Total		**141**	**60**	**42.5±8**	**Pr= 47.21±8.21**			**113**	**68**	**60.1±9**	**Pr= 67.25±8.61**		

O. Wanderers: Casual Wanderers P. Wanderers: wanderers permanent * = Significant OR: Odds Ratio N : Numbers. n: positive. Pa: apparent prevalence ; p : p-value. CI: Confidence Interval.

of *Neospora* infection is the consumption of undercooked meat (such as barbecues), which corroborates our diagnosis. Precautions and awareness of the population on the risks of eating such types of meat ("dibiterie", barbecue) should be considered.

In the animals

In dogs, neosporosis prevalence was quite 42.5%. It is higher than that obtained in other studies in Europe (Dubey and Schares, 2011, Schüle *et al.,* 2015), Australia (Ash *et al.* 2015, Sloan et al., 2017), Africa (Asmare *et al*., 2014) and even Senegal by Kamga-Waladjo *et al*. (2009), who obtained 14.2%. The study conducted in Dakar, Senegal did not find any association between risk factors and positivity rate (Kamga-Waladjo *et al*., 2009). Despite the higher prevalence observed in our study, no variables were associated with seropositivity. This finding is consistent with the result reported a few years ago by Kamga-Waladjo *et al*. (2009). Several studies illustrated the global distribution of the parasite, but variations observed in seroprevalence have not yet been justified. However, they may reflect the maintenance of infection risk and exposure of intermediate hosts, particularly in cattle. Moreover, high prevalence observed by Kamga-Waladjo *et al*., (2008) in local cows in Dakar (71.43%) associated with that of dogs, would likely be a factor of human exposure to *N. Caninum* in Senegal.

In cats, the prevalence of *N. caninum* was 60.1± 9%. It is distinctly superior compared to other studies: 0.6% in Hungary (Hornok *et al*., 2008), 6.8% in Spain (Millan *et al*., 2009), 10.3% in Australia (Silaghi, *et al*., 2014), 24.5% in

Brazil (Bresciani *et al*., 2007), and 32% in Algeria (Dubey and Schares, 2011). These data also showed a global distribution of neosporosis in cats, but for the time being there is no explanations for the different variations observed in the prevalence rate. Sex appears as an associated risk factor (p = 0.003, OR = 3.1, CI = 1.4-7.0). In fact, females were 3 times more likely to be infected. This may be due to pregnancy stress in females that may stimulate reactivation of encysted tissue forms thus contributing to the release of tachyzoites into detectable blood. However, deworming and vaccination can be considered as protective factors to some extent.

CONCLUSION

In Dakar, the observed prevalence may reflect the risk that women become more exposed to the parasite. With the uncertainty to date on public health importance of neosporosis according to some studies (Dubey et al., 2007, Lobato *et al*., 2006, McAllister, 2017), it would be wise to invest more in research on *N. caninum* and its relationships with women during pregnancy particularly those with repetitive miscarriages to remove controversy.

REFERENCES

Adje KF, (2012). Seroprevalence and risk factors of toxoplasmosis and neosporosis in women in antenatal care and in domestic carnivores in the city of Kaolack (Senegal). Mem Epid: Dakar (EISMV); 9 [In french].B1:B18.

Ash A, Elliot A, Thompson RC A (2015). The detection and characterization of *Neospora/Hammondia*-like oocysts from naturally infected dogs within the same urban region of Australia. *Vet. Parasitol*. Regional Studies and Reports. 1–2: 47-50.

Asmare K, Skjerve E, Bekele J, Sheferaw D, Stachurska-Hagen T, Robertson L (2014). Molecular identification of *Neospora caninum* from calf/foetal brain tissue and among oocysts recovered from faeces of naturally infected dogs in southern Ethiopia. *Acta Tropica*. 130: 88-93.

Bresciani KD, Gennari SM, Serrano AC, Rodrigues AA, Ueno T, Franco L G, Perri S H V, Amarante A F (2007). Antibodies to *Neospora caninum* and *Toxoplasma gondii* in domestic cats from Brazil. *Parasitol. Res*., 100:281–285.

Dubey JP, Carpenter JL, Speer CA, Topper MJ Uggla A (1988). Newly recognized fatal protozoan disease of dogs. *J Am Vet Med Assoc*. 192: 1269-1285

Dubey JP, Vianna MCB, Kwok OCH, Hill DE, Miska KB, Tuo W, Velmurugan GV, Conors M and Jenkins MC (2007). Neosporosis in Beagle dogs: Clinical signs, diagnosis, treatment, isolation and genetic characterization of *N. caninum*. *Vet. Parasitol*. 149:158–166

Dubey JP, Schares G (2011). Neosporosis in animals–the last five years. *Vet Parasitol* 180: 90-108.

Hany I M, Penglong H, Tarek A S, Roba M T, Mahmoud I N, Xuenan X, Nishikawa Y (2009). Prevalence of *Neospora caninum* and *Toxoplasma gondii* Antibodies in Northern Egypt. *Am J Trop Med Hyg*. 80 (2): 263–267.

Hornok S, Edelhofer R, Joachim A, Farkas R, Berta K, Repasi A and Lakatos B (2008). Seroprevalence of *Toxoplasma gondii* and *Neospora caninum* infection of cats in Hungary. *Acta Vet Hung*. 56:81-88.

Kamga-Waladjo AR, Gbati OB, Kone P, Chatagnon G, Bakou SN, Boly H, Diop PEH, Akakpo JA, Tainturier D, (2008). Seroprevalence of neosporosis and impact on the success rate of artificial insemination in cattle herds in Dakar-Senegal. *RASPA.* 6 (1): 19-21 [In french].

Kamga-Waladjo AR, Gbati OB, Kone P, Dombou E, Sene L M, Amirat B, Bencharif D, Akakpo JA, PanguiLJ Diop PEH, (2009). Seroprevalence of canine neosporosis in the regions of Dakar and Thies in Senegal. *RASPA*. 7 (1): 3-5 [In french].

Lobato J, Silava DA, Mineo TW, Amaral JD, Segundo GR, Costacruz JM, Ferreira MS, Borges AS Mineo JR (2006). Detection of immunoglobulin G Antibodies to *Neosporacaninum* in humans: High Seropositivity rates in patients who are infected by human immunodeficiency virus or have neurological disorders. *Clin Vacc Immunol*, 13: 84-89.

McAllister M M (2017). Overview of Neosporosis Veterinary Manual. "Internet access" Page visited on 07.12.17. [online] http://www.msdvetmanual.com/generalized-conditions/neosporosis/overview-of-neosporosis

Millan J, Cabezon O, Pabon M, Dubey JP, Almeria S. (2009). Seroprevalence of *T. gondii* and *N caninum* in feral cats (Felissilvestriscatus) in Majorca, Balearic Islands, Spain. *Vet. Parasitol*. 165: 323–326.

Pitel PH, Legrand L, Pronost S, Maillard K, Marcillaud-Pitel C, Richard E, Fortier G (2010). Bovine neosporosis: from the study of the parasite cycle to the definition of control methods. *Bull Acad Vet France*. 163 (2): 131–142 [In french].

Schüle C, Rehbein S, Shukullari E, Rapti D, Reese S, Silaghi C (2015). Police dogs from Albania as indicators of exposure risk to *Toxoplasma gondii,Neospora caninum* and vector-borne pathogens of zoonotic and veterinary concern. *Vet. Parasitol*. : Regional Studies and Reports. 1-2 : 35-46.

Silaghi C, Knaus M, Rapti D, Kusi I, Shukullari E, Hamel D, Pfister K, Rehbein S (2014). Survey of *Toxoplasma gondii* and *Neospora caninum*, haemotropic mycoplasmas and other arthropod-borne pathogens in cats from Albania. *Parasit. Vectors*. 7 : 62.

Sloan S, Šlapeta J, Jabbar A, Hunnam J, De Groef B, Rawlin G McCowan C (2017). High seroprevalance of *Neospora caninum* in dogs in Victoria, Australia, compared to 20 years ago. *Parasit. Vectors*10:503.

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