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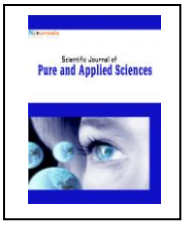

Original article

Seroprevalence of Leptospira interrogans ser. Bratislava in swine from Kaduna Metropolis, Kaduna State, Nigeria

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ABSTRACT

A cross-sectional study was conducted in Kaduna metropolis in order to determine the seroprevalence of *Leptospira interrogans* serovar Bratislava in swine. A total of 270 swine blood samples were collected from farms and slaughterhouses in the different regions of the metropolis and were analyzed for leptospirosis using Indirect – ELISA. Out of the 270 serum samples examined, 118 (43.7%) of the samples were positive for *Leptospira* ser. Bratislava. Although samples from the slaughterhouses had a higher prevalence (52.50%) than that from the farms (40.0%), there was no statistically significant association between the source of the samples and the seropositivity ($p = 0.149$; $X^2 = 2.385$). Similarly, there was no statistically significant association in seroprevalence between the sexes of the swine and among the Local Government Areas within Kaduna metropolis from where swine were sampled. In conclusion, 43.7% pigs in Kaduna metropolis were positive for leptospiral infection which could constitute health risk to the farmers and slaughterhouse workers; hence there is need for an increased enlightenment campaign about the infection and its zoonotic implications among pig farmers and slaughterhouse workers.

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1. Introduction

Leptospirosis is among the world's most wide spread zoonotic diseases especially in tropical and sub-tropical regions of the world. It has both veterinary and public health importance (Everard and Everard, 1993; Ratnam, 1994). It has a re-emerging health problem, because of its increasing incidence among humans and domestic animals (Vijayachari et al., 2008; Cruz et al., 2009; Adler and De la Pena Moctezuma, 2010). The disease is caused by a Gram-negative tightly and helically coiled spirochaete bacteria of the genus *Leptospira.* Rodents are the primary sources and reservoirs of pathogenic leptospires in natural foci (Valkonen et al., 2002). The disease can affect most domestic animals including cattle, sheep, goats, pigs, horses and dogs. The reported prevalence rates of the disease in animals across the world are between 1.0% and 57.1% depending on the region of the world and the animal species (Michel et al., 2002; Leal-Castellanos et al., 2003).

In considering the epidemiology of leptospiral infection, susceptible animals may be classified as maintenance or incidental hosts (Ellis, 1999). Among swine housed together, direct transmission may occur through contact with urine from an infected animals and venereal transmission (Faine et al., 1999). Indirect transmission occurs through contact with surfaces that have been contaminated from urinary shedding, which may be contaminated effluent, feed, water, bedding or soil (Kingscote, 1986). Although this disease is sometimes mild and subclinical, it can lead to great losses in farm animals due to abortions, stillbirths, foetal death, infertility, liver damage and renal failure and with certain leptospiral serovars, death (Jenkins et al., 1979; Higgns et al., 1980).

Humans most commonly infected with this disease include the occupational, recreational, or domestic workers that often come in contact with infected animals or their products (Adler et al., 2010; Dutkiewicz et al., 2011). The commonly observable clinical signs in humans include, flu-like signs and symptoms like fever, headache, weakness, sore throat, etc, which could subsequently aggravate to meningitis, liver damage and renal failure.

Diagnosis of leptospirosis can be carried out by bacterial culture, isolation and identification and by serological techniques, including MAT, ELISA, among others and also using molecular methods such as PCR, AFLP, among others (Miller et al., 1989; Mendoza and Prescott, 1992). The need to address the paucity of information on the prevalence, level of awareness of the disease and risk factors for exposure to the disease among farm and slaughterhouse workers in Nigeria necessitated this research.

2. Materials and methods

Blood samples were collected from swine in pig farms and slaughterhouses from the four (4) Local Government Areas that make up Kaduna metropolis including; Kaduna South, Kaduna North, Chikun and Igabi Local Government Areas. Kaduna metropolis was chosen primarily because it had one-fifth ($1/5^{th}$) of the pig population in Nigeria, representing about 7.3% of the total pig Population of 3,500000 (RIM, 1992).

The samples were collected from the study area using the non-probability sampling schemes including the purposive and convenience sampling system in which the samples were collected based on availability of the samples. The survey was undertaken over a twelve (12) weeks period, from November 2013 to February 2014.

Using previous study by Adah (2013), with a prevalence of 15.83%, 270 blood samples were collected from the selected farms and slaughterhouses using the formula by Thrusfield, (1997). From the 270 blood samples, 105 samples each were from Kaduna South and Chikun Local Government Areas and 30 samples each were from Kaduna North and Igabi Local government Areas. 190 samples were collected from the farms and 80 samples were from slaughterhouses. A total of 13 slaughterhouses and 41 farms were sampled. The samples were collected from the study area using non-probability sampling schemes including the purposive and convenience sampling system.

The serum samples were analyzed using Indirect Enzyme-Linked Immunosorbent Assay (Indirect-ELISA). The kit used was Linnodee *Leptospira* Bratislava ELISA kit which was sourced from Linnodee Animal care, Ballyclare, Ireland. The Linnodee *Leptospira* Bratislava ELISA kit was a competitive ELISA system for the detection of Bratislava-specific antibodies in porcine serum. The results obtained were presented using tables and charts (descriptive statistics). Chi-square and Fisher's exact tests were used to analyze the data obtained.

3. Results

A total of 72 pig farms and 13 slaughterhouses were sampled, 123 (45.56%) of the 270 samples were collected from farms with extensive system of management, 108 (40.0%) were from farms with semi-intensive management and 39 (14.44%) were from farms with intensive management system. One hundred and sixty four (60.74%) of the swine sampled were female, while 106 (39.26%) were male and also 241 (89.26%) of the samples were from adult (≥ 8 months) while 29 (10.74%) were from piglets (≤ 7months). Finally, one hundred and ninety (70.37%) samples were collected from the pig farms while 80 (23.63%) samples were obtained from slaughterhouses.

Of the 270 collected blood samples, 118 (43.7%) were seropositive for *Leptospira* ser. Bratislava. Seventy five (45.73%) of the 164 female swine sampled were seropositive for leptospirosis while 43 (40.58%) of the 106 male swine sampled were positive for the infection (Table 2). Fifty nine (56.19%) of the 105 samples from Chikun LGA were seropositive, 43 (40.95%) of the 105 samples from Kaduna-South LGA were seropositive, 9 (30.0%) of the 30 samples from Igabi LGA were seropositive and 7 (23.33%) of the 30 samples from Kaduna-North LGA were seropositive.

While 76 (40.0%) of the 190 animals sampled from the farms were seropositive, 42 (52.50%) of the 80 animals sampled from the slaughterhouses were seropositive, although there was no statistically significant difference between the pigs sourced from pig farms and those sourced from slaughterhouses ($p = 0.481$) (Table 2). Five (17.24%) of the 29 piglets were seropositive while 113 (41.85%) of the 241 adults pigs were seropositive with no statistically significant difference ($p = 0.0371$) between the two categories (Table 2). The fewer number of young animals sampled cannot however be discounted.

Sixty seven (54.47%) of the 123 samples from farms with extensive management system were seropositive, 48 (44.44%) of the 108 samples from farms with semi-intensive system were seropositive and 3 (7.69%) of the 39 samples from intensive system of management were seropositive for the infection. There was statistically significant difference ($p = 0.0000$) between the different management system (Figure 2). But the fewer animals under intensive system of management examined may have accounted for this finding (Table 2).

The results obtained from this study did show that *Leptospira* ser. Bratislava antibodies are present in swine in Kaduna metropolis with a seroprevalence of 43.7%. The prevalence obtained in this study could be attributed to the fact that the disease may be endemic in the region and because of frequency of contact among swine from different farms (Agunloye et al., 2000; Ngbede et al., 2012).

Table 1
Representation of the study showing the ages, sex, locations and sources of the swine sampled from the different local governments.

Variables	Chikun LGA	Kaduna – South LGA	Kaduna –North LGA	Igabi LGA	Total	Percentage (%)
Male	45	38	13	10	106	39.26
Female	60	67	17	20	164	60.74
Slaughterhouse	28	34	7	11	80	23.63
Farm	77	71	23	19	190	70.37
Extensive Mgt	51	45	13	14	123	45.56
Semi-intensive Mgt	38	46	10	14	108	40.00
Intensive Mgt	16	14	7	2	39	14.44
Adult pigs	93	95	27	26	241	89.26
Piglets	12	10	3	4	29	10.74

Table 2
Seroprevalence of leptospirosis in swine within Kaduna metropolis in relation to age, sex, location, sample sources and system of management.

Variable	Parameter	Total no. of samples	No. of positive samples	Prevalence (%)	P-value	X^2
Locations	Igabi LGA	30	9	30.00	0.0735	3.382
	Kaduna-North	30	7	23.33		
	Chikun LGA	105	59	56.19		
	Kaduna-South	105	43	40.95		
Sample source	Farms	190	76	40.00	0.481	0.794
	Slaughterhouses	80	42	52.50		
Management system	Extensive	123	67	54.47	0.000	14.43
	Semi-Intensive	108	48	44.44		
	Intensive	39	3	7.69		
Gender	Female	164	75	45.73	0.972	0.357
	Male	106	43	40.58		
Age	young (≤ 7 months)	29	5	17.24	0.0371	4.12
	Adult (≥ 8 months)	241	113	46.89		
	Total	270	118			

4. Discussion

The findings of this study are in agreement with some previous studies, with prevalence of 33.4% (Adah, 2013), 40.0% (Boqvist, 2002) and 57.1% (Van Til and Dohoo, 1991). This may indicate the endemicity of leptospirosis in Kaduna State. Chikun Local Government Area (LGA) had the highest prevalence rate of leptospirosis (56.19%) while Kaduna North had the lowest prevalence rate (23.33%) but did not differ statistically ($p = 0.0735$) amongst the Local Government Areas tested. The higher prevalence obtained in Chikun LGA could be associated with the higher population of swine in that area and the predominance of extensive system of management in the area.

Though there was no statistically significant association between the source of the samples and the positivity of the samples, ($p = 0.481$), a higher prevalence of 52.50% was obtained from the slaughterhouses than from the farms (40.00%). The higher prevalence obtained from the slaughterhouses could be attributed to the fact that most of the swine slaughtered were older animals and also swine from different farms and locations aggregated in the slaughterhouses for a period of time before slaughter (Crawford et al., 1990). The frequent contact between the animals may result in the cross transmission of the organism (Agunloye et al., 1997; Fajinmi et al., 2011).

Pigs raised under extensive management system had the highest seroprevalence (54.47%), while those under intensive management system had the lowest seroprevalence (7.69%), and there was a statistically significant association ($p = 0.000$) between the management systems and positivity of the swine. The fewer number of pigs sampled under the exclusively intensive system could have been a confounding factor. The high prevalence in the extensive management system could be associated with the frequent contacts among swine from different farms while scavenging for feed and the common water bodies in which they congregate to "cool off" (Alonso-Andicoberry et al., 2001; Espi et al., 2000). However, Ellis (1994) and Lilenbaum and Santos (1996), had reported a high seroprevalence at large intensive farms.

Although there was no statistically significant association ($p = 0.972$), between the sex of the animal and positivity, a higher prevalence was obtained from female swine (45.73%) than the male (40.58%). This is suggestive of the fact that both sexes face the same risk of being infected by the organism. But the higher prevalence in the female swine could be associated with the fact that the female swine are kept and bred for longer period of time and are only sold for slaughter after they have exceeded the breeding age (Thompson et al., 2006).

The adult swine had higher prevalence of 46.0% compared with the piglets (17.24%), a finding that was statistically significant (p = 0.0371). This finding agrees with those of Thompson et al. (2006) and Wai'in et al. (2006) who reported that seroprevalence was lower in younger animals compared to older animals. The increase in seropositivity with age may be a reflection of exposure experience of older pigs naturally infected with *Leptospira* over a longer period of time.

In conclusion, movement of swine within localities should be controlled so as to limit the spread of the infection from animal to animal. In endemic area like ours, vaccination of swine should be encouraged as to control repeated outbreaks of the disease within the region. There should be increased awareness and enlightenment campaign about the infection among pig farmers and slaughterhouse workers. The farmers and slaughterhouse workers should be encouraged to take some personal protective measures while working on farms and during slaughter and dressing of pigs.

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