



# Seroprevalence of Trichinellosis among Pigs at Slaughter in a Major Abattoir in Makurdi, Benue State, Nigeria

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**Abstract** | Trichinellosis is a food-borne parasitic zoonosis of public health and economic importance. The present study was aimed at determining the seroprevalence of *Trichinella* spp amongst pigs at slaughter in Makurdi, Benue State. Blood samples were collected while slaughtering from a total of three hundred and fifty (350) pigs of different sexes, breeds and ages. The sera obtained from the blood samples collected were screened for antibodies to *Trichinella* spp using an enzyme linked immunosorbent assay (ELISA) technique. Ninety three (26.6%) out of the 350 pigs sampled were seropositive for *Trichinella* spp antibodies. The male pigs had a seroprevalence of 26.5% (40/151), while 26.6% (53/199) of the females were seropositive for *Trichinella* spp antibodies. There was no significant ( $p > 0.05$ ) association between age, sex and seroprevalence of *Trichinella* spp antibodies. However, there was a significant ( $p < 0.05$ ) association between seroprevalence of *Trichinella* spp and the breeds and sources of pigs slaughtered in Makurdi. The study has established a serological evidence of *Trichinella* spp antibodies amongst pigs at slaughter in Makurdi, Benue state.

**Keywords** | *Trichinella* spp, Seroprevalence, Abattoir, Pigs

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## INTRODUCTION

Trichinellosis is a serious food-borne parasitic zoonosis that results in economic losses and poses an important public health hazard with respect to pig production and food safety (Gottstein et al., 2009; Angi et al., 2014). The parasite has a direct life cycle where both adult and larval stages occur in the same host since *Trichinella* establishes intracellular infections in enterocytes and skeletal striated muscle cells (Pozio, 2007). The etiological agents of trichinellosis, is *Trichinella* and it causes a serious, sometimes fatal, human disease, which has been documented in 55 countries of the world (Murrell and Pozio, 2011). *Trichinella* spp are tissue-dwelling nematodes acquired by humans via the consumption of raw or semi-raw meat and meat derived products from domestic pigs, horses, dogs, and wild animals containing encapsulated larva stage (Dupouy-Camet, 2009). Domestic and wild pigs are consid-

ered to be the major source of trichinellosis in humans (Kusolsuk et al., 2009). However, horses, dogs and many other animals have also served as sources of infection but humans, swine and horses represent the most important hosts from a medical and veterinary point of view (Murrell and Pozio, 2011; Bruschi, 2012). Transmission from wild animals to domestic animals can occur when there is improper segregation of domestic animals and wildlife (Kim et al., 2015). The domestic cycle includes domestic pigs which may become infected by the consumption of infected rodents, and also through carnivorous and cannibalism (Karn et al., 2008). The role of hunters, the manner in which they deal with wild game carcasses, and free-ranging and/or backyard pig farming practices culminate to perpetuate infection with *Trichinella* spp. (Pozio, 2014).

According to the International Commission on Trichinellosis, serological methods such as the enzyme-linked

immunosorbent assay (ELISA) are not recommended as a substitute for meat inspection of individual carcasses (Gamble et al., 2000). However, ELISA is considered to be suitable for surveillance and epidemiological investigations of domestic animals and wildlife (Gamble et al., 2004). Although trichinellosis has great veterinary and public health importance, no nationwide surveillance study has been performed to determine the prevalence of the parasite in domestic pigs in Nigeria. However, very few reports on *Trichinella* in pigs have been reported in Nigeria (Akinboade et al., 1984; Dusai, 1989; Adediran and Uwalaka, 2012; Momoh et al., 2013; Ojodale et al., 2015).

The aim of this study therefore, was to investigate serological evidence of *Trichinella* infection amongst pigs at slaughter in a major abattoir in Benue State, Nigeria.

## MATERIALS AND METHODS

### STUDY AREA

The study was conducted in Makurdi, Benue state, Nigeria. Makurdi lies between latitude 7° 15' - 7° 45' N, and longitude 8° 15' - 8° 40' E, on the bank of River Benue in the Guinea Savannah vegetation belt. River Benue divides the town Makurdi into North and South banks and the town covers an area of 16 Km<sup>2</sup> (Agbo and Terlumun, 2010). The pig abattoir is located in Wurkum which is a residential settlement within the metropolis. The predominant animals kept by the residents of this area are pigs, sheep and goats. This study area was chosen because it ranks amongst the highest pig population in Nigeria representing 20% of the total pig production in Nigeria (RIM, 1993) also, pork is a special delicacy to the people of this area.

### SAMPLE COLLECTION

Blood samples were collected from the animals at slaughter into an appropriately labeled plain sample bottles. The sex, age, breed, source and weight of the sampled animals were recorded. The samples were centrifuged at 3000rpm for 10 minutes to obtain the sera. The sera were dispensed into clean labeled serum bottles and stored at -20°C until use.

### SEROLOGICAL TESTING

The serum samples were analyzed using commercially available Indirect Enzyme Linked Immuno-Sorbent Assay kit obtained from Prionics, Switzerland. An enzyme-linked immunosorbent assay (ELISA) was used to screen the serum samples for the presence of immunoglobulin G (IgG) antibodies (Ab) against *Trichinella* spp. excretory/secretory (ES) antigens. The test kit can detect antibodies to different *Trichinella* species. The test was performed as recommended by the manufacturer.

## STATISTICAL ANALYSIS

Percentage prevalence was calculated. Data analysis was performed using Graph pad Prism version 4.0 for windows. Chi-square and Fischer's exact test was used to determine the association between the presence of the infection and age and sex of the pigs, and also risk factors in farm management practices. Values of  $p < 0.05$  were considered significant.

## RESULTS

Three hundred and fifty (350) serum samples obtained from 151 (43.1%) male and 199 (56.9%) female pigs at slaughter in Makurdi of which a total of 93 (26.6%) were seropositive for *Trichinella* antibodies. Of the seropositive samples, 26.5% were males while 26.6% were females. There was no significant ( $p > 0.05$ ) association between the infection and the sex of the animal, although, it was higher in the females when compared to the males. There was also no significant ( $p > 0.05$ ) association between age of the pigs and the infection. However, older pigs had a higher prevalence of 31.7% (20/63) when compared to the young pigs with a prevalence of 25.4% (73/287).

There was a significant ( $p < 0.05$ ) association between breed and prevalence. The Large White had a prevalence of 33.6% (81/241), while the local breed had a prevalence of 11.0% (12/109). There was a significant association ( $p < 0.05$ ) between prevalence and the source of pig slaughtered in Makurdi. Pigs sourced from extensive farms had the highest prevalence of 32.64% (63/193), followed by those from semi-intensive farms 20.75% (22/106) and intensive farms 15.69% (8/51) (Table 1).

**Table 1:** Sex, age, breed, source and presence of *Trichinella* antibodies

	Variable	Number sampled	Number positive (%)	P value
Sex	Male	151	40 (26.5)	1.000
	Female	199	53 (26.6)	
	Total	350	93 (26.6)	
Age	Young (<1yr)	287	73 (25.4)	0.3445
	Old (>1yr)	63	20 (31.7)	
	Total	350	93 (26.6)	
Breed	Exotic	241	81 (33.6)	0.0001*
	Indigenous	109	12 (11.0)	
	Total	350	93 (26.6)	
Source	Extensive	193	63 (32.6)	0.0175*
	Intensive	51	8 (15.7)	
	Semi-intensive	106	22 (20.8)	
	Total	350	93 (26.6)	

\*Significant association

Trichinellosis is an important food-borne parasitic zoonosis that is widely distributed throughout the world (Kim et al., 2015). This study to the best of our knowledge is the first to serologically detect specific antibodies of *Trichinella* spp amongst Pigs at slaughter in Makurdi, Benue State Nigeria.

The present study, revealed a seroprevalence of 26.6 % of *Trichinella* spp antibodies amongst pigs at slaughter in Makurdi, Benue State. This prevalence is higher than those reported earlier by Akinboade et al. (1984) who reported a prevalence of 5.2% in slaughtered pigs in Ibadan and Dusai (1989), who documented a prevalence of 0.5 % in pigs in Kaduna state, using the tissue digestion method. However, it was lower than the 40.0% seroprevalence recorded by Momoh et al. (2013) in Zaria among backyard raised pigs. However, the seropositivity reported was within the range documented in some part of China with seropositivity of 0.01 % to 39.3 % in pigs (Cui and Wang, 2011). The prevalence observed in the present study may be due to the sensitivity of the ELISA method of *Trichinella* as it is also able to detect antibodies to *Trichinella* species in pigs with low parasitic burden (Sapkota et al., 2006) when compared to the trichinoscopy and tissue digestion method used by some previous researchers in Nigeria (Akinboade et al., 1984; Dusai, 1989). The sensitivity and specificity of the ELISA technique used in the study has been reported to range from 93.1%-99.2% to 90-6%-99.4% (Gottstein et al., 2009).

This present study also revealed a higher prevalence of *Trichinella* infection in older pigs (31.7 %), compared to younger pigs (25.4 %). Although, the association between age and seropositivity was not statistically significant, the higher prevalence among older pigs agreed with the finding of Momoh et al. (2013) and Adediran and Uwalaka (2012). This is suggestive of the fact that the older the pig the more predisposed they could be to the infection.

The study also revealed that there was no significant association between sex and the infection among pigs at slaughter, as female and male pigs had relatively similar seroprevalence (26.6 % and 26.4 %). Thus, the study showed that sex does not play a role in the infection, as both sexes have similar chances of being infected with *Trichinella*. However, this study is in contrast with the work of Larrieu et al. (2004) and Adediran and Uwalaka (2012) in which they reported that gender appears to have an effect on the seroprevalence of Trichinellosis.

The study further showed a significant association between the infection and the breed of pigs slaughtered in

an abattoir in Makurdi, Benue State. The exotic breed had a prevalence of 33.6 %, while the indigenous breed had a prevalence of 11.0%. This high prevalence among the large white may be due to their genetic makeup as they are less resistant to the infection. They may be less adapted to the environment in which they are raised. The low prevalence in the indigenous breed may be due to their hardy nature and thus a little more resistant to the infection. However, further study should be done to ascertain this claim.

The present study also demonstrated a significant association between the infection and the sources of pigs slaughtered in Makurdi, Benue state. It is practically possible that pigs with outdoor access will be at greater risk of *Trichinella* infection due to exposure to wildlife reservoirs (Ribicich et al., 2009) and as expected, the infection was found more among extensively raised pigs (32.6%), followed by the semi-intensively (20.8%) and intensively raised ones (15.7%). Also, differences in farm management practices in the study area whereby pigs are often raised under poor hygienic condition where they can have access to rodents, fed raw waste materials, pasture freely and could scavenge wild and domestic animal carcasses could also have increased the pig exposure to infection and possibility of human infection through consumption of infected undercooked pork (Sandfoss et al., 2011; Momoh et al., 2013). Most pigs at slaughter are often sourced from extensively or backyard pig production system because pig farms are not yet commercialized in Nigeria, which was also the case in the present study.

In conclusion, this is the first work to show serological evidence of *Trichinella* infection in pigs at slaughter in Makurdi, Benue state. It was also observed that pigs sourced from extensive management system had the highest seroprevalence. Therefore, we recommend a National surveillance of *Trichinella* infection in pigs in Nigeria to establish the true picture of the infection.

The limitations to this work were that; the species of *Trichinella* prevalent in this area were not detected and the *Trichinella* larva was not also checked for using artificial digestion method because these animals were slaughtered at one point and butchered at another point so getting tissue samples was almost impossible.

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## CONFLICT OF INTEREST

No conflict of interest to declare.

All authors contributed equally to this work.

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