

Full Length Research Paper

Trichinilosis in African giant rats (*Cricetomys gambianus*) in the arid-region of northeastern, Nigeria

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A survey of trichinilosis in 100 wild African giant rats (*Cricetomys gambianus*) was conducted for the first time in the arid region of northeastern Nigeria. The results showed that 10(10.0%) males, 6(6.0%) females, 11(11.0%) juveniles and 5(5.0%) adults, harboured *Trichinella* infection. The males and the juveniles were significantly ($p < 0.05$) more infected than the females and the adults respectively. According to locations, 9(9.0%) giant rats in Sanda Kyarimi Zoological Garden, 6(6.0%) in Maimallari Army Barracks and 1(1.0%) in Costums area, harboured the infection, while none (0%) of the rats on the University of Maiduguri Campus or Bagga Road area were infected. On one hand, the diaphragm, intercoastal and eye muscles of the rats did not harbour any infection while, on the other hand, the tongue 3(3.0%), biceps 7(7.0%), and masseter muscles 6(6.0%), harboured *Trichinella* larvae. The artificial enzymatic digestion technique, significantly ($p < 0.05$) detected 10(10.0%) cases, more than histopathology 4(4.0%) and squash compression microscopy 2(2.0%). We corroborate the importance of the African giant rat, as a potential reservoir of trichinilosis, which is zoonotic in nature.

Key words: Trichinilosis, giant rats, arid region, Nigeria

INTRODUCTION

Trichinellosis is a zoonotic disease caused by the parasitic nematodes of the genus: *Trichinella*. It is worldwide in distribution and affects most mammals (Soulsby, 1982). *Trichinella* has been reported recently, in birds and crocodiles (*Crocodylus niloticus*) in Africa (Jean et al., 2002). The death of a captive European brown bear was associated with the consumption of trichinous rat (Lynn and Susanne (2004). *Trichinella* is transmitted from one animal to another through the ingestion of flesh containing *Trichinella* larvae (Soulsby, 1982). Similarly, humans are infected by eating raw or uncooked meat containing encysted *Trichinella* larvae. The cyst also called a "nurse cell" becomes, digested. The released larvae invade intestinal mucosa, which are carried to tissues via intestinal lymphatic or mesenteric venules (Soulsby, 1982; Makedonka and Douglas, 2006).

Trichinellosis in man begin with a sensation of general discomfort, headache, fever, chills, diarrhoea, abdominal

pain, pyrexia, oedema of eyelids and face. This represents the principal syndrome of the acute stage, which is often, complicated by myocarditis, thrombo-embolic disease, encephalitis and death (Leslie et al., 1998; Dupouy-Camet, 2000). Although, trichinilosis have not been reported previously in giant rats in Nigeria, the increasing popularity of the giant rat meat in Africa in general and the semi-arid region of northeastern Nigeria in particular, may predispose the consumers to the disease. As such, this study was conducted to ascertain the presence of trichinilosis among African giant rats (*Cricetomys gambianus*) in the arid region of northeastern, Nigeria and its possible zoonotic implication.

MATERIALS AND METHODS

Study Area

Sanda Kyarimi Zoological Garden, where captive warthogs (*Phacocoerus aethiopicus*) were kept and Maimallari Army Barracks where pigs roam freely were selected for the study. Similarly, non-pig rearing areas such as the University of Maiduguri Campus,

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Table 1. Prevalence of trichiniosis among African giant rats (*Cricetomys gambianus*) examined in the arid region of northeastern, Nigeria according to sex and age

Parameters	No. Examined	No. Infected (%)	
Sex	Male	51	10(10.0) ^a
	Female	49	6(6.0) ^b
Total	100	16(16)	
Age	juveniles	45	11(11.0) ^a
	Adult	55	5(5.0) ^b
Total	100	16(16)	

^{a, b} superscripts differed significantly ($p < 0.05$)

Costums Barracks and Bagga road Area were also selected. These areas are located between latitude 11° 05' N and 11° 4 0' N and longitude 13° 05' E and 13° 2 5' E within the Sahel savannah, with rainfall under 700 mm. The rainy season lasts for a short period (3-4 months) from June–September, followed by a prolonged dry season (October – May) (Udoh, 1981).

Animals

Fresh carcasses of one hundred (100) wild African giant rats (*Cricetomys gambianus*) of both sexes, different ages and weighing between 1.2 to 1.87 kg were obtained from local trappers and hunters within the various locations. Information concerning specific locations, where they were trapped was obtained from the trappers and hunters. The carcasses were transported on ice to the Parasitology Laboratory of the Faculty of Veterinary Medicine, University of Maiduguri, Nigeria where the study was conducted.

Enzymatic Digestion Technique

Tissues (diaphragm, tongue, biceps, intercostals, eye and masseter muscles) were harvested, cut in 2-3cm sizes, transferred into 20ml of acid pepsin solution and incubated over night at 35-37°C. The preparation was centrifuged at (1500) rpm for 2-5 minutes to sediment the larvae, which were examined under a microscope (Olympus Japan at x 400) magnification and identified using standard criteria (Soulsby, 1982).

Squash Preparation Technique (Squash compression microscopy)

This technique essentially involved the slicing of the harvested muscle tissues into thin layers and placed between 2 glass slides. The two slides were compressed together, bound with a rubber band, and examined microscopically for coiled larvae of *Trichinella* at x 400 magnification (Monica, 2004).

Histopathological Examination

Samples of the harvested tissues were fixed in 10% formal saline, embedded in paraffin wax, sectioned at 5μ thickness and routinely stained with haematoxylin and eosin stain for histopathological examination of larvae, nurse cells or associated basophilic transformation of muscle cells (Drury and Wallington, 1976).

Statistical Analysis

The Chi square test χ^2 ICC (adjusted for intra-cluster correlation) was used to judge differences in risks between various strata (Donald and Donner, 1988).

RESULTS

Table1 show the prevalence of *Trichinella* larvae among African giant rats (*Cricetomys gambianus*), examined in the arid-region of northeastern, Nigeria according to sex and age. Out of the 51 males and 49 females examined, 10(10.0%) males were significantly ($p < 0.05$), more infected than 6 (6.0%) females. Similarly, out of the 45 juveniles and 55 adults examined, 11(11.0%) juveniles were significantly ($p < 0.05$) more infected than 5(5.0%) adults. Table 2 shows the prevalence of trichiniosis among the giant rats examined according to locations. Of the rats captured from Sanda kyarimi Zoological Garden and Maimalari (Army) Barracks 9(9.0%) and 6(6.0%) of the rats were infected respectively, while 1(1.0%) from Custom's Area harboured the infection. Meanwhile, those captured from the University of Maiduguri Staff Quarters and Baga Road Area had 0(0%) prevalence rate.

Table 3 shows the prevalence of the infection among the giant rats according to predilection sites. The infection was commonly encountered in the biceps muscles 7(7.0%), followed by the tongue 3(3.0%), then masseter muscles 6(6.0%) while non 0(0.0%) occurred in the diagram, intercostal and eye muscles. Table 4 shows the sensitivity of the various techniques employed in detecting the larvae of the parasite in tissues of the giant rats. Between the three methods employed, the artificial enzymatic digestion technique, significantly ($p < 0.05$) detected 10(10.0%) followed by histopathology 4(4.0%) then squash compression microscopy 2(2.0%). Figure 1 shows tissue section of biceps muscle with spirally coiled *Trichinella* larvae while Figure 2 shows a transverse sections of *Trichinella* larvae within a distinct cysts "nurse cells".

DISCUSSIONS

Decades ago, Gomez et al. (1986) reported that some doubts exist of the occurrence of the parasite in West Africa. However, the results of this survey showed for the first time that trichiniosis exists commonly among the giant rat population in the arid region of northeastern, Nigeria. The apparent absence of the parasite in West Africa in general, was probably due to lack of intensive search for the infection. Similarly, in Sokoto, Nigeria a previous study did not yield positive results (Faleke et al., 2000). Even though Maiduguri and Sokoto share similar geographical disposition, cultural and religious believes, the absence of the infection among giant rats in Sokoto Nigeria was unclear. However, we believe that, only giant

Table 2. Prevalence of trichiniosis among African giant rats (*Cricetomys gambianus*) examined in the arid region of northeastern, Nigeria according to locations

Trichiniosis			
S/No.	Locations	No. Examined	No. Infected (%)
	Sanda Kyarimi Park (zoo)	25	9(9.0) ^a
	Maimalari (Army) Barracks	19	6(6.0) ^a
	University of Maiduguri staff Quarters	18	0(0) ^b
	Customs area	20	1(1.0) ^c
	Baga Road area	18	0(0) ^b
Total	100		16(16)

^{a, b, c} superscripts differed significantly (p<0.05)

Table 3. Prevalence of trichiniosis among African giant rats (*Cricetomys gambianus*) examined in the arid region of northeastern, Nigeria according to predilection sites

Trichiniosis			
S/No.	Predilection sites	No. Examined	No. Infected (%)
	Diaphragm	18	0(0) ^a
	Tongue	16	3(3.0) ^b
	Biceps muscles	15	7(7.0) ^c
	Intercostal Muscles	20	0(0) ^a
	Eye Muscles	15	0(0) ^a
	Masseter Muscles	16	6(6.0) ^d
Total	100		16(16)

^{a, b, c, d} superscripts differed significantly (p<0.05)

Table 4. Sensitivity of the various techniques employed in the diagnosis of trichiniosis among African giant rats (*Cricetomys gambianus*) in the arid region of northeastern, Nigeria

Techniques	No. Examined	No. Positive (%)
All methods	100	16(16.0%)
Squash preparation technique (Squash compression microscopy):	100	2(2.0%) ^a
Artificial enzymatic digestion technique:	100	10(10.0%) ^b
Histopathology:	100	4(4.0%) ^c

^{a, b} Superscripts in column differed significantly (p<0.05)

rats that dwell in pig-rearing areas or in game reserves may harbour the infection. This hypothesis, proved true because the positive cases encountered during the survey were mainly from Sanda Kyarimi Zoological Garden where, a herd of captive warthogs (*Phacochoerus aethiopicus*) were kept for captive breeding and in Maimalari (Army) Barracks where large herds of pigs roam freely. This is consistent with the findings of Monica (2004) who reported the occurrence of trichiniosis among African giant rats (*Cricetomys gambianus*) where pigs abound.

This therefore, suggests on one hand that a 'synantropic' association existed between the giant rats and the free-roaming domestic pigs in the Army barracks while a 'sylvatic' association was maintained between

warthogs (*Phacochoerus aethiopicus*) and the giant rats in Sanda Kyarimi Zoological Garden. This therefore, shows that the giant rats may serve as reservoir hosts and could play a vital role in the epidemiology of human trichiniosis in the arid-region of northeastern, Nigeria or elsewhere in the world. Outbreak of trichiniosis in an arctic village of Alaska and California was associated with communal feasts when meat from infected walrus (*Odobenus rosmarus*) and polar bear (*Thalarctos maritimus*) were eaten (Cinque et al., 1979; Soulsby, 1982).

The results also revealed that male giant rats were more infected than the females. This might be associated with the fact that the male roam more in the exhibition of territoriality, and cover larger areas in search of food, and

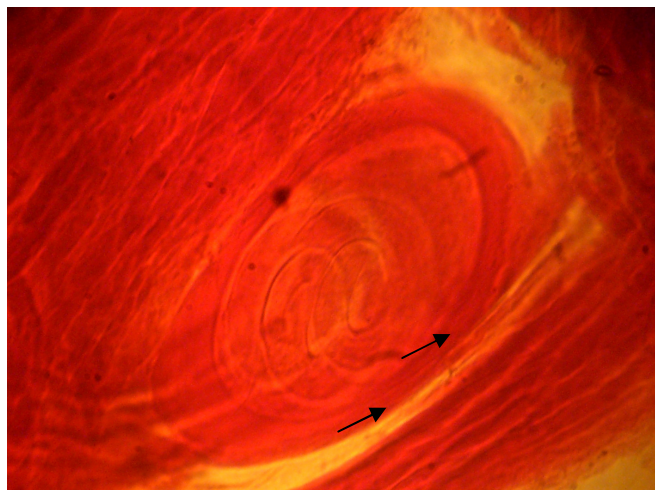


Figure 1. Showing spirally coiled *Trichinella* larvae (arrow) in the biceps muscle of African giant rat (*Cricetomys gambianus*) in the arid region of northeastern, Nigeria after squash compression microscopy (x 400).

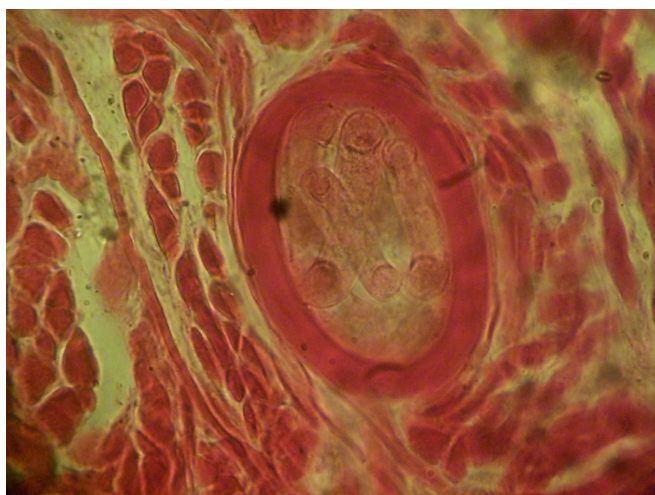


Figure 2. Showing a distinct "nurse cell" (arrow) containing cross sections of *Trichinella* larvae in biceps muscle of African giant rat (*Cricetomys gambianus*) in the arid region of northeastern, Nigeria (H&E x 400).

female partners and hence its rate of contact with domestic or wild pigs is greatly enhanced (Ajayi, 1977; Kingdon, 1989). The prevalence according to different age groups, shows a higher prevalence ($p < 0.05$) among the juveniles than the adults. This might be attributed to the lack of fully developed immunity among the young, which makes them more susceptible to the infection than the adults (Soulsby, 1982).

The result also showed that the infection occurred more commonly in the biceps muscles, then masseter followed by the tongue while none was encountered in the diaphragm, intercostals and eye muscles. From the above findings, it is obvious that *Trichinella* larvae preferred muscles that are more active. This is in

consonance with the findings of many authors (Soulsby, 1982; Ribicic et al., 2001). They believe that rich oxygen tension associated with skeletal muscular activities may favour larval development, survival and subsequent transmission. The diagnostic procedures showed that the artificial enzymatic digestion method proved superior to the histopathology and squash compression microscopy in detecting the infection. However, more cases might have been detected if automated enzyme-linked immunosorbent assay (ELISA), a highly sensitive and specific method was employed (Gamble, 1998; Kampel et al., 1998).

CONCLUSION

In conclusion, this preliminary survey, conducted for the first time in the semi-arid region of northeastern, Nigeria showed that giant rats in the area, harboured *Trichinella* larvae of zoonotic importance. This is of public health concern, since giant rat meat is considered a delicacy in the area.

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