

Seroprevalence of *Clostridium tetani* in Donkeys in Kaduna State, Nigeria

Onoja Emmanuel¹, Shuiabu Mohammed², Abagharandu Mordecai³, Alimi Abdulrasheed⁴, Udugwu Deborah⁵

¹Department of Veterinary Medicine, Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria, Nigeria

²Department of Veterinary Pathology, Faculty of Veterinary Medicine Ahmadu Bello University, Zaria, Nigeria

³Department of Veterinary Public Health, Faculty of Veterinary Medicine University of Abuja, Abuja, Nigeria

⁴Department of Physiology and Biochemistry, Faculty of Veterinary Medicine, University of Abuja, Abuja, Nigeria

⁵Department of Veterinary Public Health, Faculty of Veterinary Medicine University of Abuja, Abuja, Nigeria

Email: eionoja@gmail.com, msagana04@gmail.com, niftymordy@yahoo.com, yusuf.alimi@uniabuja.edu.ng, udugwudebby@gmail.com

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Abstract

Tetanus is an acute non-contagious and infectious disease caused by *Clostridium tetani* exotoxins that affect many animal species and humans. It is associated with high mortality rate, ranging from 58% to 80% in Equidae. This study investigated the seroprevalence of *C. tetani* antibodies in donkeys in Kaduna State. A total of 384 donkeys were sampled from the study area, 5 ml of blood was collected aseptically from the jugular vein and sera was harvested and tested for tetanus using ELISA kits. A seroprevalence of *C. tetani* of 295/384 (76.8%) was recorded. Male donkeys had a higher seroprevalence (89.9%) than female (64.1%), young donkeys had 78.5% compared to 75.7% for adults; donkeys with wounds had a seroprevalence of 92.1% while those without wounds (42.4%). Donkeys from free range had a higher seroprevalence of 88.0%. Donkeys with BCS of 1 and 2 had 87.8% being the highest value, based on breeds, the Fari and Idabari had the higher seroprevalence (85.7% and 87.2% respectively). It was concluded that the donkeys in the Northern Kaduna had a high seroprevalence to *C. tetani* and also sex, age, breeds and presence of wounds were the main risk factors to *C. tetani* infection in donkeys and it was recommended that the use of donkeys in production of tetanus antitoxins and toxoid should be investigated.

Keywords

Tetanus, Equidae, Seroprevalence, *Clostridium tetani*, Auraki, Dune, Fari, Idabari

1. Introduction

Equidae is a family of donkeys, horses and zebras. They have various uses ranging from sports to recreation, however, donkeys are mostly used as draught and pack animals because they are intelligent, easy to train and also cheap to maintain [1].

Even as donkeys continue to be a source of livelihood to human lives in arid areas, their physical needs are always ignored due to their hardiness [2].

Tetanus is an acute non contagious infectious disease caused by *C. tetani* exotoxins that affect many animal species and human beings [3]. The causative agent of tetanus is *Clostridium tetani*, [4]. Tetanus continues to be associated with a high mortality rate, ranging from 58% to 80% in Equidae [5] [6].

Among animal species, the horse and its family are considered most susceptible to tetanus toxin [7]. The clinical signs of tetanus in animals include spasm of the head muscles, lockjaw, prolapse of the third eyelid [8]. Ears stand erect and the horses can adopt a sawhorse stance in severe case and sudoresis, then recumbency before death [9].

Diagnosis is usually through clinical signs [10]. Treatment is usually through administration of tetanus antitoxin with small amount of toxoid. Penicillin is also administered to help fight the bacterial spores [11]. Prevention is usually through vaccination and thorough wound treatment [12].

Donkeys are money generating power of the equine, a great population of the arid regions depends on it for their source of livelihood, but their health needs have been greatly ignored, and wounds have been known to be of great concern in donkeys even with this, little recorded cases of tetanus in donkeys exist so this study is designed to investigate immune response to *C. tetani* in donkeys in Northern Kaduna State, Nigeria.

2. Methodology

2.1. Study Area

The study was carried out in Northern part of Kaduna State, because that is the part of the state with high population of donkeys and these donkeys are mostly used for work and transportation. The State lies between longitude 7° and 44' East of the Greenwich Meridian and latitude 6° and 11' North of the Equator [13]. Kaduna State has distinct wet and dry seasons and it is within the Guinea Savannah vegetation zone and part of the Sudan Savanna of Nigeria. It has an annual rainfall of between 1000 mm and 1500 mm and a rainy season, which is from 120 to 150 days long [13]. It is essentially an agrarian society with about 75% of the population engaging in farming. It also has potentials for the livestock industry [14].

2.2. Physical Examination

Physical examination was conducted, the ages, sex and breed were recorded. Body condition of each donkey was scored according to Pearson scale; as thin (1

and 2), moderate (3 and 4) and fat (5) [15]. The body was examined for the presence or absence of wounds.

Names of breeds of donkeys in *Hausa* which were according to their colours commonly found in Nigeria are; *Auraki* (Rust or red colour) *Dune* Dark brown to black colour) *Fari* (Pale cream to white colour) and *Idabari* (Grey to light-medium brown colour) [16].

2.3. Blood Sampling and Serological Investigation

Five milliliters of blood was aseptically collected from the jugular vein of each donkeys. Serum was harvested after centrifuging (at ~375 g for 10 minutes) and serological analysis was performed using i-ELISA kit based on the manufacturer's instruction.

2.4. Data Analyses

The data obtained were reduced to tables (descriptive statistics) and analyzed using Statistical Package for Social Sciences (SPSS) version 20.0 (SPSS Inc. Chicago IL, USA).

3. Results

Out of 384 donkeys sampled, a seroprevalence of *C. tetani* of 76.8% was recorded. The seroprevalence of *C. tetani* was higher in male (89.9%) than female (64.1%). The difference was statistically significant. Young donkeys had a slightly higher seroprevalence of *C. tetani* of 78.5% while adult donkeys had 75.7% (Table 1). For wound, the seroprevalence of *C. tetani* was significantly higher in donkeys with wounds (92.1%) than without wounds (42.4%). Function of donkeys, those not used for work had low seroprevalence of *C. tetani* (45.5%) while those found in the free range and mostly used for work; as pack animals for transportation of goods and farming, had a higher seroprevalence of *C. tetani* of 88.0% (Table 2). Donkeys with 1 and 2 BCS had the highest seroprevalence of *C. tetani* (87.8%), while donkeys with BCS of 5 had the lowest seroprevalence (44.4%). For Breed, the *Idabari* and *Fari* breeds of donkeys had the highest seroprevalence of *C. tetani* (87.2% and 85.7%) respectively, while *Auraki* breed had the lowest seroprevalence of *C. tetani* (45.9%) (Table 3).

Table 1. Seroprevalence of *Clostridium tetani* by the sex and age of Donkeys in Northern Kaduna State Nigeria.

Parameters	No. Examined	No. Positive	Seroprevalance (%)	χ^2	P value
Sex					
Male	189	170	89.9	36.004	0.000
Female	195	125	64.1		
Total	384	295			
Age					
Adult	235	178	75.7	0.395	0.529

Continued

Young	149	117	78.5
Total	384	295	

$P \leq 0.05$ is significant.

Table 2. Seroprevalence of *Clostridium tetani* based on wounds and purpose of Donkeys in Northern Kaduna State Nigeria.

Parameters	No. Examined	No. Positive	Seroprevalance (%)	χ^2	P value
Wound					
Present	266	245	92.1	113.543	0.000
Absent	118	50	42.4		
Total	384	295			
Purpose					
No work	101	46	45.5	75.305	0.000
Free range	283	247	88.0		
Total	384	295			

$P \leq 0.05$ is significant.

Table 3. Seroprevalence of *Clostridium tetani* based on Body Condition Score (BCS) and Breeds of Donkeys in Northern Kaduna State, Nigeria.

Parameters	No. Examined	No. Positive	Seroprevalance (%)	χ^2	P value
BCS					
1 and 2	278	244	87.8	67.854	0.000
3 and 4	97	47	48.5		
5	9	4	44.4		
Total	384	295			
Breeds					
<i>Auraki</i>	47	23	45.9	53.861	0.000
<i>Dune</i>	57	30	52.6		
<i>Fari</i>	147	126	85.7		
<i>Idabari</i>	133	116	87.2		
Total	384	295			

$P \leq 0.05$ is significant.

4. Discussion

A high seroprevalence was recorded this could be due to the fact that, wounds which are the portal of entry for the causative agent of tetanus was found on donkeys in the study area, the wounds are usually superficial which doesn't give the organism enough hypoxic environment for toxin production, hence this could be the cause of high seroprevalence, yet little recorded cases of te-

tanus in donkeys and also immunity could be gotten from low grade infection of the intestine after ingestion of *C. tetani* contaminated faeces by donkey [17].

Young donkeys had a higher seroprevalence than Adult donkeys this could be due to transmission of antibodies from the dam through suckling, and also the eating habit of young donkeys could involve eating grasses with *C. tetani* infected faeces.

Seroprevalence of *C. tetani* is higher in male donkeys this could be due to the fact that Male donkeys are more active and thus exposed to more injuries and these injuries serve as a portal for entry of *C. tetani* which in turn elicit immune response.

Donkeys with wounds had a higher seroprevalence of *C. tetani* than those without wounds. This could be because wounds are a major risk factor in tetanus; it serves as the main portal of infection of *C. tetani* and are foci for proliferation and toxin release.

Similarly donkeys sampled from villages *i.e.* free range had a higher prevalence this is because they are mostly kept for work and most of the villagers don't usually seek Veterinary care for their donkeys, thus they are exposed to injuries which is a risk factor for *C. tetani* proliferation whereas the donkeys not use for work; those kept as pet and also for research purposes and are rarely exposed to injuries and diseases.

Donkeys with Body Condition Score of 1 and 2 had the highest Seroprevalence of *C. tetani*. This could be because BCS of 1 and 2 is characterized by emaciation, presence of sharp keel bones and also wounds at pressure points this could have aided infection of the organism and which then elicit immune response.

The seroprevalence of *C. tetani* varies across donkey breeds. *Fari* and *Idabari* had the highest values because they are stronger among the breeds and as such are exposed to more work and less health care hence prone to injuries [16].

5. Conclusion

A high seroprevalence of *C. tetani* in donkey was recorded (76.8%) in northern Kaduna State, Sex, age, Wound, Purpose, Body Condition Score and breeds of donkeys all affected the seroprevalence of *C. tetani* in donkeys in the study area.

Recommendations

The roles of donkeys in the epidemiology of tetanus in animals should be investigated. The use of donkeys as a source of Tetanus Anti Toxin should be studied.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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