



## Knowledge, Attitude and Practice of Dog Handlers, Dog Meat Consumers and Risk Factors of brucellosis for Dogs and Handlers in North Central Nigeria

Momoh-Abdullateef Habiba\*, Enem Simon Ikechukwu, Egwu Godwin Onyemaechi, Ijale Gabriel Ogbaji, Madubuike Stella, Olaolu Olushola Samuel and Ogbu Kenneth Ikejiofor

Department of Animal Health, Federal College of Animal Health and Production Technology, National Veterinary Research Institute, Vom, Plateau State, Nigeria, Nigeria

\*Corresponding Author: Momoh-Abdullateef Habiba, Department of Animal Health, Federal College of Animal Health and Production Technology, National Veterinary Research Institute, Vom, Plateau State, Nigeria, Nigeria

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### Abstract

The increase in dog ownership in Nigeria and in the North Central region in particular is associated with some risk factors that render them vulnerable to brucellosis. Many exotic breeds of dog are not screened before being imported into the country and the probability of importing *Brucella* species infected dogs is therefore high. This study was undertaken to determine the level of Knowledge, Attitude and Practice of dog handlers, dog meat consumers and risk factors for dogs and handlers in North Central Nigeria by means of a structured questionnaire. Five hundred and fifty respondents were interviewed and 550 sera samples collected from dogs presented by these respondents were analyzed using the RBPT. The seropositivity of 239(43.45%) obtained by the RBPT was compared with information provided by the respondents. Seropositivity of dogs managed indoor was 49(25.26%) whereas it was 190(53.37%) in those managed outdoor. A large proportion 296(53.82%) of the respondents lacked knowledge of canine brucellosis. Likewise, 426(77.45%) of the respondents took no precaution before and after handling and large proportion of 286(52%) consumed undercooked dog meat. The study shows that there is a high risk of exposure of dog owners, handlers and Veterinarians to the disease and therefore enlightenment programs on brucellosis as a zoonosis should be carried out in North central Nigeria.

**Keywords:** Dog Handlers; Seropositivity; Structured Questionnaire; North Central Nigeria; Brucellosis; Enlightenment

### Abbreviation

RBPT: Rose Bengal Plate Test; FCT: Federal Capital Territory

### Introduction

Brucellosis is a highly contagious bacterial zoonotic disease caused by members of the genus *Brucella* that can affect humans but primarily domestic animals and pets [1]. It is the second most serious zoonotic disease after rabies [2]. As a zoonosis, it poses serious human health hazards worldwide [3]. *Brucella* is the etiological pathogen of brucellosis [4]. According to host preferences, *Brucella* is divided into six classical species, namely: *Brucella melitensis* affecting goats and sheep, *Brucella suis* in pigs, *Brucella abortus* in cattle, *Brucella ovis* in sheep, *Brucella canis* in dogs and *Brucella neotomae* in wild rats. As a zoonotic disease, humans can

be infected with canine brucellosis by close contact with discharges and secretions from the reproductive tract such as aborted puppies, urine, and vaginal secretion from infected dogs. Infection usually results when infected tissues or secretions come in contact with broken/intact skin or are accidentally ingested [5]. Signs and symptoms are similar in patients despite the route of transmission [6]. In humans, although infrequent, *B. abortus* causes undulant fever [6], headache and weakness [7]. Infected people show the symptoms of fever, arthralgia, myalgia, back pain, hepatomegaly, splenomegaly, endocarditis, neurobrucellosis, epididymitis and orchitis [8-10]. Unlike dogs, humans respond more quickly to antibiotics [11]. A 6 weeks regimen of doxycycline at 200mg per day administered orally for the first 2-3 weeks is effective [12].

About 7.6% of 79 cases of humans tested in Markurdi, Benue State, were infected with brucellosis [13]. In developing countries, transmission of canine brucellosis to humans has a greater vulnerability due to ignorance, poverty and reduced access to health care [14]. Dog handlers like veterinarians and dog breeders are constantly exposed to infection as a result of poor knowledge or lack of adherence to preventive measures in the course of their professional duties [15]. Animal handlers should wear protective clothing when working with animals. Laboratory workers should culture the organism only with appropriate biosafety level 2 or 3 containment laboratories [16]. Good hygiene and prophylactic antibiotics may be prescribed for lab workers in some situations [17]. The overall proportion of *B. abortus* causing human brucellosis is high and its potential impact on population risk should not be underestimated.

Dogs are important household pets kept for security, hunting, and leading of the blind and as a source of meat; therefore there is increased interest in keeping dogs [18,19]. The population of dogs in Nigeria has been variously estimated to be between three and five million [20]. The increase in dog ownership in Nigeria and in the North central regions in particular is associated with some risk factors that render them vulnerable to brucellosis. Many exotic breeds of dogs are not screened before being imported to other countries [21] and the probability of importing *Brucella species* infected dogs is high. Household dogs are fed with dead fetuses from cows and remnants from slaughtered cattle with history of bovine brucellosis from abattoirs [22]. Household dogs also roam around freely placing them at greater risk of exposure to brucellosis.

Due to the persistent security challenges in some States in North Central Nigeria, a lot of people keep dogs at home and other places as a form of security measure. Many communities also in these areas use dogs as a source of meat and other food delicacies [23]. The region is laden with many dog breeders who rely on it as their source of livelihood as it is a very lucrative business [24,25]. All these put humans that come in contact with dogs at risk of contracting the disease, hence the need to carry out this study.

Canine brucellosis remains a major zoonosis worldwide [26-28] and most of *Brucella species* are capable of infecting humans, although they have highly variable zoonotic potentials. *B. melitensis* is the most pathogenic species of *Brucella* for humans, whereas *B. suis* and *B. abortus* have intermediate zoonotic potentials. *B. canis* has

the lowest zoonotic potential among the classic *Brucella species*. The disease has important economic, veterinary and public health consequences [29,30]. The results of this study will form baseline data for regulatory body and government agencies to make policies that will help control zoonotic canine brucellosis in man and dog.

## Materials and Methods

This study was carried out in three (3) states, Plateau, Nasarawa, Kogi states and the FCT in North central Nigeria which is one of the six geo-political zones in Nigeria. Plateau State has an area of 30,913km<sup>2</sup> and a population of 3,206,531 people [31]. It is located between latitude 08° 24'N and longitude 008° 32' and 10° 38'E. Nasarawa State is located between latitude 7° 45'N and longitude 9°25'N. It has a population of about 1,869,377 people according to the 2006 population estimate [31]. Kogi state is also in the central region of Nigeria. It has a population of 3,314,043 people at the 2006 census [31]. Abuja is located in the centre of the country. It is located on Latitude 8°50'W and 7°10'E. The 2006 census estimated its population as 776,298 [31].

A cross sectional epidemiological study was used in this study. Simple random sampling by balloting was used to select three (3) states and the FCT from the study area namely: Plateau, Nasarawa and Kogi States. Veterinary clinics/Kennels/breeder houses were listed and Eight (4 from clinics, 2 from kennels and 2 from breeder houses) selected using purposive sampling techniques. Dogs presented were sampled using systematic method chronologically until the sample size of 550 was obtained. A well-structured questionnaire was distributed to the dog owners/handlers at the points of visit and at the veterinary clinics. Two hundred and ten (210) samples were collected from Plateau, 160 samples from Nasarawa, 100 samples from FCT, Abuja and 80 samples from Kogi State.

## Questionnaire survey

Questionnaire was used to determine the risk factors for dogs. Information on the dog's age, breed, sex, location and obstetrical history was obtained using a structured questionnaire. Information on the owner's occupation, literacy level and level of awareness of the disease was also obtained using a close ended, structured questionnaire pre-tested for validity. The study was clearly explained to the client/dog handler/breeder/butcher/veterinary personnel and informed consent obtained before administering the questionnaire.

Dogs were properly restrained and five millilitres of venous blood was aseptically collected from the cephalic vein into a clean and well labelled sample bottle devoid of anticoagulant using sterile hypodermic needle and 10ml syringe. The blood samples were allowed to clot by laying the sample bottles in a slanting position for an hour and the sera obtained by decantation and also centrifugation (when serum was not gotten from decantation) into a new, well labelled sample bottles with sample number corresponding to serial numbers on the questionnaire. Sera samples were then transported to the Bacterial Zoonoses Laboratory of the National Veterinary Research Institute, Vom, in a Coleman box with ice packs and stored at -20°C in a Freezer before being used.

**Serology**

The *Brucella abortus* antigen for the Rose Bengal Plate Test (RBPT) was obtained from Animal Health Veterinary Laboratory Agency, United Kingdom. The RBPT procedure was performed as described by Macmillan [32]. Thus, 30µl of antigen was placed on the test plate using a clean Pasteur pipette and the same volume of test serum was placed beside the antigen using another clean Pasteur pipette. The two were mixed thoroughly using a sterile applicator stick and rocked gently for 4 minutes and observed for agglutination. The formation of distinct pink-red granules (agglutination) was recorded as positive while the absence of agglutination was recorded as negative. Plates used were then washed with water and methylated spirit and allowed to dry before being re-used.

**Results**

A prevalence rate of 239(43.45%) of the 550 sera sample tested using the RBPT was obtained. Table1 shows that brucellosis infection was higher among dogs kept outdoor 190(53.37%) than those kept indoors 49(25.26%) and the association was statistically significant. Sixty seven (48.90%) of the exotic breeds of dogs presented by the respondents to the selected clinics were positive as shown in table 2. Figure 1 shows the level of awareness of dog owners on brucellosis and 296(53.82%) of the respondents had no knowledge on brucellosis while 254(46.18) had knowledge on brucellosis. Also, about 425(77.28%) of the respondents do not screen their dogs before breeding while 125(22.72%) screened before breeding and this was statistically significant using the chi-square formula. The questionnaire revealed that 330(60%) of the respondents consumed roasted dog meat, 143(26%) consumed boiled dog meat, 50(9%) consumed fried dog meat and 27(5%) consumed all three delicacies of dog meat respectively as shown by figure 2.

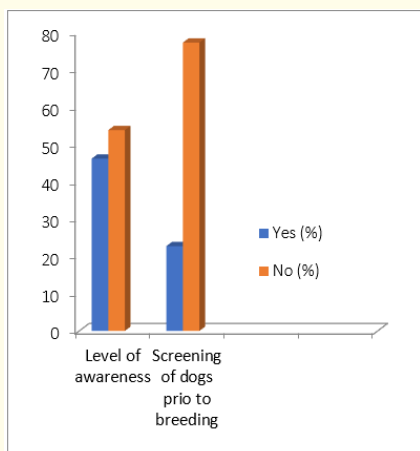
Based on the level of hygiene of the respondents, 489(88.90%) took no precaution (no protective wears and hand hygiene) before and after handling of dogs. Twenty-eight (5.10%) used protective wears when handling dogs, 22(4.00%) did proper hand washing after handling dogs and 11 (2.00%) used protective wears before handling dogs and washed and disinfected hands after handling dogs. This is shown in figure 3.

Management System	Total Number of Dogs Examined	Total Number of Dogs Positive	Prevalence (%)	95% CI	OR	X2	P-Value
Intensive	194	49	25.25	19.3-32.0	3.4	40.390	P < 0.001
Extensive	356	190	53.37	48.0-58.7			
Total	550	239	239	43.45			

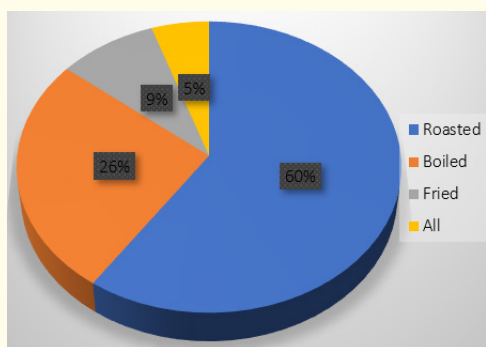
**Table 1:** Seroprevalence of Brucella in dogs based on management system in North central Nigeria using RBPT.

Breed	Total number of Dogs examined	Number of Dogs Positive	Prevalence (%)	95% CI	X <sup>2</sup>	p-value
Local	238	102	42.86	53.1-76.0	136.171	P < 0.001
Mix	175	70	40.00	21.0-53.0		
Exotic	137	67	48.90	32.8-64.7		
Total	550	239	43.45			

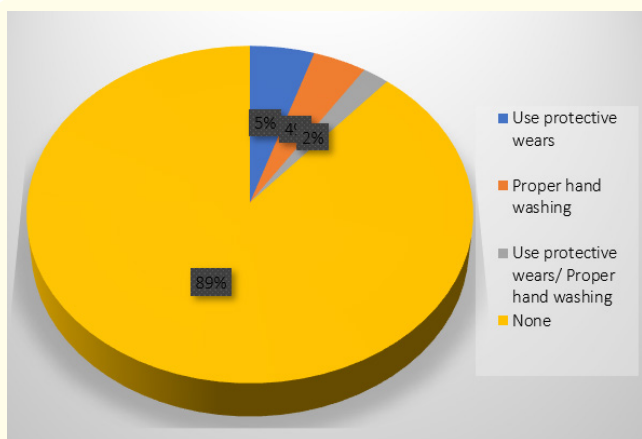
**Table 2:** Seroprevalence of Brucella in dogs based on breed distribution in North central Nigeria using RBPT.



**Figure 1:** Level of awareness on Brucellosis by the respondent and screened/unscreened dogs used for breeding.



**Figure 2:** Percentage types of dog meat consumed by the respondents in North central Nigeria.



**Figure 3:** Percentage level of hygiene among the respondents in North central Nigeria.

## Discussion

Brucella infection in dogs in North central Nigeria was likely acquired through indiscriminate breeding and outdoor management system. Dogs kept by the outdoor management system could roam about freely and are at risk of picking up food materials contaminated with Brucella organism such as aborted or after-birth materials, they are also at risk of mating dogs infected with brucellosis [29]. Stated that ingestion of tissues, foodstuff or fluid containing the organism is a major route of the disease transmission and that eating aborted fetuses can also lead to the disease. A previous study demonstrated a higher prevalence of infection in stray compared with non-stray dogs [33]. Dogs have been shown to be mechanical and biological vectors of brucellosis and sexual transmission is also an important means of spread of the infection as males can excrete the organism in large numbers in their semen [34].

The study shows that seropositivity was higher in unscreened than screened exotic dogs and this was statistically significant as the p-value was less than 0.05 meaning that the occurrence of brucellosis is associated with the screening and non-screening of dogs. The importation of exotic breed of dogs into the country without screening could contribute to the prevalence of the infection in the study area and the country at large [21]. Stated that many exotic breed of dogs are imported that are not screened before entry in to the country and that the introduction of dog breeding in Nigeria has contributed to the re-emergence of brucellosis as an international concern for both indigenous and foreign breeds of dogs.

The higher prevalence of brucellosis in dogs that have had one or more abortion(s) and/or stillbirth(s) suggests that the infection may be responsible for the abortions and stillbirths [35]. stated that *Brucella canis* can cause abortion and stillbirth in pregnant dogs particularly at the 7<sup>th</sup> to 9<sup>th</sup> week of gestation. Based on the level of awareness of canine brucellosis among dog owners, more of the respondents were unaware of the disease compared to those who had knowledge on it and this could be responsible for the prevalence of the infection in the study area. Canine brucellosis continues to be a problem common in dogs simply because people lack enough information about it [36]. A large proportion of dog owners used bare hands when handling dogs with no protective clothing such as coverall, laboratory coats, boots, hand gloves, or hand washing after handling of dogs. This is risky as Brucellae can enter through intact skin and abrasions [37].

Most of the respondents consumed undercooked dog meat (Roasted meat) and are at risk of contracting the disease because

brucellosis can be transmitted through consumption of contaminated raw animal products, like improperly cooked meat [38,39] also stated that the risk of infection is proportional to the degree of contact with *Brucella* infected edible by-products like dog offal (Intestine, liver, kidneys, uterus and testicle).

[40] in a similar study in goats in Benue, North central Nigeria has established risk factors such as lack of vaccination, introduction of newly purchased goats into the herd without isolation or examination by a professional, semi-intensive system of management, improper disposal of after-birth materials and lack of use of protective clothing when handling goats.

### Conclusion

This study has established risk factors such as outdoor management system, lack of screening of dogs, maintenance of low level of hygiene by dog handlers, consumption of undercooked dog meat among others. There is a low level of awareness of brucellosis among dog owners in North central Nigeria and therefore awareness and enlightenment programs on brucellosis should be carried out with emphasis on its zoonotic importance. Prevention of stray dogs and indoor management system should be encouraged to reduce indiscriminate mating and consumption of infected food materials and if dog meat must be consumed, it should be properly cooked.

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### Conflict of Interest

The authors declare that they have no conflict of interest.

Chronic kidney disease (CKD) encompasses several pathological processes associated with abnormal kidney function and a progressive decline in glomerular filtration rate [1,2]. With a global prevalence of 13%, CKD is considered a global public health problem. Its growth is evidenced by the increase in deaths attributed to it as well as by the incidence and prevalence of the end stage of the disease in the population [3,4]. The increasing occurrence of CKD in many countries is due to the older age of the human population and changes in lifestyle, along with the growing prevalence of obesity [5]. On the other hand, despite the high mortality caused by CKD and its greater presence in the population, clinical diagnosis

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