Seroprevalence of Brucella Infection in Humans, Bovine and ovine in Wards of Tal District, Pankshin LGA, Plateau State Nigeria

[1]Dayok, O; [1]Kum, F.O & [2]Bismoyi Dilkit,I

[*1]Department of Science, School of Science and Technology, Plateau State Polytechnic, Barkin-Ladi
[2]Bacterial Vaccine Production Division, National Veterinary Research Institute, Vom
[*]Corresponding Author: dayokolukemi5080@gmail.com

Abstract
A serological study was conducted to determine the percentage seroprevalence of brucellosis in humans, bovine and ovine among different farms of two wards in Tal district, Pankshin Local Government area of Plateau state. Blood samples were collected from 43 humans, 173 bovine and 192 ovine, given a total 408 samples. Samples were screened for brucellosis using the Rose Bengal Plate Test (RBPT). Results showed the percentage seroprevalence values of 0% in humans, 4.6% in bovine and 6.8% in ovine. However, percentage seroprevalence in bovine and ovine brucellosis was higher in Tal B ward than Tal A ward and higher in females than males respectively. In consideration of age significance on brucellosis, seroprevalence of bovine was higher (4.7%) among the age group 6-12 months. In ovine, results showed a higher percentage seroprevalence in age group 6-36 months (7.4%) as compared to 6.1% in age group > 36 months. Similarly, no statistical significant association between species, sex, age and occurrence of B. brucellosis at P>0.05. The absence of brucellosis in humans in both wards of Tal may not indicate an apparently brucellosis free status of the residents of the area due to the presence of bovine and ovine brucellosis in the study area which could pose a significant public health risk to the same residents. A wider and a periodic study on herds of bovine, ovine and cross species transmission to humans is recommended. This will aid policy making in combating cross transmission of brucellosis.
Key Words: Seroprevalence, brucellosis, humans, bovine and ovine.

Introduction

Brucellosis is recognized as an important potential zoonosis in developing countries (Ducrotoy *et al.,* 2014). The World Health Organization has declared brucellosis to be a significant re-emerging zoonosis. World Health Organization (WHO, 2004).

Nigeria's food animals' population is estimated at 15.2 million cattle, 23 million sheep and 28 million goats. A great proportion of families in the State keep sheep and goats, which provides sources of income to them. It is also a common practice to find those who keep cattle especially the Fulani pastoralists as well as other farmers keeping sheep and goat alongside. This practice is common among the rural population of the middle belt and northern parts of Nigeria. Sheep and goats are also reared along with cattle in most private or government owned farms which are semi-intensive in nature. The major husbandry practice in the State is the extensive seasonal confinement system. The animals are allowed to fend for themselves during the dry season but are taken out for grazing or tethered during the day in the rainy season and are brought to the house in the evenings. The keeping of sheep with cattle provides an opportunity for the spread of brucella infection from cattle to small ruminants (Ocholi *et al.*, 2005).

In Nigeria, several authors have reported brucellosis in Nigeria livestock (Ishola *et al.*, 2001, Cadmus *et al,* 2006), with evidence of the spread of the disease in all parts of the country. The role of brucellosis in limiting livestock production and its economic impact on the livestock industry in Nigeria is widely recognized (Ajogi, 2002). Brucellosis is endemic in Nigeria and causes severe economic losses to livestock farmers. It is serious risk to human health and has been documented in different part of the country, especially in ranches, livestock breeding centre and dairy farms in Nigeria (Ocholi *et al.*, 2005).

The risk factors for brucella infection include consumption of raw milk and unpasteurized dairy products and direct contact with animals and their products (Vassalo *et al.*, 2009).

Brucellosis in human is transmitted by poor hygiene, close contact with animals and consumption of unpasteurized dairy products and undercooked meat products. For example, consumption of traditional delicacies such as infected raw liver can cause human infection.

Acquiring infection through direct contact is possible to occupational groups such as veterinarians, farmers, butcher men, milkers, laboratory workers and inseminators. The routes of infection are through contamination of broken skin, inhalation of aerosols containing organism and contamination of the conjunctiva or other membranes (Regassa *et al*, 2009).

The present study is aimed at determining the prevalence rate for brucella infection in human, sheep and cattle in Tal district, Pankshin Local Government Area, Plateau State.

Method

Study Area

The research was conducted at Wards of Tal District. Pankshin Local Government Area of Plateau state, Nigeria which is geographically located in the South-Eastern part of Pankshin Local Government Area of Plateau State.

They are neighbors with the Dokpai and Angas people to the North, Piapung and Koenoem to the south, Tal to the east and Chip, Belning and Mupun to the west. It has a land size of about 104 square miles.

Sample size

A total of 408 blood samples were collected (43 from Humans, 173 from Bovine and 192 from Ovine) from different herds and selected households from Tal A and B wards of Tal district.

Sampling Techniques

A simple random sampling technique as described by Yates *et al.,* 2008) was used, Bovine and Ovine herds were randomly selected from each ward alongside selected household to give the required sample size in this study.

Method of Sample Collection

With the help of a phlebotomist and a veterinarian, approximately 5ml of blood were obtained from humans through the venous method; collection were done at the ante-cubital vein with sterile hypodermic needle and syringe and 5ml of blood were also obtained from Bovine and Ovine through jugular vein with sterile hypodermic needle and syringe, after which the blood samples were allowed to clot, centrifuged and serum transferred into sterile plain tube and stored at -20^{o}C until required.

Serological Test

The samples were serologically screened using standard Rose Bengal Plate Test as described by (OIE, 2012) at the *Brucella* Laboratory of the National Veterinary Research Institute Vom.

Rose Bengal Plate Test

This test was performed following the standard procedure described by OIE, (2012), by mixing 30ml of Sera and 30µl of the Rose Bengal Plate, Test antigen from *Onderstepoort* Biological Product (OBP) South African on white ceramic tile.

The Sera and the antigen were mixed with an applicator stick and rocked gently for four minutes and observed for *agglutination*. Samples that show distinct *agglutination* were recorded as positive and those without *agglutination* were considered negative. The controls for Rose Bengal Plate test were set up concurrently with the test samples, one positive control and one negative control were set up to validate the result using known positive and negative control sera samples.

Results

Table 1: A total of 173 Bovine were sampled. Tal B ward recorded the highest percentage seroprevalence rate of 5(8.8) of 57 Bovine from the ward and Tal A ward recorded 3(2.6) of the 116 Bovine from the ward. The percentage seroprevalence infection rates were not statistically associated at p>0.05

Table 2: A total of 192 Ovine were sampled. Tal B ward also recorded the highest percentage seroprevalence rate of 9(9.2) of 96 Ovine from the ward and Tal A ward recorded 4 (4.2) of the 96 Ovine from the ward.

However, the percentage seroprevalence infection rates were not statistically associated at P>0.05.

Table 3: A total of 173 Bovine were sampled (90 females, 83 males). Findings showed a higher percentage seroprevalence rate of 5(5.6) in female while the males recorded 3(3.6).

However, the percentage seroprevalence infection rates were not statistically associated at P>0.05

Table 4: A total of 192 Ovine were sampled (125 females, 67 males). The females also recorded the highest percentage seroprevalence rate of 10(8) of the 125 females sampled while the males recorded 3(4.5) of the 67 males tested.

However, the percentage seroprevalence infection rates were not statistically associated at p>0.05.

Table 5: A total of 173 Bovine were sampled (68 of age group 6-36 months, 105 of age group> 36 months). Result showed age group > 36 Months recorded the highest percentage seroprevalence rate of 5(4.7) while age group 6-36 reported a lower 3(4.4).

However, the percentage seroprevalence infection rates were not statistically associated at p>0.05.

Table 6: A total of 192 Ovine were sampled (94 of age group 6-36 months, 98 of age group> 36 months). Result showed age group 6-36 months recorded the highest percentage seroprevalence rate of 7(7.4) while age group>36 reported a lower 6(6.1).

However, the percentage seroprevalence infection rates were not statistically associated at p>0.05

Table 1: Seroprevalence of Brucellosis in bovine herds in wards A and B of Tal District

Ward	**Bovine sampled**	**Number Positive (%)**
A	116	3(2.6)
B	57	5(8.8)
Total	**173**	**8(4.6)**

X^2 = 2.0612 P Value = 0.1512 OR = 0.2761 P>0.05

Table 2: Seroprevalence of *Brucellosis* in Ovine herds in ward A and B of Tal District

Ward	**Ovine sampled**	**Number Positive (%)**
A	96	4(4.2)
B	96	9(9.4)
Total	**192**	**13(6.8)**

X^2 = 1.32 P Value = 0.2500 OR = 0.4203 P>0.05

Table 3: Association between Sex and Seroprevalence of Bovine Brucellosis distribution in Tal District

Ward	**Bovine sampled**	**Number Positive (%)**
Male	83	3(3.6)
Female	90	5(5.6)
Total	**173**	**8(4.6)**

X^2 = 0.006004 P Value = 0.8119 OR = 0.6375 P>0.05

Table 4: Association between sex and Seroprevalence of Ovine brucellosis distribution in Tal District

Ward	**Ovine sampled**	**Number Positive (%)**
Male	67	3(4.5)
Female	125	10(8)
Total	**192**	**13(6.8)**

X^2 = 0.3901 P Value = 0.5454 OR = 0.5391P>0.05

Table 5: Association between age and Seroprevalence of Bovine and Ovine Brucellosis distribution in Tal District

Age Group (Months)	**Bovine sampled**	**Number Positive (%)**
6-36	68	3(4.4)
>36	105	5(4.8)
Total	**173**	**8(4.6)**

X^2 = 0.1254 P Value => 0.99999999 OR = 0.8393 P>0.05

Table 6: Association between age and Seroprevalence of Bovine and Ovine Brucellosis distribution in Tal District

Age Group (Months)	**Ovine sampled**	**Number Positive (%)**
6-36	94	7(7.4)
>36	98	6(6.1)
Total	**192**	**13(6.8)**

X^2 = 0.006055 P Value = 0.9369 OR = 1.234 P>0.05

Discussion

The result of this research work showed the presence of brucellosis in cattle and sheep herds and non on human in Tal district of Pankshin Local Government as this is the first time the disease is being diagnosed and documented.

The seroprevalence of bovine brucellosis as reported in Yobe (34.0%) and Adamawa (36.6%) respectively (Adamu *et al*, 2016).

Similarly, in Southern Nigeria, (Cadmus *et al*, 2010) reported a seroprevalence of 6% in 2004, 6.17% in 2005, which was higher than the seroprevalence of bovine brucellosis reported in this study.

Cadmus *et al* 2013 reported higher seroprevalence of 8.6% in three cattle production system in South West Nigeria.

However the seroprevalence of 4.6% for bovine brucellosis in this study are higher than overall 3.8% reported by Wungak *et al.*, 2011 on serological survey of antibodies against brucellosis in cattle in Jos South Local Government Area and Jajere *et al.*, 2016 in seroprevalence study of brucellosis among cattle slaughtered in three municipal abattoirs of Gombe state.

The bovine seroprevalence of 4.6% in this study is also similar to those reported in other African countries such as Ethiopia 4.9% (Mekonnen *et al*, 2010) Eritrea 4.2% (Omer *et al.*, 2000).

In this study, the seropositivity of bovine brucellosis was reported higher in Tal B ward than Tal A ward. However, there was no statistically significant association between breeds and occurrence of brucellosis in cattle (P>0.05) (Table 1).

In addition, even though the proportion of bovine brucellosis was higher in females than in males, the difference was not statistically significant (p>0.05) Table 2).

This disparity in the seroprevalence of bovine brucellosis in different parts of the country is in congruent with the report of Mai *et al.*, 2012 where the authors reported that the prevalence of bovine brucellosis varied between animals in the same agro-pastoral zone.

This difference in the seroprevalence of the disease could be attributed to the difference in breeds, sensitivity of test kits, seasonal variation, farming system, and sample size.
A higher rate 14.5% was reported by Bertu *et al.*, 2010 in sheep in plateau State which is higher than the 6.8% of sheep reported in this study. The 6.8% in sheep in this study is also similar to the 6.0% as reported by Tijani *et al.*, 2009 in Borno and Yobe States.

Gusi *et al.*, 2010 in another study, reported a seroprevalence rate of 5.5% for sheep which is lower than the 6.8% in this study. This may suggest a likely increase in the rate of infection in the sheep herds since most of the animals were acquired from local markets without recourse to their brucellosis status. In a related study on small ruminants in Bauchi and environs, Shehu *et al.*, 1999 recorded a 6.6% prevalence of sheep which is similar to sheep in this study but a higher 10.8% on bovine brucellosis.

In this study, the seropositivity of ovine brucellosis was also higher in Tal B ward than Tal A ward.

In Eastern Sudan, Gumaa *et al*, 2014 reported seroprevalence of 2.15%, after sampling 2500 serum samples collected form sheep which is lower than the report from this study.
The difference in prevalence could be due to the difference in breeds, geographical location sample size, serological techniques and inter-laboratory variation. Variation in sex of bovine and ovine sampled in this study could be for economic reasons because the farmers tend to keep more female for higher production of animal and animal products than female in practices. However, there was also no statistically significant association between breeds and occurrence of brucellosis in sheep (P>0.05) Table 1. In addition, even though the proportion of ovine brucellosis was also higher in females than in males, the difference was also not statistically significant (P>0.05) Table 2
The 0% as reported in humans in this study is similar to the report of Ducrotoy *et al.*, 2014. Who reported that several serological investigations for animal-originated human brucellosis in Nigeria.

The risk of bovine and ovine brucellosis is not only restricted to the animal husbandry alone but also represent significant zoonotic implications characterized by debilitating and severe complications in humans (Gwida *et al.*,2016).
In Nigeria, serological studies have shown that bovine brucellosis is a common problem in

many grazing zones in Nigeria (Adamu *et al.*, 2016).

From reports, it was observed that there was variation in the prevalence of bovine brucellosis in many countries, the surveillance strategies adopted for the control and prevention of the disease is generally very poor.

Purchase of infected animals as replacement, interaction with wildlife, free movement of animals by nomads, change in climatic conditions, and the system of animal production others include regulatory issues and demographic factors were also considered as likely factors that increase the spread of bovine brucellosis. More factors include sharing of bulls between farmers, the practice of free range grazing and movement as a result of trade have greatly increased the risk of exposure to brucellosis in cattle (Adamu *et al.*, 2016).

Conclusion

This study revealed that the percentage seroprevalence rates brucellosis is endemic with the seroprevalence percentage rates of 0% in human, 4.6% in bovine and 6.8% in ovine in the studied area.

Findings also showed higher percentage seroprevalence in Tal B ward that Tal A ward, the infection rates was higher in the females than males.

The zoonotic implication so increase prevalence are the likelihood of increase spread to susceptible animals and humans. The fact that bovine and ovine tested serologically positive to brucellosis in this study area, more proactive precautionary measures should be put in place since brucellosis is a zoonotic disease of both public health and economic importance hence contamination of common grazing lands by infected by apparently clean looking herds could serve as a source of *Brucella* infection to other herds.

Recommendation

1. Personal hygiene and good sanitary measures must be practice to reduce/avoid the disease through contact with infected material such as unpasteurized milk, meat and other animal products.
2. The herding of bovine with ovine which usually increase the risk of transmission of this disease should be discouraged.
3. Regular culling of infected animals should be enforced.
4. Restocking or replacement of animals from local markets and neighboring farm or borders with consideration of their brucellosis status is recommended.
5. An effective control/preventive measures should be carried out by government in the studied area of bovine and ovine brucellosis using *B. abortus* 519 vaccines to prevent further spread of disease to other areas.

Refrences

Adamu S., Atsanda, N., Tijhani A., Usur, A., Sule A &Gulani, I. (2016). Epidemiological study of bovine brucellosis in three senatorial zones of Bauchi state, Nigeria. *Veterinary World*, 9(1): 48:5

Ajogi, I., Osinubi, M.O.V., Makun, H., Luga, I. & Andrew A. (2002). Seroprevalence of brucellosis is an institution farm Zaria. Proceeding of the 39th Nigeria Veterinary Medical Association Conference, Sokoto, Nigeria.

Bertu, W.J., Ajogi, I., Bale, J.O,, Kwaga, J.K. & Ocholi, R.A. (2010). Seroepidemiology of brucellosis in small ruminants in Plateau state, Nigeria. *Africa Journal of Microbiological Research* 4:1935-1938.

Cadmus, S., Adesokan, H., Adedokun, B. & Stack, J. (2010). Seroprevalence of bovine brucellosis in trade cattle slaughtered in Ibadan, Nigeria, Nigeria, from 2004-2006. *Journal of South Africa Veterinary Association,* 81 (1): 50-53

Cadmus, S.I.B., Ijagbone, J.F., Oputa, H.E., Adenosak, H.L. & Stack, J.A. (2006). Serological survey of brucellosis in livestock animals and workers in Ibadan, Nigeria. *Africa Journal of Biomedical Research* 9: 163-168.

Cadmus, S. I., Alabi, P. I., Adesokan, H. K., Dale, E.J & Stack, J.A. (2013). Serological investigation of bovine brucellosis in three cattle production Systems in Yewa Division, South-Western Nigeria. J. South Africa Veterinary Association. 84(1): E1-E6.

Ducrotoy, M.J. Bertu, W.J., Ocholi, R.A., Gusi, A.M., Bryssinckx, W. & Welburn, S. (2014). Brucellosis as an Emerging Threat in Developing Economies: Lessons from Nigeria. *PlosNegl Trop Dis* 8(7) e 3008. Doi: 10.1371*/journal*. pntd.0003008.

Gumaa, M., Osman, H., Omer, M., El Sanousi, E., Godfroid, J. & Ahamed, A. (2014). Seroprevalence of brucellosis in sheep and isolation of *Brucella abortus* biovar 6 in Kassala State, Eastern Sudan. Review science technology office Internation des Epizootics , 33:957-965.

Gusi, A.M., Bertu, W.J., Mwankwon, E.S., Hassan M. & Ocholi, R.A. (2010). Prevalence of *Brucella* antibodies in animals and butchers at Jos Abattoir, Nigeria, Vom *Journal of Veterinary Science* 7: 30-34

Gwida, M., El-Ashker, M., Melzer, F., El-Diasty, M., El-Beskaws, M. & Neubaver, H. (2016). Use of serology and real time PCR to control outbreak of bovine brucellosis at a dairy cattle farm in the Nile Delta region, Egypt. *Irish Veterinary Journal*, 69(1):1

Ishola, O.O. & Ogundipe, G.A.T. (2001). Seroprevalence of brucellosis in Trade CattleSlaughtered in three municipal abattoirs of Gombe state, Northeastern Nigeria, *Veterinary World*, 9(10): 1082-1086.

Jajere, S.M., Atsanda, N.N., Bitrus, A.A., Hamisu, T.M. & Ayo, A.O. (2016). Seroprevalence of brucellosis among cattle slaughtered in there municipal abattoirs of Gombe State, Northeastern Nigeria, *Veterinary World, 9(10):* 1082-1086.

Mai, H.M., Irons, P.C., Kabir, J. & Thompson, P.N. (2012). A large seroprevalence survey ofBrucellosis in cattle herds under diverse production systems in northern Nigeria.*Biomedical Veterinary Research,* 8(1):1.

Mekonnen, H., Kalayou, S. & Kyule, M. (2010). Serological Survey of bovine brucellosis in barka and arado breeds (Bos indicus) of western Tigray, Ethipia. *Preview Veterinary Medicine* 94(1): 28-35.

Ocholi, R.A., Kwaga, J.K., Ajogi, I. & Bale J.O. (2005). Abortion due to *Brucella abortus* in sheep in Nigeria.*Review Science Technology office Internation Des Epizooties* 24:973 979.

Office International Des Epizooties OIE (2012). Bovine Brucellosis In: Manual of Diagnostic Tests and Vaccines for Terrestrial Animals. World Organization for Animal Health. Paris, France, 2.4.3: 44-78. http://www.oie.int/fileadimin/home/en g /health standards/tahm/2.04.16 bovine brucella.

Omer M., Skjerve E., Zerai W. & Gudmund H. (2000). Risk factors for Brucella spp. infection In dairy cattle farms in Asmara, State of Eritrea. 46(4):257-65

Regassa, G., Mekonnen, D., Yamuah, L., Tilahun, H., Guta, T., Gebreyohannes, A., Aseffa, A., Theressa, Abdoel, H. & Smits, A.L. (2009). Pastoral communities in Ethiopia, *International Journal of Tropical Medicine*, 4(2):59-64.

Shehu, L. Yusuf, H., Kudi, A.C. & Kalla, D.U. (1999). Sero prevalence of Brucllosis in rumminats in Bauchi and Environs. *Nigeria Veterinary Journal*, 20 (1): 67-74

Tijani, A.O., Musa, H.I., Onsoumanou, O. & Akintola, O. (2009). *Sahel Journal of Veterinary Science* .8(1): 55-60.

Vassalo, C.M., Economou, V., Vassalou, E. & Papidaulor, C. (2009). Brucellosis in humans: why is it so elusive*? Review of Medical Microbiology* 0:63-7robiology 0:63-7

WHO (2004). Emerging Zoonoses Available at: http://www.who.int/zoonoses/emerging zoonoses/en/

Wungak, Y.S, Aworh, M.K.F., Maurice, N.A., Balami, A.G., Danmarwa, A. & Danthe, H.D. (2011). Serological survey of antibodies against vom *Journal of Vertirinary* Science; 8:39-42.

Yates, D.S., David, S.M., & Daren S.S., (2008). The practice of statistics, 3rd ed. ISBN-13: 978-0716773092