



Detection of Ig G Antibodies To Bovine Viral Diarrhoea Virus in Domestic Ruminants in Maiduguri, Nigeria

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SUMMARY

Bovine viral diarrhoea virus infection has been recognized as an important cause of infertility among cattle worldwide. The aim of this research was to determine the prevalence rate of BVDV antibodies in cattle, sheep and goats in Maiduguri, northeastern Nigeria. Sera from 333 animals comprising 160 cattle, 92 sheep and 81 goats were tested for the presence of BVDV antibodies using a commercial Enzyme linked immunosorbent assay. The result showed an overall prevalence of 47.4% (158/333) among livestock sampled in this study and out of this percentage Cattle makes up 22.2% (74/333), Sheep, 13.2% (44/333) and Goats 25.3% (40/333). The result showed no statistically significant ($P < 0.05$) difference in gender of the animals studied. This study showed that antibodies to BVDV is prevalent in ruminant species in Maiduguri. A more detailed epidemiological study encompassing a wider livestock farming area in Nigeria will be required to elucidate on the spatial distribution and to determine the serotype of the field strains of BVD Virus circulating in livestock in Nigeria.

Key words: Bovine Viral Diarrhoea Virus, Infertility, Ruminants, Seroprevalence.

INTRODUCTION

Bovine viral diarrhoea (BVD) is a worldwide disease of cattle and also one of the most economically important viral disease of this species of animals (BedeKovic *et al.*, 2012; Bachofen *et al.*, 2013; Zhang *et al.*, 2014). The disease is caused by bovine viral diarrhoea virus (BVDV), which belongs to the pestivirus genus of the family Flaviviridae (Solis-Calderon *et al.*, 2005; Booth *et al.*, 2013). Infection is known to occur primarily through aerosol in cattle but it has been

reported also in sheep (Paton *et al.*, 1989), rabbits (Frolich and Streich *et al.*, 1998), camels (Belknap *et al.*, 2000) and goats (Passler *et al.*, 2014). Clinical signs of BVD following horizontal transmission may range from clinically undetectable to severe (Zhang *et al.*, 2014) and may involve the respiratory (Richer *et al.*, 1988), enteric (Zhang *et al.*, 2014), immune (Lanyon *et al.*, 2014) and reproductive systems (Bachofen *et al.*, 2014). Vertical transmission of the virus can result in cases of abortion,

stillbirth or birth of fetus(s) with congenital defects and or birth of a persistently infected (PI) calf (Palomares *et al.*, 2013). Bovine viral diarrhoea virus is spread and maintained in cattle populations by persistently infected (PI) calves (Bachofen *et al.*, 2013; Palomares *et al.*, 2013).

Screening of animals is important as it helps to identify PIs which are necessary when establishing control and eradication measures. Due to economic losses accompanying BVDV infection, some European countries have undertaken eradication programmes (Bachofen *et al.*, 2014).

Although, antibodies to BVDV have been detected in livestock in some parts of Nigeria (Taylor *et al.*, 1977; Baba *et al.*, 1996; Bello *et al.*, 2016), the current status of the disease is yet to be determined in most parts of the country. This study was conducted to determine the prevalence of BVDV in cattle, sheep and goats populations in Maiduguri, northeastern Nigeria.

MATERIALS AND METHODS

Study Area and Animals

The Study was carried out in Maiduguri, northeastern Nigeria. The city is located between latitudes 10°48'N and longitudes 11°51'E within the conventional Sahel savannah zone; and lies 354m above sea level. This part of the country has two distinct seasons, the hot and the wet seasons with mean ambient temperature ranging from 13-41°C (Mayomi and Mohammed, 2014).

Sheep, goats and sometimes cattle are kept in small holder operations by suburban dwellers within towns and cities such as Maiduguri. These animals serve as sources of animal protein and quick cash; and have religious and/or cultural values. They are majorly managed under the semi intensive husbandry system.

Sample Collection, Processing and Storage

Blood samples were collected through jugular veno-puncture from cattle (n=160), sheep (n=92) and goats (n=81). The samples were transferred into sterile plain vacutainer tubes, placed on ice and transported to the Animal Virus Research Laboratory, University of Maiduguri, Nigeria. The blood was then centrifuged at 1000 x *g* for 15 minutes. Serum was separated and stored in properly labeled vials at -20 °C until analysis.

Antibody Detection

Sera were tested for antibodies specific to BVDV using an indirect Enzyme Linked Immunosorbent Assay (ELISA) Kit (Bio-X Diagnostics, Belgium). The test was performed according to the manufacturer's instructions. Both positive and negative control sera were included in the assay. The results were read by a microplate reader (Emax precision Micro plate reader, California, USA), where the optical density (OD) of the positive and negative sera and those of all the samples were measured at 450 nm wavelength. The cut-off point for negative and positive tests were OD values ≤ 2.216 and ≥ 3.391 respectively.

Statistical Analysis

Prevalence was calculated as: number of antibody positive animals/number of sampled animals) x100. Fischer's exact test (GraphPad InStat, version 3.05, 32 bit for windows, GraphPad Software Inc, USA) was used to compare prevalence between male and female animals of same species with P-value considered significant at 0.05.

RESULTS

From the 333 serum samples tested, the overall seroprevalence rate was found to be 47.4% (158/333) and out of this percentage cattle make up 22.2% (74/333), sheep, 13.2% (44/333) and goats 12.0% (40/333). The specie and sex prevalence in these animals is also presented in Table 1. The

Table 1: Distribution of antibodies specific to BVDV in cattle, sheep and goats in Maiduguri, Nigeria

Animal Specie	Number tested	Number (%) positive	P-Value
Cattle			
Male	56	27 (16.9)	0.7418*
Female	104	47 (29.4)	
Sheep			
Male	43	20 (21.7)	0.8372*
Female	49	24 (26.1)	
Goats			
Male	18	12 (14.8)	0.1150*
Female	63	28 (34.6)	
Total	333	158 (47.4)	

* P value: considered not significant

result showed that out of the 160 cattle sera tested, 46.3% (74/160) had antibodies against BVDV with 16.9% (27/160) males and 29.4% (47/160) females. Similarly from the 92 sheep sera tested, 47.8% (44/92) had antibodies against BVDV with 21.7% (20/92) males and 26.1% (24/92) females. Of the 81 samples from goats, 49.4% (40/81) had antibodies against BVDV and out of which 14.8% (12/81) were males and 34.6% (28/81) were females (Table 1). In all the three species, there was no statistically significant difference ($p > 0.05$) in antibody detection among the sexes.

DISCUSSION

The results of the present study showed an overall BVDV seroprevalence of 47.4% (158/333) among cattle, sheep and goat populations in Maiduguri. This finding revealed evidence of immune response to natural exposure to BVDV in these animals since vaccination against BVDV is not being practiced in Nigeria at the moment unlike in European countries. The presence of antibodies to BVDV have previously been reported in Nigeria (Taylor *et al.*, 1977; Baba *et al.*, 1994; 1996; Bello *et al.*, 2016). The results of the present study confirm findings of the previous reports, suggesting the persistence of BVDV in livestock in Nigeria.

In the present study, cattle and sheep had seroprevalence of 46.3% and 47.8% for BVDV respectively. In one recent study in northwestern Nigeria, Bello *et al.* (2016) reported a prevalence of 66.39% for BVDV in cattle. This prevalence rate is higher than is seen in the current study (46.3%) and also in an earlier report by Baba *et al.*, (1994) who reported a prevalence of 12% prevalence in cattle. The variation in the prevalence rates between the current and previous reports could be due to a genuine rise in infectivity rate, difference in husbandry practice, breeds of animals or in the assay techniques and sample size used.

The current prevalence rates of antibodies to BVDV in Nigeria (46.3% - 66.39%) are comparable to what is obtainable elsewhere globally. For example in South Africa, prevalences of BVDV in the range of 6 to 70% have previously been reported (Anderson *et al.*, 1998; Njiro *et al.*, 2011). The 46.3% prevalence rate observed in cattle in the present study is congruent with the findings in a similar work reported from Western China (Gao *et al.*, 2013). However, the rate of detection of BVDV antibodies in the current study is lower than the 72.5% to 90% previously reported in Iran (Felleisen *et al.*, 1998); Chile (Reinhardt *et al.*, 1990), Canada (Solis-Calderon *et al.*, 2005) and South Vietnam (Duong *et al.*, 2008). High prevalence rate (50-90%) of BVDV have

been reported in some countries such as Chile (Reinhardt *et al.*, 1990), Iran (Garoussi *et al.*, 2008) and Canada (Ahmad *et al.*, 2011), although a lower prevalence rate (14%) compared to the present findings have also been reported in a study involving Yucatan cattle in Mexico (Solis –Calderon *et al.*, 2005). It is quite plausible that these observed differences may be due to differences in cattle population, housing systems, bio-security and management practices (Stahl *et al.*, 2012).

The detection of antibodies to BVDV in these species of animals is significant as it provides information on the current status of the infection in these species in this part of the world. Given that cattle, sheep and goats may be found commonly being raised together in close proximity in many African countries (Mshelia *et al.*, 2013), this may allow for ease of transmission of BVDV among these animal species (Passler *et al.*, 2009).

The origin, source and transmission pattern of BVDV have not been determined in the present study. The date, origin and point of entry of bovine viral diarrhoea virus into Nigeria is not known but it is possible to have occurred prior to the first report of detection of BVDV antibodies in the country (Taylor *et al.*, 1977). It is also possible that the virus was introduced into the country through infected trade animals from

neighboring countries. It is important that future studies should be focused on elucidating on the epidemiology of this disease in Nigeria.

CONCLUSION

This study has shown that there is a relatively high prevalence of BVDV antibodies in cattle sheep and goats in Maiduguri, Nigeria. This high seroprevalence rate of BVDV antibodies may pose a threat to the reproductive potentials of these animals which should not be underestimated. Further studies will be required to understand the epidemiology and pathogenesis of BVDV infection in Nigeria. There is also need to characterize the field strains of BVDV in Nigeria so as to understand the virus diversity and molecular epidemiology. This will facilitate a rapid diagnostic approach to BVDV and effective control measures against the spread of this disease in Nigeria and curb its potential consequences on lowered reproductive efficiency in these ruminant species.

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REFERENCES

- AHMAD, A., RABBANI, M., MUHAMMAD, K., SHABBIR, M. Z., YAQUB, T., MUNIR, K., AKHTER, F and CEPICA, A. (2011): Prevalence of Bovine Viral Diarrhoea Virus Persistency in 12 Holstein Cattle Dairy Herds of Charlottetown, Canada. *Pak J Zool*, 43(2): 255-261.
- ANDERSON, E.C. and ROWE, L.W. (1998): The prevalence of antibodies to the viruses of bovine virus diarrhoea, bovine herpes virus 1, rift valley fever, ephemeral fever and blue tongue and to *Leptospira sp* in Free-ranging wildlife in Zimbabwe. *Epidemiol Infect*, 121:441-449.
- BABA, S.S., BOBBO, A.G., AKOMA, M.B. and OSIYEMI, T.I. (1994): Slaughter House survey for antibodies against selected ruminant sera in Maiduguri, Borno State, Nigeria. *Der Tropenlandwirt, Zeitschrift fur die Landwirtschaft in den Tropen und Subtropen* 95, Jahrgang, 55-62.
- BABA, S.S., TEKKI, S. and AKOMA, M. (1996): Preliminary Survey for

- state, Nigeria. *West Afr J Biol* 4(1): 56-62.
- BACHOFEN, C., GRANT, D. M., WILLOUGHBY, K., ZADOKS R.N., DAGLEISH M. P. and RUSSELL, G.C. (2014): Experimental infection of rabbits with bovine viral diarrhoea virus by a natural route of exposure. *Vet Res*, 45:34. DOI: 10.1186/1297-9716-45-34.
- BACHOFEN, C., WILLOUGHBY, K., ZADOKS, R., BURR, P., MELLOR, D. and RUSSELL, G.C. (2013): Direct RT-PCR from serum enables fast and cost-effective phylogenetic analysis of bovine viral diarrhoea virus. *J V Methods*, 190: 1–3.
- BEDEKOVIC, T., LOJKIC, I., LEMO, N., CAC, Z., CVETNIC, Z., LOJKIC, L. and MADIC, J. (2012): Genetic typing of Croatian bovine viral diarrhoea virus isolates. *Veterinarski arh.*, 82 (5): 449-462.
- BELKNAP, E.B., COLLINS, J.K., LARSEN, R.S. and CONRAD, K.P. (2000): Bovine Viral Diarrhoea Virus in New World Camelids. *J Vet Diagn Invest*, 12:568-570.
- BELLO, S.M., DANEJI, A.I., CHAFE, U.M., ABUBAKAR, M.B., JIBRIL, A.H. and FESTUS, A. (2016): Detection of antibodies to bovine viral diarrhoea virus in cattle presented for slaughter at Sokoto metropolitan abattoir, Nigeria. *J Vet Med Anim Hlth*, 11-14.
- BOOTH, R.E., THOMAS, C.J., EL-ATTAR, M.R., GUNN, G. and BROWNLIE, J. (2013): A phylogenetic analysis of Bovine viral diarrhoea virus (BVDV) isolates from six different regions of the UK and links to animal movement data. *Vet Res*, 44(1)1. Doi: 10.1186/1297-9716-44-43
- DUONG, M.C., ALENUS, S., HUONG, L.T.T. and BJORKMAN, C. (2008): Prevalence of *Neospora caninum* and bovine viral diarrhoea virus in dairy cows in southern Vietnam. *Vet J*, 175 (3): 390-394.
- FELLEISEN, R.S.J., LAMBELET, N., BACHMANN, P., NICOLET, J., MULLER, N. and GOTTSTEIN, B. (1998): Detection of *Trichomonas fetus* by PCR and DNA enzyme immunoassay based on rRNA gene unit sequences. *J Clin Microbiol*, 36: 513–519.
- FROLICH, K. and STREICH W. J. (1998): Serological evidence of bovine viral diarrhoea virus in free-ranging rabbits from Germany. *J Wildl Dis.* 34 (1):173-8.
- GAO, S., LUO, J. and DU, J. (2013): “Serological and molecular evidence for natural infection of Bactrian camels with multiple sub genotypes of bovine viral diarrhoea virus in Western China”. *Vet Microbiol*, 163(1-2): 172–176.
- GAROOUSSI, M. T., HAGHPARAST, A. and ESTAJEE, H. (2008): Prevalence of bovine viral diarrhoea virus antibodies in bulk tank milk of industrial dairy cattle herds in suburb of Mashhad-Iran. *Prev Vet Med.*, 84 (1–2):171–176.
- LANYON, S.R., HILL, I. F., REICHEL, M.P. and BROWNLIE, J. (2014): Bovine viral diarrhoea: Pathogenesis and diagnosis. *Vet J*, 199(2):201-9.
- MAYOMI, I. and MOHAMMED J.A. (2014): A decade assessment of Maiduguri Urban Expansion (2002-2012) Geospatial Approach. *Global Journal of Human-Social Science: B Geography, Geo Sciences, Environmental Disaster Management*, 14 (2) ISSN: 2249-460x.
- MSHELIA, G.D., ABBA, Y., VOLTAIRE, Y.A.C., AKPOJIE, G., MOHAMMED, H and AONDONA

- D.U. (2013): Comparative uterine bacteriology and pathology of camels (*Camelus dromedarius*) and cows in north-eastern Nigeria. *Comp. Clin. Path.*, 22, 1195-1200.
- NJIRO, S.M., KIDANEMARIAM, A.G., TSOTETSI, A.M., KATSANDE, T.C., MNISI, M., LUBISI, B.A., POTTS, A.D., BALOYI, F., MOYO, G., MPOFU, J., KALAKE, A. and WILLIAMS, R. (2011): A study of some infectious causes of reproductive disorders in cattle owned by resource-poor farmers in Gauteng Province, South Africa. *J. S. Afr. Vet. Assoc.*, 82(4): 213–218.
- PALOMARES, R.A., MARLEY, S.M., GIVENS, M.D., GALLARDO, R.A. and BROCK, K.V. (2013): Bovine Viral diarrhoea virus fetal persistent infection after infection after immunization with a contaminated modified-live virus vaccine. *Theriogenology*, 79: 1184-1195.
- PASSLER, T, RIDDELL, K.P., EDMONDSON, M.A., CHAMORRO, M.F., NEILL, J.D., BRODERSEN, B.W., WALZ, H.L., GALIK, P.K., ZHANG, Y. and WALZ, P.H. (2014): Experimental Infection of Pregnant Goat with Bovine viral diarrhoea virus (BVDV) 1 or 2. *Vet Res*, 45(1): 1.
- PASSLER, T., WALZ, P.H., DITCHKOFF, S.S., BROCK, K.V., DEYOUNG, R.W., FOLEY, A.M. and GIVENS, M.D. (2009): Co Habitation of Pregnant White-tailed Deer and Cattle Persistently Infected with Bovine Viral Diarrhoea Virus Results in Persistently Infected Fawns. *Vet Microbiol*, 134:362-367.
- PATON, D.J., GOODEY, R., BROCKMAN, S. and WOOD, L. (1989): Evaluation of the quality and Virological status of semen from bulls acutely infected with BVDV. *Vet Rec*, 124(3), 63-64.
- REINHARDT, G., RIEDEMANN, S., ERNST, S., AGUILAR, M., ENRIQUEZ, R. and GALLARDO, J. (1990): Sero-prevalence of bovine viral diarrhoea/mucosal disease in southern Chile. *Prev Vet Med*, 10: 73–78
- RICHER L., MAROIS, P. and LAMONTAGNE, L. (1988): Association of Bovine viral diarrhoea virus with multiple viral infections in Bovine Respiratory Disease outbreaks. *Can Vet J.*, 29(9): 713.
- SOLIS-CALDERON, J.J., SEGURA-CORREA, V.M. and SERA CORREA, J.C. (2005): Bovine Viral diarrhoea Virus in beef cattle herds of Yucatan, Mexico: Seroprevalence and risk Factors. *Prev Vet Med*, 72: 253-262.
- STAHL, K. and ALENIUS, S. (2012): Bovine viral diarrhoea virus control and eradication in Europe-an update. *Jpn J Vet Res*, 60:S31-S39.
- TAYLOR, W.P., OKEKE, A. N. and SHIDALI, N.N. (1977): Prevalence of bovine Virus diarrhoea and infectious bovine rhinotracheitis antibodies in Nigerian sheep and goats. *Trop Anim Health Prod*, 9 (3): 171-5.
- ZHANG, S., TAN, B., DING, Y., WANG, F., GUO, L., WEN, Y., CHENG, S. and WU, H. (2014): Complete genome sequence and pathogenesis of bovine viral diarrhoea virus JL-1 isolate from cattle in China. *Virol J*, 11(1):1.