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Sero-prevalence of Border Disease Virus Antibodies in Recently Introduced Dorper Sheep Flocks at Debre Birhan Agricultural Research Center, Ethiopia

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ABSTRACT

A study was conducted to investigate the serological prevalence of Border Disease Virus (BDV) antibodies in newly introduced Dorper sheep flocks at Debre Birhan Agricultural Research Center (DBARC), Amhara Region, Ethiopia. Blood samples were collected from the jugular vein of 186 sheep in the research center and the serum was decanted and sent to the National Animal Health Diagnostic and Investigation Center, Sebeta, Ethiopia for laboratory examination. All serum samples were examined using blocking ELISA test with a sensitivity of 94.3% and specificity of 93.7% to detect antibodies for BDV. Of these, 55 (29.57%) tested sero-positive and the rest 131 (70.43%) tested sero-negative for BDV antibodies. The sero-prevalence of sheep born in the research center was found at 23.97% (29/121) whereas the sero-prevalence of those sheep imported directly from abroad was found at 40% (26/65). In this research, a higher prevalence of BDV antibodies were recorded in the imported sheep than in the sheep which are born in the research center and the difference in prevalence between the two groups was found statistically significant (P<0.05). Therefore, it is of utmost importance to study the status of the disease from indigenous breeds of sheep and utilize more sensitive tests such as RT-PCR.

Keywords: Antibodies, bELISA, Border Disease Virus, Dorper Sheep, Sero-prevalence.

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INTRODUCTION

Border disease (BD) is a viral disease of sheep and goats first reported in sheep in 1959 from the border region of England and Wales **(Hughes *et al*., 1959).** The disease is caused by Border disease virus (BDV) which is closely related to similar viruses of cattle and swine, bovine viral diarrhea virus (BVDV) and classical swine fever virus (CSFV), respectively. They are classified together as ruminant *pestiviruses* which readily cross between the two species so that border disease in sheep can be caused by either BDV or by BVDV **(Nettleton and Entrican, 1995).** BDV infections are most associated with sheep but all domesticated and wild cloven-hoofed artiodactyls are likely to be susceptible **(Feknous *et al*., 2018).**

Distribution of the virus is worldwide and the prevalence varies in sheep from 5% to 50% among countries and from region to region within countries **(Nettleton *et al*., 1998; Krametter-Froetscher, 2008).** It has been reported throughout Europe, Australia, North and South America, Asia and Africa. BDV spreads naturally among sheep by the oro-nasal route and by the vertical transmission route **(OIE, 2017).** It is principally a cause of congenital disease in sheep and goats, but can also cause acute and persistent infections **(OIE, 2017).** BDV infection is uncommon in goats, in which persistent infection is rare whereas abortion is the main presenting sign **(OIE, 2017).** Sheep can become infected with BVDV from cattle **(Carlsson, 1991),** and in some countries, BVDV can be a more common cause of BD than BDV.

Oro-nasal infection in healthy adults or neonates causes mild or in-apparent disease **(OIE, 2017**). The consequences of infection are primarily reproductive barren ewes, abortions, stillbirths and stunted, weak lambs with variable degrees of nervous dysfunction. Other occasional effects include 'hairy' and mal-pigmented wool, tremor, skeletal abnormalities, and immunosuppression with subsequent secondary bacterial infection **(Nettleton *et al*., 1998; Pratelli *et al*., 1999).**

Vertical transmission is important in the epidemiology of BD. The infection of fetuses in early gestation can result in the birth of persistently infected (PI) lambs. These PI lambs are viraemic, BDV antibody negative and constantly excrete virus. They are a potent source of infection and ensure the spread of the virus within susceptible populations **(OIE, 2008).**The control of BD is hampered by lack of vaccines **(Volkan *et al*., 2014).** Therefore, effective

control has to rely on the identification of PI animals and the prevention of infection of susceptible pregnant dams, especially during the first half of gestation.

Due to the low productivity of the indigenous breeds, the Ethiopian government had been introducing different exotic sheep and goat breeds in the past **(Aschalew, 2006; Tibbo, 2006).** Despite the efforts on genetic improvement, unexpected diseases have been introduced like Maedi-visina **(Tsegaw and Adem, 2012).** Incidences of new cases with undefined etiology and typical clinical signs similar to BD that include barren ewes and the birth of small weak lambs, abnormal body conformation, tremor, fleece changes, diarrhea, ill thrift, and death from immune incompetence have been observed in introduced exotic Dorper sheep breed nucleus flock maintained at Debre Birhan Agricultural Research Center. According to **Monies *et al.* (2004),** enteric diseases characterized by diarrhea and ill-thrift are common problems in lambs persistently infected with BDV.

The reproductive and neonatal diseases of small ruminants like border disease are far more important because they can cause huge economic disasters **(Yilmaz *et al.*, 2014).** Therefore, the establishment of diagnostic systems and control strategies after the disease survey should be performed in order to continue the expected genetic improvement program through cross-breeding at the farmer level. Hence, this research activity is initiated to verify the presence and to determine the prevalence of BDV antibodies in the newly introduced Dorper sheep breed maintained at Debre Birhan Agricultural Research Center.

MATERIALS AND METHODS

Study Area:

The study was conducted in Debre Birhan Agricultural Research Center (DBARC). DBARC is found in North Shewa Administrative Zone of Amhara National Regional State, North eastern part of Ethiopia. It is located in the central part of the Nation, at a road distance of about 120 kilometers from Addis Ababa, the capital city of the country. Geographically, the area lies between 09 ^{0} 0 35'45" to 09 ^{0} 0 36'45" north latitude and 39 ^{0} 29'40" to 39 ^{0} 31'30" east longitude with an average elevation of about 2828 meters above sea level. It has an average annual rain fall of about 897.8mm and average annual temperature of about 19.9°C **(Debre Birhan Agricultural Research Center, 2016)**

Study Population and Sample Size

Apparently healthy, newly introduced Dorper breed sheep that are found in DBARC, Amhara Region, in Ethiopia were considered as study animals for this research. All the Females **Dorper breed sheep in the flock (186),** with the age one year and above were sampled to check the sero-prevalence of BDV antibodies.

Study Design and Data Collection

Cross-sectional study design was considered for this serological study. Blood samples were collected in 10 ml vacutainer tubes without adding any anticoagulant, allowed to clot overnight and serum was separated from each collected sample. After serum separation, it was kept at -20 ^{0}C until laboratory testing. The samples were sent to the National Animal Health Diagnosis and Investigation Center, Sebeta, Ethiopia for examination. Blocking Enzyme-Linked Immunosorbent Assay (Ab ELISA) with the sensitivity of 94.3% and specificity of 93.7% was used for the detection of serum antibodies against BDV.

Data Management and Analysis

Descriptive statistics of the variables was calculated and the overall sero-prevalence of Border disease in the sampled sheep and the prevalence of the same disease in the sheep that were directly imported from abroad and in those that were born in the research center were determined. Data analysis was performed using SPSS software and determination of statistically significant differences in disease prevalence between age groups was tested using Chi- square statistical method and declared if $P<0.05$.

RESULTS

One of the most important persistent viral infections affecting small ruminant populations globally is BDV. The presence of persistently infected animals in flocks and the births of persistently infected off-springs mean that flocks contain animals without clinical signs of infection but continuously infect others, making it impossible to eliminate infection . Based on the individual antibody detection using blocking ELISA, the overall sero-prevalence of BDV antibodies in Dorper breed sheep was recorded as 29.57% (table 1).

Table 1: Prevalence of border disease virus antibodies in Dorper sheep nucleus flock at Debre Birhan Agricultural Research Center

Risk factor	N	N+ *(Prevalence in %)*	N- *(Prevalence in %)*	χ^2	*p*-value
Age in years				5.219	0.022
1-2 years	121	29 (23.97)	92 (76.03)		
>2 years	65	26 (40.00)	39 (60.00)		
Total	186	55 (29.57)	131 (70.43)		

DISCUSSION

The result agrees with the finding of **Valdazo González *et al.* (2008)** who reported that depending on the country and the region, sero-prevalence in sheep varies from 5% to 50%. Similarly, **Krametter Froetscher *et al.* (2007)** investigated sero-positivity rates of 29.4% in Australian samples using ELISA, which also agrees with the findings of this work.

However, **Burgu *et al*., (1987)** reported sero-positivity of 0.06-3% particularly in samples from aborted sheep and **Yavru *et al.* (2014)** reported pestiviruses antigens in 8.82% of fetuses and fetal tissue samples (liver, lung and brain), both of which were by far lower than the finding in this study. In contrary to these reports, **Ameen and Karapinar (2018), Gür (2009) and Yilmaz *et al.* (2014)** reported sero-prevalence of pestivirus-specific and BDV antibodies of 45.2%, 78.5% and 74.57%, respectively, in sheep from different regions and countries.

The differences between the prevalence of Border Disease Virus antibodies reported by this work and other research activities may be due to variations in flock size and structure, population density, types of sample taken, the study design and types of sampling implemented to investigate the antibodies and diagnostic methods used.

Out of 186 samples tested for BDV antibodies, 65 sheep were imported from abroad and the rest 121 sheep were born in the research center. From the imported sheep, 40% (26/65) were sero-positive while in sheep borne in the research center; there were 23.97% (29/121) sero-positive samples. From this result, it can be observed that the prevalence is higher in imported Dorper sheep than the sheep which were borne in the research center and the chi square test showed that the difference in prevalence of Border Disease Virus antibodies between the two groups was statistically significant ($P<0.05$). The finding recorded in this study agrees with reports of **Shohreh *et al.*, (2014)** who indicated that the number of sero-positive animals increase with the age because the directly imported Dorper sheep were older (above 6 years) than the same breed of sheep which were born in the research center (1 to 2 years) during the sampling year.

The tendency to higher risk among older sheep as compared to younger sheep is probably due to the fact that Border Disease Virus antibodies in most cases are lifelong **(Shohreh *et al.*, 2014).** Therefore, the older the sheep, the higher is the probability to be infected during its life. According to the result, it can be concluded that it is likely the presence of persistently infected (PI) animals within the imported Dorper breed sheep were responsible for the presence of antibodies in the flock. Since vaccination against Border Disease Virus was not practiced in the Dorper sheep in history of the research center, serological response recorded in this work reflected natural infection or infection before they were imported to Ethiopia.

CONCLUSION

Border Disease Virus, which is common in small ruminant flocks worldwide, is important due to the economic losses it causes. The serum antibodies of this disease were found in the newly introduced Dorper sheep flocks at Debre Birhan Agricultural Research Center. However, this work is a serological survey and detected the presence of antibodies only in Dorper sheep flocks at one station using blocking ELISA test. The prevalence was higher from imported sheep than sheep borne in the center. Therefore, further research should be conducted especially on more sensitive tests including RT-PCR techniques to check the presence of the disease in both native and cross breeds of sheep at regional as well as national level. Using more sensitive tests can also provide more clear pictures on the extent of antibody or disease distribution on wider areas which will encourage more effective preventive and control measures including proper identification of persistently infected animals and their removal from flocks. In addition, up to date diagnostic techniques and most effective quarantine procedures should be used and followed to prevent the introduction of disease especially those disease that has not been reported before in the country.

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Conflict of interest

None of the authors have conflict of interest.

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