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Study of Bovine Viral Diarrhea Virus (BVDV) Infection in Dairy Cattle

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Abstract: In this study, blood and milk samples were collected from 500 cattle that were selected out of 1250 cattle by random sampling method (40% of the animals) and detected by their ear numbers, located in 5 different enterprises in Konya and around between the years 2009-2010 and not vaccinated with Bovine Viral Diarrhea (BVD). Serum samples prepared from these specimen (blood and milk) were studied for antibody presence using commercial indirect ELISA kits and white blood cell samples were studied for antigen presence by commercially obtained direct ELISA kit. As a result of ELISA applied to blood serum samples, out of 500 animals, 449 were detected positive, 6 doubtful and 45 negative. Seropositivity was detected between 80.68-100% on the basis of enterprises while it was at a rate of 89.80% regionwide. As a result of ELISA applied to milk serum samples, out of 500 animals, 442 were detected positive, 1 doubtful and 57 negative. Seropositivity was detected between 82.50-95.24% on the basis of enterprises while it was at a rate of 88.40% regionwide. At the first step of the virological part of the study, as a result of ELISA applied to detect BVDV antigen in white blood cell samples, antigen presence was detected in only 3 animals out of 500 (0.60%). In the second sampling done to detect whether these 3 animals that were antigen-positive and antibody-negative were persistently infected or not, antigen presence couldn't be detected in white blood cell samples and these 3 animals were considered as acute-infected in terms of BVDV. Consequently, PI presence wasn't detected for cattle in the region and BVDV infection was at a similar rate when compared to the serological study done previously. Besides, the fact that close results were obtained as a result of ELISA applied to blood and milk serum shows that using milk serum in serological tests could be preferred as an alternative method to blood serum since sampling is easy and cheap for the researcher.

Key words: BVDV, antigen, antibody, ELISA, dairy cattle, Turkey

INTRODUCTION

Bovine Viral Diarrhea (BVD) is one of the most important gastrointestinal, respiratory and reproductive infections causing intrauterin infections and serious conclusions in cattle. The infection could end up with various diseases from subclinical infection to mucosal disease (Nettleton and Entrican, 1995). During the first 80-120 days of pregnancy, infection of pregnant cows might cause birth of immunotolerant calves Persistently Infected (PI) with Bovine Viral Diarrhea Virus (BVDV) (Moennig and Liess, 1995). Intrauterin BVDV infections might cause serious problems such as abortion, stillbirth, fetal resorption, mummification, congenital anomalies and weak calf birth (Moennig and Liess, 1995; Houe, 1999).

Superinfection of PI viremic animals with an antigenic relevant cytopathic strain causes fatal mucosal disease (Brownlie *et al*., 1984). PI animals are the main source of epidemics and spread virus around the environment continually. Removing PI animals away from the herd is the most efficient method of controlling and preventing the disease (Straver *et al*., 1983).

While PI represents the main source for virus spread, acute infected animals also might be the other source of virus contamination upon herds that weren't exposed to infection previously and might be responsible for BVDV circulation within infected herds (Brock, 2003). With the previous research in Turkey, infection seroprevelance was determined between 14.3-100% (Yavru *et al*., 2005; Kale *et al*., 2006; Okur-Gumusova *et al*., 2007; Duman *et al*., 2009; Kale *et al*., 2010).

This study has been carried out in order to search virological and serological state of the infection in cattle selected from dairy cattle enterprises in Konya and around with casual sampling method, to detect prevelance of PI animals and also to determine the importance of milk samples that are easier to collect than blood samples in diagnosing BVDV infection.

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MATERIALS AND METHODS

Animals and sample collection: Animals used in the study were selected (40% of the animals) by random sampling method out of 1250 cattle not vaccinated with BVD and located in 5 large dairy cattle enterprises (animal number over 200) in Konya and around. From a total of 500 sampled animals, blood and milk samples were collected to detect antibody against BVDV and blood samples to detect BVDV antigen presence in white blood cell samples. Sterile vacuumed tubes with kaoline were used to obtain serum from blood samples and sterile tubes with EDTA were used to obtain white blood cells. The collected blood serum, white blood cells and milk serum were stored at -20°C until testing.

ELISA in blood serum samples: In order to introduce antibody presence against BVDV in blood serum of dairy cattle, Institute Pourquier ELISA BVD/MD/BD p80 Antibody (Blood Serum) kit sold commercially was used.

ELISA in milk serum samples: In order to introduce antibody presence against BVDV in milk serum of dairy cattle, Institute Pourquier ELISA BVD/MD/BD p80 Antibody (Milk Serum) kit sold commercially was used.

ELISA in white blood cell samples: To detect BVD antigen presence in white blood cell samples, BVDV Antigen ELISA (Bio-X Diagnostics, Belgium) kit was used.

RESULTS AND DISCUSSION

As a result of ELISA applied to blood serum samples, out of 500 animals, 449 were detected positive, 6 doubtful and 45 negative. Seropositivity was detected between 80.68-95.24% on the basis of enterprises and at a rate of 89.80% regionwide. As a result of ELISA applied to milk serum samples, out of 500 animals, 442 were detected positive, 1 doubtful and 57 negative. Seropositivity was detected between 82.50-95.24% on the basis of enterprises and at a rate of 88.40% regionwide. As a result of ELISAs applied to blood and milk serum, close seropositivity rates (respectively 89.80 and 88.40%) were determined. During the first step of virological part of the study, as a result of direct ELISA applied to detect BVDV antigen in white blood cell samples, antigen presence could be detected in only 3 animals out of 500 (0.60%). In the second sampling done to detect whether these 3 animals determined as antigen-positive and antibody-negative were persistently infected or not, antigen presence couldn't be detected in white blood cell samples. Therefore, these 3 animals were considered as acute-infected in terms of BVDV infection.

BVDV infection has been detected commonly in many countries of the world and seroprevelance rates, variable for sampled animals and controlled herds were stated between 21 and 96% (Duong *et al*., 2008; Guarino *et al*., 2008; Talafha *et al*., 2009; Tabar *et al*., 2010). In the studies carried out on BVDV in different regions of Turkey so far, seropositivity rates changing between 14.3-100% have been detected (Yavru *et al*., 2005; Kale *et al*., 2006; Yapkic *et al*., 2006; Okur-Gumusova *et al*., 2007; Duman *et al*., 2009; Kale *et al*., 2010).

By taking enterprise records into consideration, it was stated that BVD vaccine wasn't applied to the animals within the sampled herds in the study and therefore obtained serological data occured in relation with natural infections. Detecting close seropositivity rates (89.80 and 88.40%) regionwide as a result of ELISAs applied to blood and milk serum shows that using milk serum in serological tests could be preferred as an alternative method to blood serum since sampling is easy and cheap for the researcher. Besides, these detected rates stated that seropositivity rates changing from herd to herd might be possible and BVD virus infection was present at a common level in the so-called herds though. In the study, seroprevelance rates detected against BVDV were determined much higher than those obtained in different countries of the world (except the infection rate by Duong *et al*., 2008). When compared to studies carried out in Turkey, seropositivity rates determined by using blood and milk serum differed from (high or low) seropositivity rates obtained in the other studies. On the other hand if we examine the serological studies previously carried out in Konya and around (Yavru *et al*., 2005; Duman *et al*., 2009), we might realize that progress of the infection in the region fluctuates by years and obtained seropositivity rates vary between 44.09 and 100%. These differences between the obtained seropositivity rates might be related to structural differentiation in cattle herds, their housing types and observing alterations for infection seroprevelance depending on the management (Houe, 1999) as well as sampled cattle looking clinically healthy or ill. For instance, Duman *et al*. (2009) sampled dairy cattle showing respiratory system symptoms and naturally detected a high seropositivity rate (96.04%) in the region.

In order to eradicate BVDV infection, animals need to be controlled both serologically and virologically. Firstly, animals controlled serologically and detected seronegative at the end of the process should then be

tested virologically and removed away from the herd while at the same time realizing that detecting persistently infected animals and infection of PI animals is the most important factor for contamination with sensitive animals in the herd (Zimmer *et al*., 2002; Brodersen, 2004; Lindberg and Houe, 2005).

While there is no certain figure on persistent infection rates in different countries of the world and in Turkey, it is stated as 0-4.9% (Duong *et al*., 2008; Tabar *et al*., 2010).

Houe and Meyling (1991) detected PI animals at a rate of 1.4% in a study they carried out on 19 Danish dairy cattle herds whose previous states in terms of BVDV infection were not known. They determined seropositivity as 87% for herds containing PI animals while 43% in herds not containing them. And in this study while a high seropositivity was detected in enterprises studied for BVDV infection and regionwide, PI animal presence couldn't be detected in any of the enterprises different from that one Houe and Meyling (1991) stated however, 3 animals were reported acute-infected. Since owner of enterprises were informed about this difference detecting PI animals by studies previously done in the research area, these animals were considered to be originated from elimination by owners of enterprises.

On the other hand, though it was low, detecting acute-infected animal presence in so-called herds might be considered as BVDV continued circulation actively in cattle populations in the area. BVDV's ability of circulation in cattle populations is also affected by acute infections.

CONCLUSION

PIs represent the main source of virus spread and also acute-infected animals might constitute another source of virus spread upon herds not exposed to infection previously and might be responsible for BVDV circulation within the infected herds. Depending on constant movement of animal groups and merchandising, acute infections might be crucial in BVDV contamination with cattle and its survival (Brock, 2003). In addition, acute infections constitute diseases of breeding and respiration resulting with important economical losses in cattle industry (Kale *et al*., 2006, 2010).

When obtained data is evaluated, studies to serve for controlling the so-called infection in the region (animals are serologically controlled periodically, acute-infected and PI animals are eliminated from the herds, vaccine strains are determined and vaccines are applied, etc.) are necessary to be planned urgently.

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