OPEN ACCESS
Advances in Animal and Veterinary Sciences

Research Article

Association between Bovine Leukemia Virus Infection, Reproductive Performance and Milk Production in Water Buffaloes and Dairy Cattle in Egypt

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Abstract | Bovine leukemia virus (BLV) is a retrovirus, affects lymphoid tissue and causes malignant lymphoma and lymphosarcoma. There is strong evidence that BLV has deleterious impact on fertility and milk production of animal. The main objective of the present study was therefore to characterize the impact of BLV infection on reproduction efficiency and milk production in water buffaloes and Holstein-Friesian cattle raised in Egypt. The study was conducted on 100 buffaloes from one herd and 350 cows from three different herds to investigate antibodies against BLV and its association with service per conception (SPC) and milk production. The results revealed significant (P=0.001) increases in SPC in seropositive-buffaloes (N=9) compared to healthy buffaloes (N=91). However, no significance difference in SPC between seropositive and seronegative cows. The seropositive buffaloes showed significant (P<0.05) reduction in days in milk, daily milk and total milk production (N=9) than the seronegative buffaloes (N=91). Similar to SPC result, the seropositive cattle didn't show reduction in milk production. In conclusion, BLV infection has more injurious impact on the reproductive performance and milk production in water buffaloes than dairy cattle. Therefore, this study recommends effective prevention strategies against BLV infection in water buffaloes farms in Egypt.

Keywords | Bovine leukemia virus, Fertility, Milk production, Water buffaloes, Holstein-Frisian cattle

Received | June 01, 2020; **Accepted** | August 05, 2020; **Published** | August 20, 2020
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Citation | Manaa EA, Marawan MA, Abdelhady A, Selim A (2020). Association between bovine leukemia virus infection, reproductive performance and milk production in water buffaloes and dairy cattle in Egypt. Adv. Anim. Vet. Sci. 8(11): 1109-1113.
DOI | http://dx.doi.org/10.17582/journal.aavs/2020/8.11.1109.1113
ISSN (Online) | 2307-8316; **ISSN (Print)** | 2309-3331

INTRODUCTION

Bovine leukemia virus (BLV) is a member of retroviridae, infects lymphoid tissue and causes malignant lymphoma and lymphosarcoma. Bovine leukemia virus naturally infects cattle, zebu and water buffalo but can also experimentally infects sheep, goats or alpaca (Lee et al., 2012).

The main source for BLV infection is blood lymphocytes of infected animals and the infection transmitted mainly thorough horizontal route but frequently though vertical transmission (Meas et al., 2002). Most of BLV-infected animals (about 70%) are clinically asymptomatic and about 30% of them develop persistent lymphocytosis (PL) (Pandey et al., 2017).

The BLV infection is highly prevalent in many regions around the world including Eastern Europe, Asia, North and south America. However, the middle east region showed lower prevalence except for Iran and Turkey (Mousavi et al., 2014; Ramírez Vásquez et al., 2016).

The investigation of antibodies against BLV infection is the best indicator for monitoring the infection. Moreover, ELISA test is the most reliable test for cattle over

6-month-old because it has high sensitivity ranging from 97% to 100% and good specificity (78% to 100%) (Selim et al., 2019).

In Egypt, Zaghawa et al. (2002) has been reported the disease during1989 in Arab El-Aoumar, Assiut. In addition, the disease have been reported serologically in dairy cattle in some localities in Egypt (Zaher and Ahmed, 2014). Recently, antibodies against BLV infection were detected in buffaloes (9%) and cattle (20.8%) in some governorates at Northern Egypt (Selim et al., 2019).

The occurrence of BLV causes significant economic losses in dairy industry, such as decrease in conception rate, milk production and increase the veterinary costs and susceptibility to other infectious diseases such as mastitis and pneumonia (Ott et al., 2003; Selim and Gaede, 2015).

A number of authors have been confirmed negative effect of BLV infection on milk production, while other studies have not been found association between BLV infection and milk production (Emanuelson et al., 1992; Pollari et al., 1992; Sargeant et al., 1997). Furthermore, the BLV infection have other indirect economic impact such as restriction on animal movement between countries (Kuczewski et al., 2019).

Therefore, the present study aimed to assess the economic impact of the BLV infection through characterization the association between the BLV infection and reproductive performance and milk production of water buffaloes and Holstein-Friesian cattle raised in Egypt.

MATERIALS AND METHODS

Animal, housing and feeding

The study was performed on four herds (one buffalo and three cattle herds) located in Kafr Elsheikh Governorate situated geographically at 31°06′42″N 30°56′45″E. The buffalo`s herd includes approximately 200 buffaloes with age ranged between <1 to 10 years old while each cattle herd had nearly 200 animals within age group >1 to 10 years old. The selected animals were in different parities and lactation status or within dry period.

The four selected herds were raised under similar condition of feeding program and management. All animals enrolled in this study were provided with total mixed ration (TMR) as recommended by the National Research Council (NRC, 2001). The four herds raised in farm which have shelter occupied 70% of the yard at 5m in height with dusty floor. Also, the farms had automatic fans and water sprinklers to maintain the body temperature of animal during summer season.

Study design

In a cross-sectional study design, data and samples collections were performed under owner's consent and the study was approved by the Internal Ethics Review Committee of Faculty of Veterinary Medicine, Benha University.

The samples size was determined by EpiInfo 7 (Info) based on previous reported prevalence of 16% (Ali et al., 2019), an expected error 5% with 95% confidence interval. The calculated sample size (154 cattle and 102 buffaloes) was increased to 350 cattle and 100 buffaloes to have representive samples from each herd.

The selected animals were marked by an ear tag which have specific number for each animal. Data of SPC, milking period, daily milk and milk production of each animal were collected form disease record scheme of the farm.

Blood samples (3 ml) were collected from examined animals from the jugular vein using vacuum tube without anticoagulant and transported immediately to laboratory. The serum was collected after centrifugation at 10.000xg for 10 minutes and then stored at −20°C for serological examination.

Serological identification of BLV infection

All serum samples were examined serologically using commercial IDEXX Leukosis Serum Screening Ab Test kit (IDEXX laboratories, Westbrook, Maine, USA) to detect antibodies against BLV according to manufacturer's instructions. Results were expressed as sample to positive percentage (S/P %), as recommended by the manufacturers. Samples with an S/P % greater than or equal to 60% were classified as positive for BLV antibodies.

Statistical analysis

Data were statistically analyzed using Spss (Ver 24, USA). Chi-square test was used to measure the difference between categories and the values were considered significant at a probability level ≤0.05.

RESULTS

The seroprevalence of BLV infection was higher between the dairy cattle (20.8%; P<0.001) than the water buffaloes (9.0%), (Table 1).

The seropositive-buffaloes showed significant increase (2.66; P<0.001) in SPC compared to healthy buffaloes (1.44). However, no difference in SPC was reported between infected and non-infected dairy cattle (Table 2).

In general, the results of this study showed marked reduction in milk production in seropositive buffaloes compared to seropositive cattle, where the seropositive buffaloes showed short lactation period, and reduction in daily milk and total milk production (P<0.05), however no significant changes in theses parameters were observed in dairy cattle (Table 2).

Table 1: Seroprevalence of bovine leukemia virus in water buffaloes and dairy cattle.

Animal	No of examined animals	% of positive animal	P value
Cattle	350	20.8	0.0001
Buffaloes	100	9	0.0001

The results are significant at $p < 0.05$.

Table 2: Service per conception and milk production (mean±SE) in seropositive and seronegative animals.

Variable	Cattle			Buffalo		
	positive animal	negative animal	P value	positive animal	negative animal	P value
Number service per conception	2.06± 0.26	1.99± 0.16	0.59	2.66± 0.23	1.44± 0.17	0.001
Day in milk (days)	213.89± 32.37	255.53± 34.88	0.46	176.55± 9.17	212.94± 8.62	0.01
Total milk production (kg)	2555.93±151.31	2634.11±313.98	0.81	1256.56±86.14	1743.95±100.08	0.001
Daily milk production (kg)	13.03± 0.56	13.81± 1.42	0.38	6.82± 0.27	8.07± 0.33	0.01

The results are significant at $p < 0.05$.

DISCUSSION

Most of BLV infection are asymptomatic and can be only identified by serological test (Selim et al., 2019). The disease is chronic in nature and negatively impact the reproduction performance (SPC) and milk production in water buffaloes or dairy cattle (Chi et al., 2002).

In Egypt, there are few studies were reported BLV infection in water buffaloes and dairy cattle in Egypt in last few years (Ali et al., 2019; Selim et al., 2019, 2020) but the economic impact of BLV infection on reproduction or milk yield was not considered. Therefore, the present study is the first report in Egypt to evaluate the economic impact of BLV infection in water buffaloes and dairy cattle.

Our results confirmed the presence of antibodies against BLV in water buffaloes (9%) and dairy cattle (20.8%) in the four herds under the study. Overall, these finding are in line with previous studies that reported seroprevalence of BLV infection of 16% in Egyptian dairy cattle (Ali et al., 2019) and 25.4% in Iranian dairy cattle (Haghparast and Mohammadi, 2008). However, some provinces in Iran showed high BLV infection, Isfahan province (81.9%) (Morovati et al., 2012) and the seroprevalence of BLV infection in Turkey was 48.3% (Rodríguez et al., 2011). In water buffaloes, the reported seroprevalence of BLV infection in this study was higher than that reported in Pakistan (0.8%) (Meas et al., 2000).

The variation in prevalence rates of BLV infection may be attributed to animal breed or managemental factors whereas the absence of monitoring and control program or using the same needle in treatment or vaccination of more than one animals help in spreading of the disease (Nekoei et al., 2015; Selim et al., 2018; Elhaig et al., 2018).

From the obtained data, it is clear that the BLV infection have significant effect on SPC in water buffaloes but had not effect on dairy cattle. These findings were consistent with previous study that showed no impact for BLV infection on SPC in seropositive cattle (Chi et al., 2002). Moreover, the present findings come in accordance with other previous studies that have been found minor effect on fertility but significant increase in calving interval among BLV-positive animals (Brenner et al., 1989; Emanuelson et al., 1992).

The strong association between reproduction and BLV positive-buffaloes indicated that the natural breeding with asymptomatic seropositive bull may be play an important role in spreading of infection within herd (Elhaig et al., 2017). In contrast, dairy cattle herd depends mainly on artificial insemination after carefully examination of semen and bull (Sharifzadeh et al., 2011).

Our findings showed sharp reduction in milk production in seropositive-buffaloes compared to seropositive-cattle. Similarly, a marked reduction in milk production was observed in previous studies (Chi et al., 2002; Heald et al., 1992; Pollari et al., 1992). They concluded a negative association between milk production and BLV-positivity. Contrary to our finding, few studies have been reported negative association between lactation period and milk yield in cattle and BLV positivity (Yang et al., 2016).

At this stage of understanding, we believe that the species of animal, breed, and parities play an important role in the degree of the economic impact of BLV infection on the reproduction performance and milk production of animal.

Therefore, further studies are recommended to define the risk factors of BLV infection in different farm animal.

CONCLUSION

The present study provides an evidence that the BLV infection in water buffaloes is more aggressive and cause injuries reduction in reproduction and milk production than the dairy cattle. This study suggests several studies should be conducted to prove causation.

ACKNOWLEDGEMENT

This work supported by Scientific Research Fund, Benha University

AUTHORS CONTRIBUTION

Eman Manaa helped in laboratory work, writing, and publishing the work; Marawan Adel helped in editing the work; Abdelhamed Abdelhady helped in designing, editing, and publishing the work and Abdelfattah Selim helped in designing, sample collection, writing, and publishing the work.

CONFLICT OF INTEREST

The authors have declared no conflict of interest.

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