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Seroprevalence and Associated Risk Factors of Lumpy Skin Disease in Dairy Cattle

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Abstract: Lumpy skin disease (LSD) is one of highly infectious viral disease of cattle cause by Neethling virus, genus: Capri poxvirus, family poxviridae. The present study was conducted on 11888 dairy cattle situated at Eastern province of Saudi Arabia to determine the seroprevalence of LSD and assessed the risk factors associated with LSD infection. The overall seroprevalence for LSD infection among dairy cattle was 18.7%. In addition, the seroprevalence of LSD was significant associated with age, type of house, farm management where the highest seroprevalence was observed in cattle of 2-4 years old (39.5%), loose housing system (23.2%), pregnant animals (24.5%), presence of stagnant water pool near from animals house (49%) and using of communal water source (35.3%). The study directs the attention to decrease the spread of the disease by managing the causes such as housing system, stagnant water and water source that increased the seroprevalence of the disease to implement the effective control program.

Key words: Lumpy Skin Disease · Serology · Risk Factors · Cattle

INTRODUCTION

Lumpy skin disease (LSD) is a highly viral infectious disease of cattle, causing Neethling virus of genus *Capripoxvirus* belonging to the *Poxviridae* family and is closely linked to the antigenic sheep and goat pox virus [1-3]. LSD is a vector-borne disease transmitted mainly by biting arthropods that feed on blood, mosquitoes especially *Aedes* and *Culex* which able to transmit the virus mechanically and biologically [4, 5]. The disease is more prevalent during the warm and humid months of the year which is directly associated with vector abundance or associated with lack of management of some farms such as animal mixing at communal grazing and watering [6, 7]. The clinical signs of LSD varied from moderate to extreme signs of fever and large-scale development of Lesions as nodular skin and internal organs [8-10].

The LSD was restricted in countries of Sub-Saharan Africa and the first reported case in Middle East was in Egypt in 1988, followed by several outbreaks and considered as one endemic disease now [6, 11, 12]. Subsequently, the disease was reported in several countries due to lack of management or absence of vaccine as Israel, Bahrain, Oman, Kuwait, Yamen and united Arab Emirate [7, 13-15].

In Saudi Arabia, the disease was reported for the first time in the island of Tarout and Al-Hafouf during 2015 and the disease reoccurred again in intensive breeding Al-Hassa district in April 2016, Kasem *et al.* [14].

Despite this knowledge but the epidemiological situation of LSD disease and the associated risk factors to LSD infection are not completely understood. Therefore, the present study aimed to determine the seroprevalence of LSD in dairy cattle and evaluate the associated risk factors to infection.

MATERIALS AND METHODS

Study Area: The present study was conducted on two dairy farms situated at Eastern province, Saudi Arabia geographically situated at 25°23'N 49°36'E. This area lies on 160 m above sea level and characterized by desert

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climate. The average temperature during the year 30°C and the weather is dry during the summer period. In a year, the rainfall is 74 mm. The weather condition of the study area is suitable for insect multiplication and has high density of insect pollution, mainly Culex and Aedes which increase chance for disease spreading.

Animal and Samples Collection: The study was performed on 11888 dairy cattle from two Farms located at Eastern province, Saudi Arabia During 2016. The data of examined cattle were classified according age (<2, 2-4 and >4 years), type of house (loose and tie housing), pregnancy status (pregnant or non-pregnant), presence of stagnant water near from animal house and communal water source. All of examined cattle had not history of vaccination against LSD.

Blood sample (5ml) were drawn from jugular vein of each cattle using vacuum tube, followed by centrifugation at 13.000 xg for 10 min to separate serum. The serum samples were kept at 20°C until serological analysis.

Serological Analysis: Sera were examined serologically using ID Screen® Capripox Double Antigen Multi-species (IDVet, Grabels, France) to detect antibodies against LSD infection according to manufacture? instruction. The optical density of samples was measured at 450nm using ELISA microplate reader. The samples were considered positive if OD ≥ 30% while considered negative if OD <30%.

Statistical Analysis: Data of present study was analyzed using SPSS (IBM, USA). The association between variables and LSD infection was evaluated by Logistic regression analysis and determine the risk of each factor using multivariant logistic model.

RESULTS

The overall seroprevalence of LSD infection among examined dairy cattle in Eastern province of Saudi Arabia was 18.7%. The seroprevalence varied (P = 0.0001) between different age groups. The highest prevalence rate was observed in middle age group (39.5%). In addition, type of house showed significant effect on prevalence of the disease where the seroprevalence of LSD increased in loose housing cattle (23.2%) in comparison with tie housing ones. The pregnant cattle showed high susceptibility to get the LSD infection (24.5%) more than non-pregnant ones (Table 1).

Table 1: Seroprevalence of LSD in relation to associated risk factors

Variable	Total number of animals	No of positive	%	95%CI	P value
Age					
< 2 year	4525	957	21.1	19.9-22.3	0.0001?
2-4	2454	970	39.5	37.6-41.4	
>4 year	4909	307	6.2	5.6-6.9	
Type of house					
Loose house	4525	1050	23.2	21.9-24.4	0.0001?
Tie house	7363	1184	16.1	15.2-16.9	
Pregnancy status					
Pregnant	4417	1083	24.5	23.2-25.8	0.0001?
non pregnant	7471	1151	15.4	14.6-16.2	
Presence of stagnant water beside farm					
Yes	2000	980	49	46.8-51.2	0.0001?
No	9888	1254	12.6	12.04-13.3	
Communal water source					
Yes	2800	990	35.3	33.6-37.1	0.0001?
No	9088	1244	13.6	13-14	

The results are significant at P value <0.05

Table 2: Multivariant logistic analysis of associated risk factor for LSD infection

Variable	B	SE	OR	95% CI for OR	P value
Age					
2-4	0.891	0.055	2.43	2.18-2.71	0.0001
Type of house					
Loose house	0.455	0.047	1.57	1.43-1.73	0.0001
Pregnancy status					
Pregnant	0.578	0.047	1.78	1.62-1.95	0.0001

B: Logistic regression coefficient, SE: Standard error, OR: Odds ratio, CI: Confidence interval

Furthermore, the management of the farm showed relevant role for prevalence of the disease where the seroprevalence of LSD infection increased significantly in presence of stagnant water (49%) and in case of using communal water source (35.3%; Table 1).

Three risk factors were fitted for multivariant logistic model. The results showed strong association between middle age group 2-4 years (OR=2.4, 95%: 2.18-2.71), loose housing (OR=1.57, 95%C: 1.43-1.73), pregnant animals (OR=1.57, 95%CI: 1.62-1.95) and seroprevalence of LSD infection, Table 2.

DISCUSSION

Lumpy skin disease is highly infectious disease affect dairy cattle causing severe economic losses. The first outbreaks for LSD was recorded during 2016 based on clinical signs and PCR examination [14]. The present study aimed to evaluate the associated risk factors to LSD infection to predict the prevalence of the disease. The estimated seroprevalence of LSD infection among dairy cattle in the present study was 18.7%. The seroprevalence rate come in accordance with previous rate reported in Egypt 17.3% [16]. In addition, the seroprevalence rate of the present study was higher than previous rates reported in Saudi Arabia, 6% [14], Uganda, 8.7% and Ethiopia, 7.4% [17]. The difference in prevalence of LSD between different geographic areas may be attributed to health status or breed of animals, vector activity and population, season or different in sample number or used test [1, 18]. The present findings showed strong association between age and prevalence of LSD infection where the seroprevalence rate increased significantly within 2-4 years old, as previously reported by Abera *et al.* [19]. Young calves showed low susceptibility to get LSD infection when compared with young and adult animals, may be due to low susceptibility of calves to biting by flies or passive maternal immunity. Interestingly, the seroprevalence of LSD increased significantly in loose housing system particularly in case of communal water source. The present findings were consistent with previous conclusion that confirmed the directed contact between uninfected and infected cattle may be increase the possibility of infection especially in loose housing and communal water source [6, 20, 21]. Furthermore, the seroprevalence of LSD infection was strongly associated with presence of stagnant water near animal house where it is considered favorable condition for multiplication and activities of the vector [4, 22]. The results of multi-variant analysis revealed that the risk of getting LSD infection in middle age cattle (2-4 years) was 2.4 times than young cattle and in loose housing cattle 1.57 times than tie housing ones. A similar result was previously reported in other studies [6, 17, 19, 22]. In addition, the pregnancy considered as significant risk factor to get the LSD infection that consistent with Molla *et al.* [1, 23]. We believed that the reason of this evidence may be due to negative effect of pregnancy on the immunity of animals and increase the susceptibility of animals to get the infection.

CONCLUSION

The LSD is highly infectious disease in dairy cattle in Eastern province of Saudi Arabia, cause severe economic losses. The seroprevalence of LSD infection is 18.7% among dairy cattle. The highest seroprevalence rate for LSD infection was observed in middle age of animal, loose housing pregnant cattle and presence of stagnant water near animal house. The estimated risk factors considered as aids to implement an efficient control program.

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