QUESTIONNAIRE SURVEY WITH CATTLE OWNERS REGARDING OUTBREAK OF LUMPY SKIN DISEASE (LSD) IN BASRAH PROVINCE, SOUTH OF IRAQ

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ABSTRACT

Lumpy skin disease (LSD) is a highly contagious transboundary disease of cattle with significant economic burden. Our study is based on a questionnaire designed to describe the epidemiological features keys of LSD in Basrah and to identify putative risk factors. The information obtained from this questionnaire specifically included sex, age, vaccination status, clinical signs and the number of death because of LSD in the cattle. This study was conducted from December 2018 to May 2019, with a total of 251 cattle owners participated in the interview. Out of 251 owners interviewed, 329 of their cattle were infected with LSD (accumulative incidence estimated at 16.2%). The majority of owners (91.6%) admitted that they did not segregate the infected animal from the rest of the herds. Respect to animal management and farming system, the semi-intensive system of rearing animals was the most common farming system adapted by farmers (70%) while only 30% were kept under intensive system. The majority of the owners 97.2% (244/251) reported they were not received any vaccine of LSD. The mortality rate; however, measured at 2% and the case-fatality rate measured at 11%. The abortion rate among infected pregnant cows was calculated at 10.5%. The study concluded LSD is newly emerging disease in Basrah and various preventative measures including restriction illegal movement of animals, vector control, farm biosecurity and, vaccination

program need to be considered to prevent further new incidence cases.

INTRODUCTION

Lumpy skin disease (LSD) is an important transboundary disease that causes significant economic burden. The disease caused by Lumpy skin disease virus classified under the genus of Capripoxvirus and family Poxviridae [(1)]. This disease is more likely and occurs rapidly during the wet season than a hot season; whereas, introducing new animals to the herds and communal grazing/watering pattern are considered inextricably potential factors in the spreading of LSD [(2)]. However, morbidity and mortality of Lumpy skin disease in cattle are variable which depends on a host characterisation, including age and sex, immunity status, and type of cattle breed [(3,4)]. Most typical clinical signs manifested by LSD in the infected animals are characterised by increasing of the body temperature that reaches up to more 40 ^{0}C and various sizes of nodules excessively disperse on the animal skin [(5,6)].

Lumpy skin disease causes considerable implications by accounted for both direct and indirect economic losses. The direct impact of LSD leads to enduring losses of animal production, mainly reduce milk production, abortion, and reduce fertility rate [(7)]. Furthermore, restriction of animal movements and it trades represent indirect economic impact caused by LSD during an outbreak [(8)]. The animal treatment and vaccination strategy for LSD requires a high expenditure to succeed the control programmes [(9)]. The Lumpy skin disease virus can be transmitted mechanically by blood sucking arthropods. Some species of these arthropods such as a mosquito (*Aedes aegypti*) and ticks (*Rhipicephalus decoloratus* and *Amblyomma hebraeum*), play a potential role in the transmission of the virus in cattle herds [(10-13)]. This virus was experimentally isolated from a bull semen [(14)], and also has been confirmed that transplacental infection with LSD occurs from an infected pregnant cow to its foetus [(5)]. To date, the probability of the transmission of LSD between infected and susceptible animals occurs through direct contact but despite that it has not yet been validated, although the virus was frequency isolated from saliva and nasal discharge contents [(15)].

Lumpy skin disease, however, remains a notifiable disease listed by the World Organisation of Animal Health (OIE) as one of the most endemic diseases in Africa

countries [16], and become an epidemic disease in the Middle East regions [17]. Lumpy Skin Disease has been reported in several countries of the Middle East, included Turkey, Jordan, Lebanon and Syria, Israel, and Iran [18,19]. Between 2013 to 2014, multiple-outbreaks were reported in the south, north and middle of Iraq regions, with more than 7, 000 cattle cases to have been infected with LSD, of which believed the disease crossed the borders of Iraq because of illegal animal transportation from other the neighbouring countries, particularly Syria and Turkey [18,20]. In Basrah, recent serological study indicated the prevalence of infection with LSD were reported as 18%[21]. However, the objective of the present study was to describe different epidemiological outcomes and risk factors are associated with LSD outbreak in the cattle populations.

MATERIALS AND METHODS

Area of study

The current study was conducted in Basrah province. Basrah is located in the south of Iraq, proximal to the gulf region with the latitude and longitude coordinate is 30.5258° N, 47.7738° E, respectively. This province is constructed from nine districts including Al-Midaina, Al-Qurnah, Ad Dayer, Al-Hartha, Al-Zubair, Al-Basrah, Abu Al Khasib, Al-Faw, and Shatt Alarab. The ecosystem of Basrah is extremely hot in the summer, with a mean temperature of 37.4 °C and a maximum temperature of 45 °C. The lowest mean summer temperature is 29.2°C. The annual humidity is below 50% and less than 30% during the daytime [22].

Study design and administration questionnaire

This study was conducted between December 2018 to May 2019 entail five districts of Basrah province included Abu Al-Kasib, Al-Basrah, Ad-Dayer, Al-Qurnah, and Shatt-Alarab. A structured questionnaire was prepared to investigate and assess putative risk factors that may be associated with the outbreak of LSD among cattle populations in Basrah. The questionnaire form is closed-ended questions and consists of twenty-three questions that integrated into two sections. The first section included variables related to the socio-demographic characterization of the cattle owners and animal herd species. The second part was pertinent to herd/animal management, intensive and semi-intensive system, and vaccination status. To enable to involve a large number of participations and cover the area of Basrah, seven

experience veterinarians were recruited to help to investigate on LSD cases and administrate the questionnaire with farmers where the outbreaks were notified. The questionnaire survey interviewed 251 cattle owners whose one/or more of their animal/s were infected with this disease. The herd size of these owners was categorized as a small (1-3), medium (4-6), and large (7 above). The questionnaire was revised several times to ensure the validity of each single questions; therefore, five owners were involved for a pre-test to ascertain clarity of these questions, but later they disregarded in the study. Importantly, all respondents were above 18 years old considered to be eligible to involve in the questionnaire survey. Prior to administrating the questionnaire, an oral-consent was obtained from an individual owner to be involved in the questionnaire interview and readily address the questions point to point. The questionnaire was written in the English language and afterward translated to the local language (Arabic) as the local communities speak only Arabic.

Statistical analysis

The data were entered into an excel sheet. SPSS statistical package (version 23) was used for the analysis of data. The descriptive statistics for each single variable was given by frequency and confidence interval. A Chi-square test was performed to observe any significant difference of animal variables ($P \leq 0.05$) categorized by age and sex with a case-fatality. The distribution of outbreak cases on monthly bases was illustrated by using a graph made in the excel sheet and represented the frequency of cattle infected with LSD.

Approval of study

Approval of the study was obtained from the scientific committee at the College of Veterinary Medicine/Basrah University before commencement the study.

RESULTS

Socio-demographic characteristics of the owners

A total of 251 animal owners were interviewed in this survey. The age of the respondents ranged from 18 to 82 years and the vast majority (98.4%) were males (table 1). Regarding farmers' level of education, 44% of the interviewed animal owners completed their primary school, while 12% of them were never been in school.

Table 1. Sociodemographic characterisation of the interviewed owners regarding the outbreak of LSD in Basrah (number of the owners were 251).

Factor	Category	Frequency	Percentage (95% Confidence interval)
Owner gender	Male	247	98.4 (96.0,99.6)
	Female	4	1.6 (0.4, 4.0)
Education level of owners	Never been in school	32	12.7 (8.8, 17.5)
	Literacy only	9	3.6 (1.7, 6.7)
	Primary school	111	44.2 (38.0, 50.6)
	Secondary school	70	27.9 (22.4, 33.9)
	Tertiary	29	11.6 (7.9, 16.2)
Owner location (by District)	Abu Alkasib	38	15.2 (11.0, 20.2)
	AL-Basrah	25	10.0 (6.6, 14.4)
	AL-Dyer	38	15.2 (11.0, 20.2)
	Al-Qurna	51	20.3 (15.5, 25.8)
	Shatt-Alarab	99	39.3 (33.2, 45.6)

Consequences of the outbreak of Lumpy skin disease in cattle

Of 329 cattle were reported infected with LSD, 60% (198/329) of these animals with age ≤1 year and 40% (131/329) were >1 year (table 2). The accumulative incidence was estimated to be 16.2%. The symptoms of sick animals with LSD were recorded including displayed excessive skin nodules, enlarge lymph nodes, lacrimation and nasal discharge, and conjunctivitis (figure 1). Out of 329 cattle infected with LSD, only 36 were reportedly died and a case fatality rate calculated to be 11% while the mortality rate measured at 2%. Male case- fatality (16.9 %) was significantly higher (P. value was < 0.05) compared to females (7.3%). Regarding animal age, no significance was observed between the case fatality rates and age group with less/or equal one year and above one year (P. value=0.1). Importantly, the abortion rate of the pregnancy cows which infected with LSD was estimated at 10.5% during this outbreak events, as reported by owners. Figure.2 illustrates the temporal pattern of LSD outbreak reported during the period of this study. The month of March had been the highest proportion (52%) of the infection with Lumpy skin disease were reported, but the number of cases dramatically dropped to 8% from April to May.

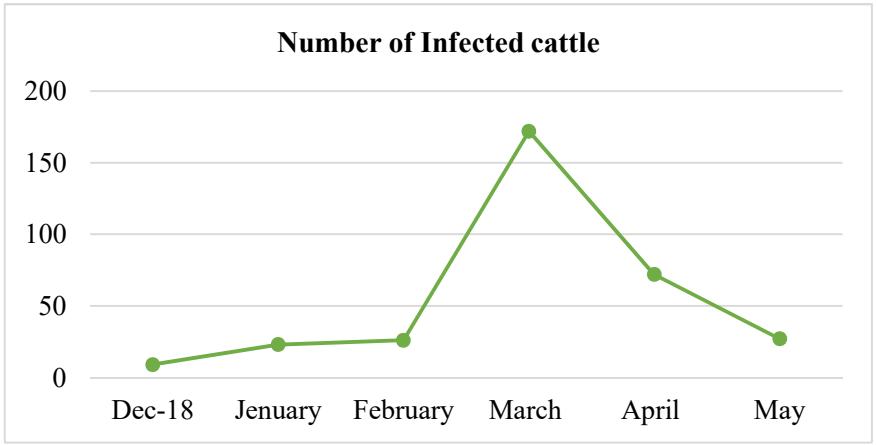
Table 2. Morbidity, abortion, and case-fatality rates as a result of LSD outbreak in Basrah in cattle population.

Variables	Category	Frequency	95% Confidence interval
Animal age	≤ 1 year	198	60.2 (53.0, 67.1)
	> 1 year	131	39.8 (34.5, 45.3)
Animal sex	Female	205	62.3 (55.3, 69.0)
	Male	124	37.7 (29.2, 46.8)
Abortion status	Aborted	8	10.5 (4.7, 19.7)
	Non-aborted	68	89.5 (80.3, 95.3)
Case-fatality (within age-group)	≤ 1 year	26	13.1 (8.8, 18.6)
	> 1 year	10	7.6 (3.7, 13.6)
Case-fatality (within sex-group)	Female	21	16.9 (10.8, 24.7) *
	Male	15	7.32 (4.2, 11.8)

* Significant found using Pearson's chi-square tests (P ≤ 0.05).

Figure 1. Clinical pictures of Lumpy skin disease in young and adult cattle shows clear skin nodules displayed on the head, neck, and body.

Figure 1. Temporal pattern of LSD outbreak reported between the period of December 2018 to May 2019.



Association of risk factors with animal management and their practices

Throughout the questionnaire survey, only 21% of the owners reported the presence of ticks on the infected cattle and half of them did not use any type of insecticides for treatment (table 3). The majority of owners 91.6% (230/251) reported they did not segregate the infected animal from rest of the herds. A very small number of owners 2.4% (6/251) sold their infected animal with LSD to butchers/other owners. Nearly, three-quarters of the owners reported 70.3% (179/251) usually allow to graze their animals outside the farm average hours on a daytime (Semi-intensive system adopted), while only 28.7% (72/251) of them restrictively feeding their animals all the time at the barn yard (Intensive system adopted). Concerning house-farming system, the majority of owners 80% (201/251) housed their animals as a group and only a few 20% (50/251) keep the animal at the individual pens. More importantly, the high majority of the owners 97.2% (244/251) reported they were not received any vaccine before or during the outbreak to protect healthy animal from LSD infection.

Table 3. Association of animal management and practices factors with LSD in cattle (number of the owners were 251).

Themes	Category	Frequency	95% Confidence interval
Herd size	Small (1-3 animal)	63	25.1 (19.9, 30.9)
	Medium (4-6 animal)	81	32.3 (26.6, 38.5)
	Large (7 above)	107	42.6 (36.4, 49.0)
Presence ticks on the infected cattle	Yes	72	21.9 (17.5, 26.8)
	No	257	78.1 (73.2, 82.5)
Use insecticide	Yes	36	50.0 (38.0, 62.0)
	No	36	50.0 (38.0, 62.0)
Last time was used an insecticide	Before six months	5	14.0 (4.7, 29.6)
	Before one year	15	41.6 (25.5, 59.2)
	Cannot remember	16	44.4 (27.9, 61.9)
Segregate an infected animal from the herd	Yes	21	8.4 (5.3,12.5)
	No	230	91.6 (87.5, 94.7)
Distance were the infected animal kept from the rest of the herd	Less than 50 meters	10	47.6 (25.7, 70.2)
	100 meters or more	11	52.4 (29.8, 74.3)
Sell any infected animal to a butcher	Yes	6	2.4 (0.9, 5.1)
	No	245	97.6 (94.9, 99.1)
Sell any infected animal to another owner	Yes	16	6.4 (3.7, 10.2)
	No	235	93.6 (89.8, 96.3)
Farming system adopted	Intensive system	179	71.3 (65.3, 76.8)
	Semi-intensive system	72	28.7 (23.2, 34.7)
Housing system adopted	Animal housed as group	201	80.1 (74.6, 84.9)
	Animal housed in individual pen	50	19.9 (15.1, 25.4)
Introduce an infected animal with LSD to the herd	Yes	7	97.2 (1.1, 5.7)
	No	244	2.8 (94.3, 98.9)
Vaccinated used against LSD	Yes	7	2.8 (1.1, 5.7)
	No	244	97.2 (94.3, 98.9)

DISCUSSION

In the current study, a face to face questionnaire survey was administrated with 251 animal owners regarding LSD outbreak in Basrah province. The questionnaire was also recorded the clinical symptoms of infected animals with LSD veterinary practitioners, who were recruited in this study. From this perspective, the clinical differential diagnosis of LSD was taken in consideration as may be caused misclassification and misdiagnosed with other skin diseases, for instance ring worm, dermatophilus infection, bovine herps mammilitis, photosensitization, insect bites,

urticaria, and demodectic manage. However, this study recorded the total of 329 cattle were severally infected with lumpy skin diseases. Geographically, Iraq as known, has an important localization in the Middle East region and extensive border with other countries, including Turkey and Syria from the north, Jordan from the west, Iran from the east, and Saudi Arabia and Kuwait from the south. It has been indicated that Lumpy skin disease was introduced to Iraq from other neighboring countries by illegal transportation of animals as failure to control borders because of influential political instability of Iraq [20]. These factors may be linked and caused widely distribution of this disease among other provinces of Iraq.
In the present study, the age distribution of the disease was found different, showing that LSD occurred more frequently in the young cattle 60% (≤ 1 year) compared to the adult cattle 40% (> 1 year). This result is in the line with the previous reports indicated the higher frequency of the disease in the younger than older animals [23,24]. The better explanation of this finding, young animals could have acquired a low level of maternal immunity which might be contributed to increase susceptibility of infection with LSD [25]. Management practices that aim to segregate young animals from the herd might have contributed to reduce exposure risk of the susceptible to the source of infection. In addition to that, the disease was observed highly frequent in the female (62.3%) compared with male animals (37.7%). Similar to this finding was also reported by Ayelet and Abate [26], showing the morbidity of LSD was higher in females than male animals. This may be cows, especially those in lactating period and milk production have stress factor and exhausted rather than attribution to the biological reason [27].

Several factors including management practices and environmental conditions could have contributed to the higher number of cases of LSD in cattle. Despite little

owners whose animals were infested with ticks (21.9%) besides half of them had never used any type of insecticides, which indeed we believe that there were various types of biological vectors being a source of infection for the virus of LSD transmission. For example, a study has been conducted in Israel ascertained that *Stomoxys calcitrans* services as a potential vector for LSD transmission[28]. Control of mechanical vectors via using insecticides or repellents in agreement with the environmental safety is considered one of the most important effective elements in control programmes, aid to reduce an opportunity of the transmission of LSD amid cattle populations.

The fewer number of owners admitted they did not separate the infected animal from the rest of the herd. Neglecting isolation of the animal infected with LSD may be posed a potential risk factor of transmitting the virus from an infected to the healthier animals, especially if they were not immunized against this disease [29]. Although the congregation of animals share a similar watering troughs and feed bunks are of significant association with increase the risk of LSD occurrence in animals, but the disease is not considered a contagious disease as it is an inefficient pathway of the transmission [23,30]. Hence, the biosecurity preventive procedures are highly recommended and encompass routine cleanliness and disinfection all types of fomites that belongings to the animal farms, to prevent or at least minimize the probability of transmission of the disease to the animals grazing nearby.

The intensive farming system is the most common farming system adopted and announced by the cattle owners in this questionnaire. Keeping of the animals under intensive care without grazing activities may be increased the risk of the vectors to feed, multiply, and spread of infection within the herds [30-32]. Within the housing system, also the majority of owners 80% adopted housing animals as a

group. Animal group rearing system includes intermingle all animals either from different ages and species (pre-weaning, post-weaning, and adult), are more likely to be increasing the risk of contracting with the disease infection. To elaborate biosecurity of farming system, farmers need to be promoted their awareness toward separation of young from adult animals through building an individual pen or maternity private section in the barn. The advantage of the segregation of animals is not only avoided overcrowding but also can maintain the hygienic level and reduce the probability of infection even to the neonate's calves [33].

Only three percent (3%) of cattle owners reported they vaccinated their animals against LSD. This may be amount of vaccines were inadequately available or capacity of the veterinary health discipline authority being less satisfied in the response to the disease outbreaks. Although there is no specific treatment has been used to treat the infected cattle from lumpy skin disease, ulceration lesion and nodules can be treated with sprays and antibiotics to prevent secondary skin infections and pneumonia. Also, an emergency mass vaccine has been recommended to be the most effective control intervention utilizing an attenuated live Capripoxvirus vaccine at least to prevent the spreading of this disease [34,35]. Another disease control program necessary to be established is a combination of the passive monitoring and surveillance system which needs to continue over a period of time to deal with a new incidence cases may be emerged.

The mortality in the present study was measured at 2% which is relatively similar to mortality rates that were reported in Egypt and Jordan 1.8, 1.9%, respectively [9,23]. Besides, the cases fatality was estimated at 11% among the infected animals. Previous epidemiological studies stated the cases fatality rate could be varied between regions. For instance, the cases fatality in Jordan has been reported of

7.5% [9], and in Iran has been reported of 19.7% [36]. As regards, the mortality and case fatality rates could be influenced by many exposure factors, including animal breeding, immunological status of cattle, and population of the vectors [30,37].

Another important epidemiological finding in this study is that the abortion rate reported at 10.5% in the pregnancy cow infected with LSD. This result is consistent with Abdulqa, Rahman [38], who pointed out that the abortion rate in the infected cattle with LSD can be reach to 10%. The current study raise possibility of occurring vertical transmission when the virus can passed through the placenta and afterward causes an inflammation (Placentitis) as similar as to the pathogenicity that caused by other diseases, such as brucellosis and Rift Valley fever [39,40]. Supporting to this evidence, a descriptive study was performed by Rouby and Aboulsoud [5], who indicated ability of the virus to be transferred from a cow to foetus through the intra-uterine route after isolated the virus from both placenta and stillbirth calve.

In respect to the number of LSD cases recorded in the present study, the highest peak of infection was observed in the month of March. During this time of the year, when turning to the winter season, temperature commonly in Iraq usually falls to less than $20C^0$ and humidity is relatively higher. Concomitantly, climate factors including humidity and temperature are considered to be a greater influential factor influences upon abundance of insect populations which can enhances the transmission of the disease in the susceptible animals [13,14,41].

In conclusion, Lumpy skin disease is an epizootic viral disease affected a large number of cattle in Basrah province. The risk factors underlined in this study were potentially associated with the outbreak of LSD in Basrah. Therefore, a vaccination zone or ring vaccine campaigns are importantly needed to be implemented to flatten the disease spreading occasionally from nearby provinces or neighbouring countries.

In conjunction with vaccination, vectors control and animal quarantine policy are additional important control measurements must to be sanctioned. Also, strict quarantine policy and regulations must be imperatively considered to avoid introducing asymptomatic infected cattle to Iraq, including banned illegal movement of animals and testing imported animals at each entry border.

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