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Most Clinically Detected Viral Diseases in Field Animals of Wasit Province, Iraq

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Abstract

Background: Infectious diseases of farm animals are one of the major threats to agriculture resulting in a considerable damage in both industrialized and developing countries.
Aim: This study was aimed to detect the most prevalent viral diseases among field animals including cattle, buffaloes, sheep, goats and camels of Wasit province (Iraq) during the year of 2022 based on clinical data.
Materials and methods: A broad clinical data investigation was carried out from several private clinics located at the main districts in Wasit province to know the most prevalent viral diseases in field animals based on number of diagnosed, treated and vaccinated animals.
Results: Clinical data obtained from of totally 433072 animals revealed that 22.63%, 77.36% and 0.01% of study cattle and buffaloes, sheep and goats, as well as camels, respectively were diagnosed to be infected clinically with viral diseases. However, prevalence rate of FMD was increased significantly in FMD (55.68%) compared to Pox (28.81%), LSD (6.25%), PPR (5.58%) and BEF (2.64%), Orf (1.01%) and MCF (0.029%). Additionally, FMD was significantly found in cattle and buffaloes (60.59%) as well as in sheep and goats (54.25%) but not in camels that infected clinically with PPR (100%). For FMD, there were significant increases in sheep and goats (75.37%) when compared to cattle and buffaloes (24.63%) as well as camels (0%). Concerning of LSD, MCF and BEF, significant higher prevalence rates were reported in cattle and buffaloes in comparison with the findings of sheep and goats as well as camels. In sheep and goats, prevalence rate of Orf (100%), PPR (99.87%) and Pox (100%) were elevated significantly; while in cattle and buffaloes, no positive findings were identified. However, positive results of PPR were detected in camels (0.13%).
Conclusion: For our knowledge, this represents the first Iraqi study aimed to confirm the most prevalent viral diseases in field animals. Based on our data, applied methods for diagnosis, treatment and prevention of viral diseases remain limited and need to more potential activities to avoid severe economic losses caused by these diseases.
Keywords: Foot and mouth disease (FMD), lumpy skin disease (LSD), Malignant catarrhal fever (MCF), Peste des petits ruminants (PPR), Bovine Ephemeral Fever (BEF)

Introduction

In the last two centuries, considerable efforts have been invested to understanding the causes and pathogenesis of different viral diseases in domestic animals with developing and modifying new methodologies for diagnosis, treatment, and control of these diseases

(Williams and Roman, 2016). Importantly, research on veterinary pathogens also had a major impact in understanding basic biological processes of different pathogens and established entire new disciplines (Jiminez *et al*., 2015). There are many viral diseases that affect large and small ruminants, some of them have been known for centuries such as Pox, papilloma, Rinderpest and FMD; others are relatively recent such as bovine spongiform encephalopathy (BSE), scrapie and caprine arthritis encephalitis (CAE); while others are emerging such as blue tongue (Oldstone, 2020; Sankaran and Weiss, 2021). However, majority of the viral diseases that affect domestic animals have a worldwide distribution, and some of them produce significant losses in livestock production, mortalities, reproductive failures and decreasing in milk production or weight gain of animals (Richter *et al*., 2017; Hashem *et al*., 2020). Additionally, livestock production is hampered by many factors that their impact can vary from reduced productivity and restricted market access to the elimination of entire flocks or herds (Sneeringer *et al*., 2015).

In some cases, the existing knowledge of veterinary pathogens has provided the scientific framework that helped to understand human diseases of obscure origin (Mackenzie and Jeggo, 2019). It is estimated that 70% of human pathogens are zoonotic in origin (Ye *et al*., 2020). Thus studies on animal viruses also have a direct impact on public health (Malik *et al*., 2020). One of the best examples to illustrate the relationship between animal pathogens and public health is influenza, a viral disease that caused the death of over 20 million people in the last century (Trock *et al*., 2012). Wild aquatic birds are considered the primary hosts of influenza virus that usually replicates in intestinal tract of these birds, and transmitted by fecal contamination of water. Occasionally, such viruses establish stable lineages in land-based birds and a limited number of mammalian species including swine, horses, dogs, and humans (Pantin-Jackwood and Swayne, 2019).

In Iraq, information available different diseases affected animals are variable between different region and between diagnostic assays, changed annually, and dispersed. Hence, this study was aimed to detect the most prevalent viral diseases among field animals including cattle, buffaloes, sheep, goats and camels of Wasit province (Iraq) during the year of 2022.

Materials and methods

Ethical approval

The current study was licensed by the Scientific Committee of the College of Veterinary Medicine, University of Wasit (Wasit, Iraq).

Study data

A broad investigation was carried out among several private clinics in the main districts in Wasit province (Al-Kut, Al-Hay, Al-Aziziyah and Shaykh Sa'd) during December (2022) to February (2023). To know the most prevalent viral diseases in field animals, only documented clinical data were reported and classified to three categories of animal species are cattle and buffaloes, sheep and goats, and camels. Also, the targeted data were included all information that related to diseased, treated and vaccinated animals against different viral infections.

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Statistical analysis

One-Way Analysis of Variance (ANOVA) in the GraphPad Prism Software was applied to detect significant variation in values of prevalence rate of different viral diseases as well as variation between categories of study animals. In this study, values were represented as percentages (%) and differences were considered significant (*) at $P<0.05$ (Gharban and Yousif, 2021; Gharban *et al*., 2023).

Results

Clinical data obtained from of totally 433072 animals revealed that 98007 (22.63%) cattle and buffaloes, 335034 (77.36%) sheep and goats, and 31 (0.01%) camels were diagnosed with viral infections (Figure 1).

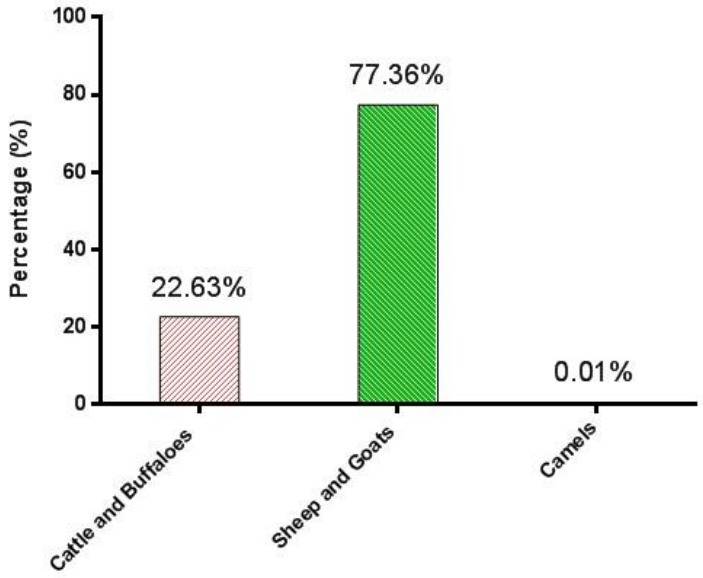

Figure (1): Total results of clinically infected field animals with viral diseases

Among study animals, significant increases in prevalence rate of diseases ($P<0.0293$) were reported in FMD [241140 (55.68%)] while significant decreases ($P<0.05$) were seen in Orf [4376 (1.01%)] and MCF [125 (0.029%)] when compared to other viral diseases including Pox [124750 (28.81%)], LSD [27052 (6.25%)], PPR [24180 (5.58%)] and BEF [11449 (2.64%)] (Figure 2). Additional statistical analysis of study results showed that FMD was the most prevalent diseases in cattle and buffaloes (60.59%) as well as in sheep and goats (54.25%) but not in camels that found significantly ($P<0.05$) to be infected with PPR (100%), (Table 1).

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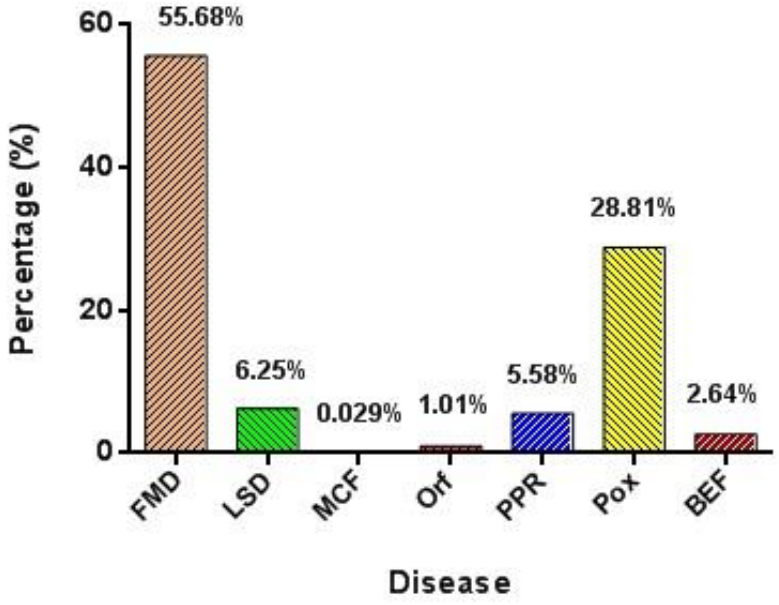

Figure (2): Prevalence rate of viral diseases among study areas

Table (1): Prevalence rate of viral diseases according to species of study animals

Disease	Cattle and buffaloes	Sheep and goats	Camels
FMD	59381 (60.59%) *	181759 (54.25%)	0
LSD	27052 (27.6%)	0	0
MCF	125 (0.13%)	0	0
Orf	0	4376 (1.31%)	0
PPR	0	24149 (7.21%)	31 (100%)
Pox	0	124750 (37.24%)	0
BEF	11449 (11.68%)	0	0
p-value	0.0201	0.0314	0.0428
Total	98007	335034	31
***Significance* * (P<0.05)**			

Significantly, differences in prevalence of viral diseases were seen in current study (P<0.05). For FMD, there were significant increases in incidence rate of disease in sheep and goats [181759 (75.37%)] when compared to cattle and buffaloes [59381 (24.63%)] as well as camels [0(0%)], (Figure 3). Concerning of LSD, MCF and BEF, significant higher prevalence rates were reported in cattle and buffaloes [27052 (100%), 125 (100%) and 11449 (100%), respectively] in comparison with the findings of sheep and goats as well as camels which showed no positive results for all these diseases at P<0.0325, P<0.0133 and P<0.0104, respectively (Figures 4-6).

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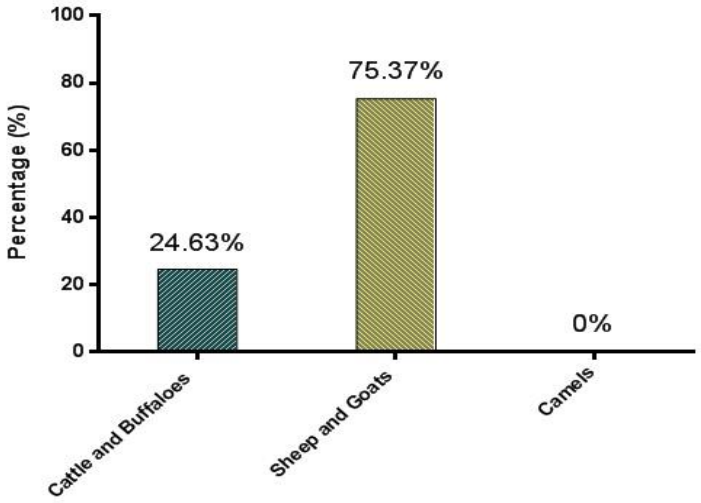

Figure (3): Results of FMD disease in treated and vaccinated cases

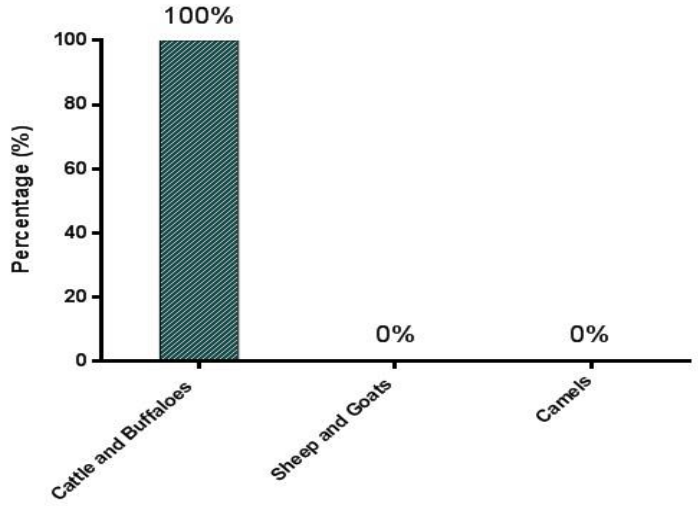

Figure (4): Results of LSD disease in treated and vaccinated cases

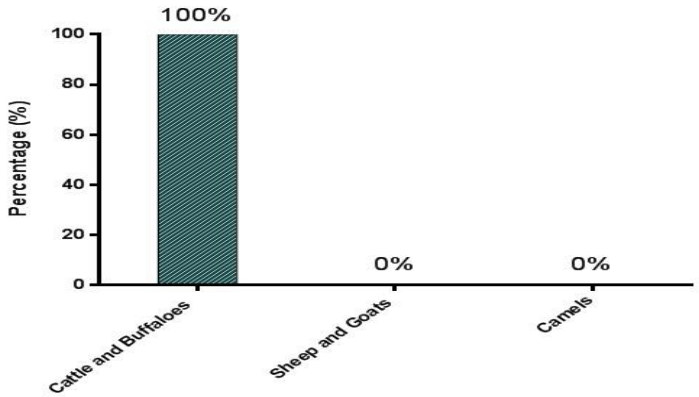

Figure (5): Results of MCF disease in treated and vaccinated cases

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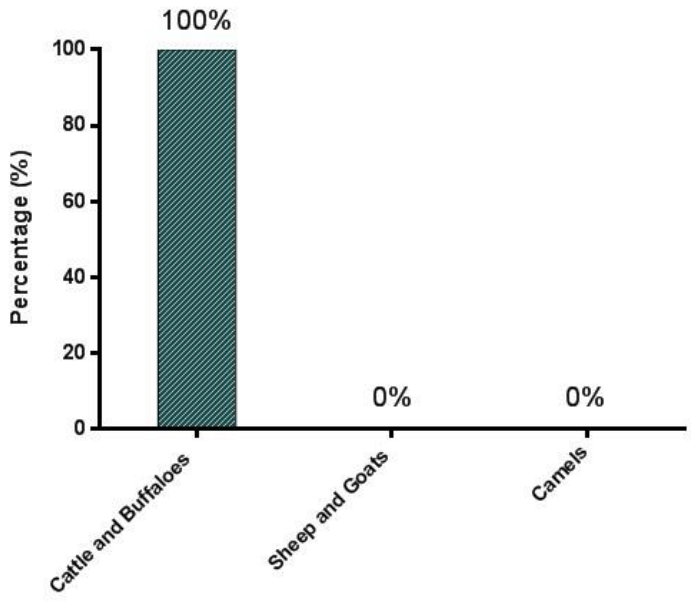

Figure (6): Results of BEF disease in treated and vaccinated cases

In sheep and goats, prevalence rate of Orf [4376 (100%)], PPR [24149 (99.87%)] and Pox [124750 (100%)] were elevated significantly (P<0.0108, P<0.0139 and P<0.0116, respectively); while in cattle and buffaloes, no positive findings were identified. However, positive results of PPR were detected in camels [31 (0.13%)], (Figures 7-9).

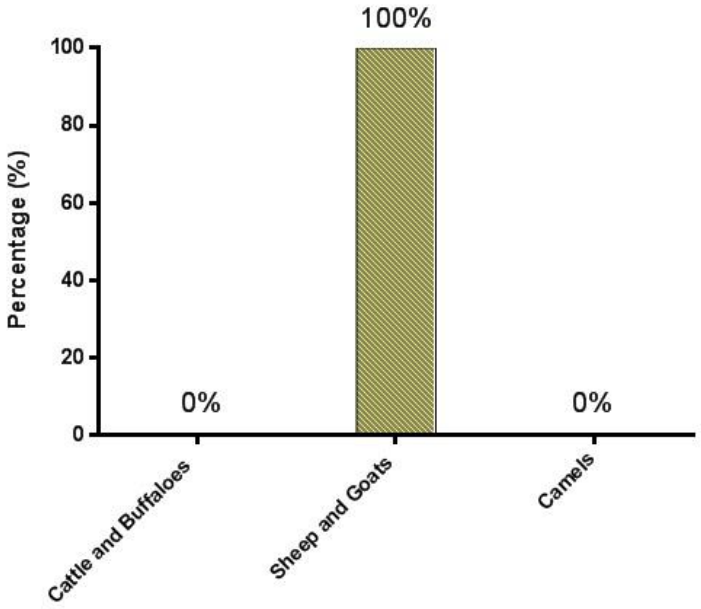

Figure (7): Results of Orf disease in treated and vaccinated cases

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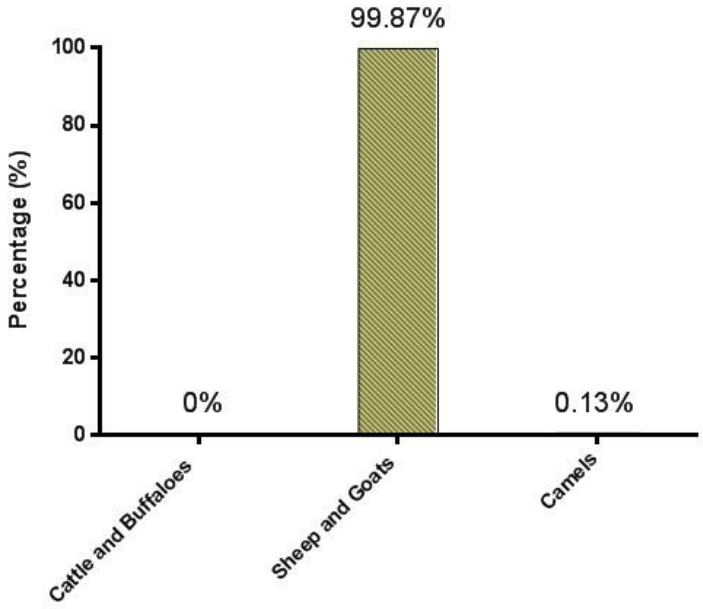

Figure (8): Results of PPR disease in treated and vaccinated cases

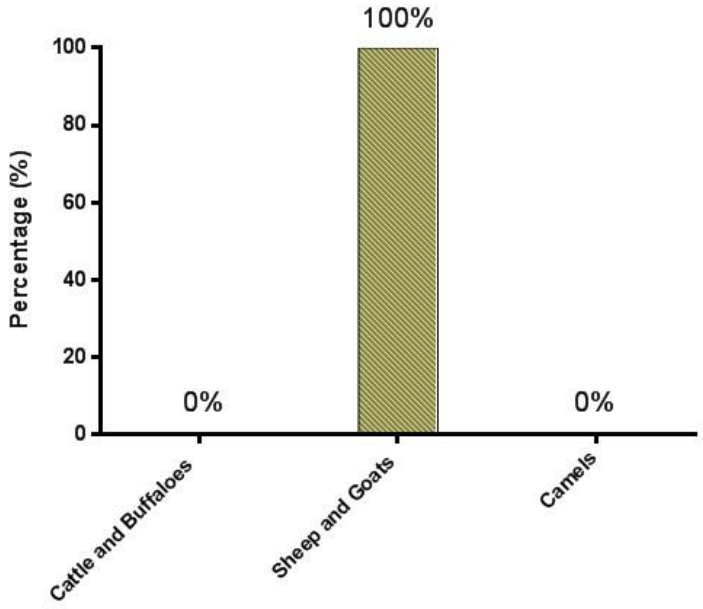

Figure (8): Results of Pox disease in treated and vaccinated cases

Discussion

Iraq is the land of Mesopotamia that has domesticated small and large ruminants for more than 6000 years. Iraq is rich in livestock and is considered the nucleus of all species of farm animals. The Iraqi Ministry of Agriculture conducted the census of animals in 2008, and the estimated population of cattle, buffalo, sheep, goat, and camel was 2,552,113; 285,537; 7,722,375; 1,474,846; and 58,293, respectively (MOA, 2008). However, the comparison of these numbers with 1978 animal's census revealed a drop in animal's population, where the estimated numbers were 9.7, 2.1, 1.7 million and 70,000 for sheep, goat, cattle, and camel, respectively, except for buffalo. After 2003, the border control between Iraq and neighboring

countries was corrupted down and assisted in the smuggling of different types of animals from Iraq to the outside and *vice versa* that led to various serious trans-boundary diseases, such as FMD and lumpy skin disease (Al-Salihi, 2019). During last six decades, many viral diseases have been confirmed in large and small ruminants by application of different laboratory diagnostic assays (Hasso, 1997; 2016). However, FMD caused by the FMD virus that belongs to *Aphthovirus* genus of Picornaviridae family, remains the most frequent and prevalent viral diseases in domestic animals in particular cattle and sheep. The disease is endemic throughout different areas in Iraq causing tremendous economic losses to owner's livestock every year (Aidarose, 2002; Mahdi, 2010; Jamal *et al*., 2011; Mohammed, 2013). Although, there are appropriate plans for providing vaccine to the farmers, there is limitation to implement it on the ground. Furthermore, the open retail is overwhelmed with the uncontrolled vaccine of undefined efficacy and free movement of the animal between different governorates in Iraq. The probability that a new sublineage of virus led to FMD outbreak in Iraq is expected to play a major role in increasing the number of infected animals, since the vaccine strain that did not closely match the isolated serotypes from the field could probably protect against infection. This interpretation is in agreement with other studies mentioned that the vaccine would influence the value of FMD control by vaccination strains available and at this time, closely matched serotypes would be required immediately to formulate a vaccine (Kitching *et al*., 1989; Elnekave *et al.*, 2013). These reasons may explain why the number of infected and vaccinated animals increased largely in last 10 years in particular after 2016. For example, the number of infected large (Cattle and buffaloes) and small (sheep and goats) ruminants with FMD was 967 and 2315 in 2004, 2828 and 12, 957 in 2007, as well as 1,541,375 and 4,833, 721 in 2016 (Mohammed, 2013; Sameer and Jarullah, 2014; Al-Salihi, 2019).

In Iraq, despite vaccination programs applied since the first outbreak in 2013, LSDV remains large in persistence and distribution among most areas of the country, resulting in apparent morbidities and mortalities. LSD is an exhausted viral disease affecting many countries, particularly at Africa and Asia resulting economically in great losses due to the high rates of morbidity, chronic debilitation in diseased cattle, abortion, severe reduction in milk production, weak growth, damage to hides, and temporary or permanent sterility. In addition, it is considered one of the transboundary animal diseases for its significant impact on trade and food security and the ability for spreading to other countries (Abutarbush *et al*., 2015). The real danger of the disease lies in the fact that it has continued to spread and to extend in its range to include new areas, countries, and fields (Tageldin *et al*., 2014). In Iraq, many outbreaks have been reported during the past 6 years, which varied in their severity and incidence; nonetheless, it is unclear how the disease is maintained during interepidemic periods. It thought that LSDV could preserve by either the inapparent infections cycled in cattle or old lesions or the role of wildlife animals in pathogenesis (Van Vuuren and Penzhorn, 2015). However, it is claimed that the very young calves, lactating cows, and animals suffering from malnutrition were developed generally the most severe infections probably due to an impairment of cellular immunity (Tageldin *et al*., 2014). Besides, the high ambient temperature coupled with farming practices to produce high milk might be deemed for stressing of these animals and contribute to the severity of the disease (Hunter and Wallace, 2001). To support clinical signs, Gharban *et al*. (2019) suggested that effective

control of LSD requires an accurate and rapid laboratory diagnostic method like PCR assay which considered the best available test of choice for the identification of the disease.

MCF caused by MCF viruses that grouped within ruminant gammaherpesviruses of the genus Macavirus, causes a significant economic impact on susceptible hosts in particular in cattle resulting in different disease forms that ranged from acute severe inflammatory disease with a short clinical course to a more chronic syndrome occasionally with skin form (Stahel *et al*., 2013; Erkilic *et al*., 2017). Unfortunately, the knowledge about the current situation of MCF infection of cattle in Iraq is absolutely rare. In a recent study (Khudhair *et al*., 2019), the evaluation of suspected MCF cases by clinical and molecular methods for detect the causes of the disease which was likely to have contributed directly to the death of cattle in Iraq. In small ruminants, the asymptomatic feature of disease might be the cause of absence of clinical studies in Iraq.

Bovine ephemeral fever (BEF), caused by the genus *Ephemerovirus* of the *Rhabdoviridae* family, is an arthropod-borne viral disease that mainly infects cattle and buffaloes in tropical and subtropical regions of Africa, Asia, Australia and Middle East (Al-Sultany and Hassan, 2013). The disease that first recorded in the late 19th century and named usually as three-day sickness, was first described in Iraq in 1991 when Al-Bana (1991) studied the influence of *Theileria* vaccine and the infection of BEF virus on the efficacy of rinderpest vaccine, whereas Poushijian (1997) isolated the virus of BEF in 1996 in Ninavah. In cattle, the disease that characterized by acute febrile reaction, stiffness, lameness and spontaneous recovery in three days, occurs mainly in subtropical and temperate regions of Africa, Asia and Australia with high morbidity and low mortality (Bulut and Azkur, 2016). However, the disease has major economic significance as there are major economic losses due to drop in production in dairy herds and reduction in condition of prime animals or disruption of stock movement and disruption of markets. Also, it is the prime time to create the substantial awareness both in individuals and industry owners about the epidemiology, transmission, prevention and control of the disease to avoid the enormous economic losses (Zaghawa *et al*., 2016; Abdullah *et al*., 2020). Sheep and other domestic animals are not susceptible by passing of BEF virus through sheep experimentally has become possible (Walker and Klement, 2015).

ORF is recognized as sore and scabby mouth disease, contagious ecthyma, and contagious pustular dermatitis, considered one of the most important viral skin diseases in goat farms. It mainly affects sheep, goat and some other housetrained and wild ruminants, causing economic loss in the livestock construction (Hosamani *et al*., 2019). Disease is spread worldwide and widespread in many countries wherever sheep and goats are owned, and the disease also has zoonotic latent affecting the farmers, veterinarians and butchers who are in direct interaction with infected animals especially during shearing, docking, drenching and slaughtering or indirect connection with infected animals (Lacasta *et al*., 2021). The spread within a group is carried out over direct contact between animals during a confrontation or suckling. Morbidity is actually higher in young animals and mortality is usually low, but it may be very great when bacterial or fungal secondary infections occur (Ganter, 2015). Orf causes highly economic losses including weight loss, premature culling, in addition to treatment and control costs. Many studies indicate the worldwide and very high incidence of Orf infection in goat and sheep herds, which develops from erythema to macule, papule, vesicle creation and at that time pustules to dense crusts called scabs. The scabs are often

friable and minor trauma makes the lesions bleed simply. These lesions are ordinarily started on muzzle, lips, oral mucosa, ears and round the nostrils. The lesions can also be gotten on feet, eyelids and teats (Mansour *et al*., 2022). Suspected Orf disease can be identified based on clinical signs, tracked by laboratory tests such as serum neutralization test (SNT), electron microscopy, histopathology of the infected tissues and polymerase chain reaction (PCR) (Bala *et al*., 2018; Vellucci *et al*., 2020).

In addition to trypanosomiasis, PPR disease possesses high impact on several countries economy through induction animal losses particularly in various Africa and Asia countries (Khalafalla *et al*., 2010; Al-Abedi *et al*., 2020). In Iraq, limited studies have done for clinical (Al Sadi and Younis, 2010), serological (Hussain, 2021) and molecular (Candlan *et al*., 2017; Khoran *et al*., 2021) detection of PPR in small ruminants, with only recent serological study in camels (Gharban *et al*., 2022). Based on clinical observations, many outbreaks of PPR were suspected in small ruminants at different Iraqi regions throughout the last months of the 2021, and we thought that these outbreaks contributed significantly in increasing the seroprevalence of the disease among study camels. The result of study performed by Khalafalla *et al*. (2010) identified that the clinical features of PPR were abortion and sudden death of healthy camel as well as bloody diarrhea. Although, several serological studies determined the ability of camels to infect with PPR virus, there is no obvious clinical features could be observed seen among seropositive animals (Haroun *et al*., 2002; Abraham *et al*., 2005; Abubakar *et al*., 2008; Albayrak and Gür, 2010).

The etiological agent of sheep and goat pox diseases is *Sheeppoxvirus* (SPPV) *Goatpoxvirus* (GTPV) respectively, which both are belong to the genus *Capripoxvirus* within the family *Poxviridae* (Shehbaz and Hassan, 2017). The disease is notifiable to the World Organization of Animal Health (OIE) (Babiuk *et al*., 2008; Mirzaie *et al*., 2015), and pose serious socioeconomic impact to small ruminant productivity in terms of hide damage, morbidity, mortality, and trade restriction (OIE, 2010; Seyoum and Teshome, 2017). Clinically, the disease is characterized by pyrexia, rhinitis, conjunctivitis, excessive generalized multifocal necrotic lesions in the skin and internal organs including lungs, gastrointestinal tract, liver, lymphadenopathy and death (Al-Shabebi *et al*., 2014). Geographical distribution of the sheep pox has been relatively stable. Sheep pox and goat pox are endemic in many countries including Iraq as well as Iran, Turkey, Pakistan, India, Afghanistan, China, Nepal, Bangladesh, and Africa. Sporadic outbreaks were reported in a number of countries in Southern Europe and other parts of the world because of extensive trade between other foreign countries (Constable *et al*., 2017; Hurisa *et al*., 2018; Limon *et al*., 2020). Although pox disease has no effective treatment, regular annual vaccination programs of sheep and goat flocks with a safe and efficient vaccine participate in decreasing of serious and economic losses in endemic regions (Hurisa *et al*., 2018).

Conclusion

To date, there is an essential need for additional studies about the epidemiological factors contributed to elevated prevalence rate of viral diseases in Iraq and the active tools for slowing the spreading of these diseases among different animals. In this study, the collected data revealed that viral diseases still a major problem for farmers as well as veterinarians

since there are noticed limitations in availability of low cost diagnostic assays with potential therapeutic and preventive schedules. Management strategies like clean water, well enclosure housing, balanced diet and minimizing stress during cold season and lambing stage should be provided. Also, biosecurity measures should be considered in enzootic areas.

Limitations

These are including (1) clinical data were not collected from all veterinarians clinics found in Wasit province (2) many veterinarians does not documented all treated or all vaccinated cases (3) a number of clinics were not provided the required data for authors.

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Author contribution

HNSA, HAHJ and AAAA: Collection of clinical data; ZAHA: Categorizing of data; HAJG and GJKA: Statistical analysis and writing of initial copy of article. All authors have approved the final copy of this work.

Conflict of interest

The authors declare that they have no competing interests.

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