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Research Article

Upsurge of Crimean-Congo Hemorrhagic Fever During Eid-Al-Adha Period 2023 in Iraq

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Abstract

Background: Crimean-Congo Hemorrhagic Fever (CCHF) is a tick-borne zoonotic disease. It has a case fatality rate of up to 40%. Animal sacrifices during the Eid-Al-Adha period are a common religious tradition in the country. Since 2021, Iraq has been plagued by a continuous epidemic. ***Objectives***: To investigate the upsurge of CCHF cases during the Eid-Al-Adha period in 2023 and determine the times of high incidence and related risk factors. ***Methods***: A cross-sectional study was conducted using data derived from the Communicable Disease Control Center in Iraq during the period from June 19 to July 30, 2023, and included all laboratory-confirmed cases during the study period. The studied variables were categorized according to before, during and after the Eid period. The chi-square test and regression analysis were used to analyze the variables. ***Results***: CCHF cases increased during the Eid period (118 compared to 63 before and 23 after). Slaughtering activities during the Eid period increased by more than 45%. Being a butcher and participating in slaughtering activities significantly contributed to the increase in cases during the Eid period. The only significant predictor identified was the presence of slaughtering activities before and after Eid, compared to the Eid period itself. ***Conclusions***: CCHF cases increased during the Eid-Al-Adha period, which may be due to animal sacrifice activities during this Islamic festival.

Keywords: Crimean-Congo, Eid Al-Adha, Hemorrhagic fever, Iraq.

تصاعد حمى القرم والكونغو النزفية خلال فترة عيد الأضحى 2023 في العراق

الخلاصة

الخلفية: حمى القرم والكونغو النزفية (CCHF)هي مرض حيواني المنشأ ينتقل عن طريق القراد. ويصل معدل إماتة الحالات فيها إلى 40٪. الأضاحي الحيوانية خلال فترة عيد الأضحى هي تقليد ديني شائع في البلاد. منذ عام 2021، ابتلي العراق بوباء مستمر. **الأهداف**: التحقيق في تصاعد حالات حمى القرم النزفية خلال فترة عيد الأضحى في عام 2023 وتحديد أوقات ارتفاع معدل الإصابة وعوامل الخطر ذات الصلة. **الطريقة**: أجريت دراسة مقطعية مستعرضة باستخدام البيانات المستمدة من مركز مكافحة الأمراض الانتقالية في العراق خلال الفترة من 19 يونيو إلى 30 يوليو 2023، وشملت جميع الحالات المؤكدة مختبريا خلال فترة الدراسة. تم تصنيف المتغيرات المدروسة حسب فترة ما قبل وأثناء وبعد فترة العيد. تم استخدام اختبار مربع كاي وتحليل الانحدار لتحليل المتغيرات. **النتائج**: زادت حالات حمى القرم النزفية خلال فترة العيد (118 حالة مقارنة ب 63 حالة قبل و23 حالة بعد). زادت أنشطة الذبح خلال فترة العيد بأكثر من 45٪. ساهم العمل في الجزارة والمشاركة في أنشطة الذبح بشكل كبير في زيادة الحالات خلال فترة العيد. وكان المؤشر المهم الوحيد الذي تم تحديده هو وجود أنشطة ذبح قبل العيد وبعده، مقارنة بفترة العيد نفسها. **الاستنتاجات**: زادت حالات الإصابة بحمى القرم النزفية خلال فترة عيد الأضحى المبارك والتي قد تكون بسبب أنشطة الأضاحي الحيوانية خلال هذا العيد الإسلامي.

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INTRODUCTION

Crimean-Congo Hemorrhagic Fever (CCHF) is a tick-borne zoonotic disease caused by a Nairovirus belonging to the Bunyaviridae family [1]. It has a case fatality rate of up to 40% [2]. It was initially identified among Soviet soldiers in the Crimean Peninsula (1944) [1]. CCHF is endemic in Africa, the Middle East, Asia and southern Europe [3]. The length of the incubation period depends on the virus's mode of transmission. It is usually one to three days after a tick bite (up to nine days) and five to six days after contact with infected blood or tissues (up to 13 days) [2]. The main clinical symptoms and signs are fever, headache, fatigue, vomiting, and diarrhea. Hepatomegaly, lymphadenopathy, confusion, and hemorrhagic symptoms develop in severe cases [1]. The diagnosis of

CCHF virus infection can be achieved by several laboratory tests, mainly enzyme-linked immunosorbent assay (ELISA) and reverse transcriptase polymerase chain reaction (RT-PCR). The treatment is mainly supportive, but the antiviral drug ribavirin has been used in some CCHF cases with apparent beneficial effects. CCHF is mainly transmitted through tick bites, contact with infected animals' blood and tissues, or contact with the blood, organs or other body fluids of infected humans [2]. Transmission of CCHF extends from spring to autumn, coinciding with the high tick multiplication activity season [4]. Iraq has been an endemic country since 1979, when the first case was identified [5]. The disease is also endemic in neighboring countries, Turkey and Iran [6]. Eid-Al-Adha is an annual Muslim sacrifice festival that happens during the Hajj season in Mecca. Sacrifices of animals are conducted in Mecca and also in all Muslim countries, including Iraq, by any Muslim who can do it. In general, Muslims slaughter animals in their homes by themselves, a relative or a friend. The date of Eid-Al-Adha drifts earlier by nearly ten days each year. That means, at least in the next five years, this occasion will happen in the summer, when CCHF is more prevalent. This will result in a rise in the number of cases due to insufficient knowledge about the disease, unethical practices in animal slaughter, inadequate tick control measures, and the uncontrolled movement of animals within and between countries [7, 8]. Since 1979, Iraq has continued to report CCHF cases on an annual or semi-annual basis. The ongoing epidemic, which has persisted since 2021, is the largest to have struck the country in the past four decades. The main objective is to investigate the upsurge of CCHF cases during the Eid-Al-Adha period in 2023 and determine the times of high incidence and related risk factors. The secondary objectives include investigating the upsurge of CCHF cases during the Eid-Al-Adha period in 2023 in order to determine the times of high infection incidence and the related risk factors.

METHODS

Study design and setting

The Communicable Disease Control Center (CDC Iraq/Zoonotic Section) conducted a cross-sectional study with analytical elements using data derived from the Iraqi national surveillance system between June 19 and July 30, 2023. The sacrifice of animals in Eid-Al-Adha started from the morning of the 1st day of Eid after Eid prayer till the sunset of the 4th day of Eid. The study sample includes all confirmed cases diagnosed by the Central Public Health Laboratory (CPHL) in Baghdad using RT-PCR and/or ELISA (IgM) techniques during the study period. Suspected cases include sudden onset of high fever (> 38°C) with headache, joint and back pain, stomach pain, and vomiting, accompanied by a history of tick bites, contact with infected animals' tissues or blood, or contact with an infected patient. A probable case is one with suspected hemorrhagic manifestations or thrombocytopenia (<50,000 platelets/mL). A confirmed case includes any suspected or probable case with laboratory confirmation of CCHF, a positive RT-PCR test, and/or an ELISA (IgM). We conducted outbreak investigation activities for all confirmed cases, exerting considerable effort to obtain precise information. The national surveillance system relies on immediate case notification and monthly routine data collection from zoonotic units in the country's provinces. The case investigation form asked about the patients' age, gender, where they lived, what they did for a living, and any fevers or bleeding. It also asked about their final outcome (cure or death) and the epidemiological link (slaughtering, tick bite) for three different time periods, each lasting two weeks: before Eid (International Weeks 25, 26: 19 June to 2 July); during Eid itself (28 June); and during the five-day period after contact with infected animal blood or tissues. During the Eid period (International weeks 27, 28, from 3 July to 16 July), the incubation period of CCHF begins five days after the 1st day of Eid, coinciding with the period after contact with infected animal blood or tissues, and includes any slaughtering activities related to the holiday. After Eid period: (International weeks 29, 30: 17 to 30 July): starting after more than two weeks (the longest incubation period of CCHF) from the date of the 4th day of Eid.

Sampling and outcomes measurements

The dependent variable is the study period (before, during, and after), and the independent variables include age group, gender, residence, occupation, slaughtering, tick bite, and patient outcome. The data from zoonotic units in different provinces in the country was received through email at the CDC Baghdad/Zoonotic Section and then analyzed.

Ethical consideration

The collection of data was kept confidential, anonymous, private and used only for study purposes. Verbal consent was obtained from each patient to use his anonymous data for statistical and research purposes. In addition to that, ethical approval was obtained from the ethical and scientific committees in the Ministry of Health.

Statistical analysis

The description and analysis of the variables were made on Excel 2019 and Statistical Package for Social Sciences (SPSS) version 26. Descriptive statistics were done for the study variables. According to the type of variable, data was expressed using frequency/percentage and mean±standard deviation. A chi-square test was used to determine the significant difference in the studied variables before, during and after the Eid-Al-Adha period. Multinomial logistic

regression analysis was used to determine the significant predictors of the increment of cases during the Eid period at a $p<0.05$ level.

RESULTS

The current study included a total of 204 patients: 63 before, 118 during, and 23 after the Eid period. Figure 1 illustrates the apparent increase in the number of cases by 2.6 times, from 27 cases in week 26 to 69 cases in week 27 (the first week of the Eid period).

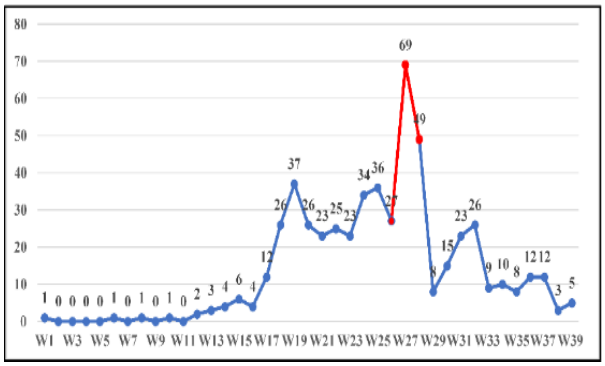

Figure 1: Epidemic curve of CCHF cases according to international weeks, Baghdad, 2023.

The total number of cases reported during the entire Eid period (weeks 27 and 28) averaged 8.4 cases per day. The number of cases decreased after the Eid period. Simultaneously, the number of slaughtering activities increased by more than 45% during the Eid period compared to the pre-Eid period (from 21 from 63 cases to 92 from 118 cases), and then began to decrease thereafter, as illustrated in Figure 2.

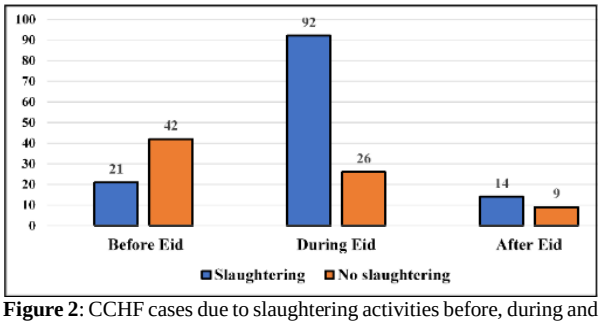

Figure 2: CCHF cases due to slaughtering activities before, during and after Eid period, Baghdad, 2023.

This study's results showed that the increase in cases during Eid was significantly associated with being a butcher (p=0.016) and slaughtering activities (p=0.000), as shown in Tables 1 and 2.

Table 1: Comparison of socio-demographic characteristics of the patients across the study periods, Baghdad, 2023

Variable	Before Eid	During Eid	After Eid	*p**
Age group				
10-44 y	36957.1)	90(76.3)	15(65.2)	0.123
45-64 y	23(36.5)	24(20.3)	7(30.4)	
≥65 y	4(6.3)	4(3.4)	1(4.3)	
Gender				
Male	36(57.1)	71(60.2)	16(69.6)	0.580
Female	27(42.9)	47(39.8)	7(30.4)	
Residence				
Rural	27(42.9)	42(35.6)	10(43.5)	0.051
Urban	20(31.7)	62(52.5)	9(39.1)	
Semi-urban	15(23.8)	10(8.5)	3(13)	
Slums	1(1.6)	4(3.4)	1(4.3)	
Occupation				
Housewife	25(39.7)	43(36.4)	5(21.7)	0.016
Butcher	2(3.2)	25(21.2)	4(17.4)	
Animal breeder	11(17.5)	8(6.8)	3(13)	
Other	25(39.7)	42(35.6)	11(47.8)	

Values were expressed as number (%). * Chi-Square test used.

Table 2: Comparison epidemiological characteristics and patient outcome of the patients across the study periods, Baghdad, 2023

Variable	Before Eid	During Eid	After Eid	*p**
Slaughtering				
Yes	21(33.3)	93(78.8)	14(60.9)	0.000
No	42(66.7)	25(21.2)	9(39.1)	
Tick bite				
Yes	2(3.2)	3(2.5)	0(0)	0.698
No	61(96.8)	115(97.5)	23(100)	
Patient outcome				
Cure	57(90.5)	105(89)	21(91.3)	0.918
Death	6(9.5)	13(11)	2(8.7)	

Values were expressed as number (%). * Chi-Square test used.

Regression analysis revealed that the only significant predictor was slaughtering activities before Eid (p=0.000) and after Eid (p=0.029) compared to during the Eid period, as presented in Tables 3 and 4.

DISCUSSION

This study was conducted during the peri-Eid-Al-Adha period in 2023 to investigate the increment in CCHF cases that were attributed to slaughtering activities during this Islamic festival. A total of 118 cases occurred during the Eid period, compared to 63 cases before the

Eid period and 23 cases after the Eid period. The study revealed that the number of cases increased by 2.6 fold from week 26 (before Eid period) to week 27 (during Eid period) in 2023. Another three-fold increase will occur during weeks 16 and 17 in 2023, coinciding with the country's usual beginning of the CCHF season each year.

Table 3: Adjusted odd's ratio of socio-demographic characteristics of the patients in relation to during Eid period (reference category), Baghdad, 2023

Period	Variable	Adjusted odd's ratio	*p*
Before Eid	***Age group (year)***		
	10-44	0.873(0.153-4.986)	0.878
	45-64	2.058(0.340-12.442)	0.432
	≥65		
	Gender		
	Male	0.523(0.098-2.801)	0.449
	Female		
	Residence		
	Rural	1.417(0.122-16.447)	0.781
	Urban	1.006(0.087-11.600)	0.996
	Semi-urban	4.903(0.381-63.060)	0.222
	Slums		
	Occupation		
	Housewife	0.412(0.074-2.298)	0.312
	Butcher	0.308(0.061-1.562)	0.155
	Animal breeder	1.196(0.339-4.226)	0.781
	Other		
After Eid	***Age group (year)***		
	10-44	0.729(0.059-8.981)	0.805
	45-64	1.670(0.128-21.784)	0.696
	≥65		
	Gender		
	Male	0.398(0.064-2.481)	0.324
	Female		
	Residence		
	Rural	0.850(0.075-9.637)	0.896
	Urban	0.538(0.049-5.948)	0.613
	Semi-urban	1.260(0.088-18.105)	0.865
	Slums		
	Occupation		
	Housewife	0.145(0.020-1.073)	0.059
	Butcher	0.950(0.241-3.745)	0.942
	Animal breeder	0.815(0.152-4.376)	0.811
	Other		

Table 4: Adjusted odd's ratio of epidemiological characteristics and patient outcome of the patients in relation to during Eid period (reference category), Baghdad, 2023

Period	Variable	Adjusted odd's ratio	*p*
Before Eid	***Slaughtering***		
	Yes	0.123(0.056-0.274)	0.000
	No		
	Tick bite		
	Yes	0.443(0.065-3.031)	0.407
	No		
	Patient outcome		
	Cure	1.579(0.472-5.280)	0.458
	Death		
After Eid	***Slaughtering***		
	Yes	0.304(0.105-0.883)	0.029
	No		
	Tick bite		
	Yes	7.016(7.016-7.016)	0.983
	No		
	Patient outcome		
	Cure	1.509(0.274-8.299)	0.685
	Death		

The sacrifice of animals during the Eid-Al-Adha period was thought to be the main reason for the increase in CCHF cases in some Islamic countries, such as Pakistan, Turkey and Oman [7,9]. This increase in cases in Iraq could be attributed to a number of factors, including an increase in animal trade and transport from both outside and within the country during Eid, a lack of control over animal sales, an increase in animal purchases, a lack of health checks on purchased animals, the slaughter of animals by untrained butchers, the public's habit of congregating around the butcher to witness the scene, and delayed and poor practices regarding the disposal of animal carcasses. The current study revealed a significant increase in slaughtering activities by nearly 45% (p= 0.000), from 33.3% of the total cases before Eid to 78.8% during Eid. On the other hand, the number of tick bites reported by patients decreased from 3.2% before Eid to 2.5% during Eid and then to 0% after Eid

(p= 0.698). In addition to that, the number of infected butchers increased significantly (p= 0.016) by 18%. The increase in CCHF cases during the Eid period, coupled with an increase in slaughtering activities (p= 0.000), and the number of infected butchers, both trained and untrained (p= 0.016), along with the insignificant difference in tick bite reporting (p= 0.698), suggest that contact with animal blood and tissues may be the primary cause of this significant increase in CCHF cases during the Eid-Al-Adha period. However, we cannot rule out the possibility of tick bites, as they can be painless and go undetected [10]. However, finding new tick species during this period is possible due to increased animal gathering and movement [11]. In a study conducted in Oman, it was found that the main exposure risk was contact with animal tissue in 83% of the cases, while only 1 case reported a tick bite alone [9]. In another study in Pakistan, the increased cases during the Eid-Al-Adha period could be attributed to altered patterns of animal movements, butchery, handling and animal exposure [7]. The most affected age group in the 3 study periods was 10–44 years, with no significant increase during Eid period in the same age group (p= 0.123). The reason may be that this affected young age group is the main working age group in the country. A study in Afghanistan on all CCHF cases (probable and confirmed) from 2015–2018 found that the majority of the cases (74.8%) were in the age group 10-44 years [12]. The result was somewhat similar to a study from Pakistan, in which the most affected age group was 20–29 years from the total cases admitted to the isolation ward with clinical CCHF evidence [13]. On the other hand, the majority (57.3%) of serologically confirmed cases from 2012–2021 in Turkey were in the group above 45 years of age [14]. Regarding gender, nearly 60% of the cases in our study were males and 40% were females, with no significant difference across the study periods (p= 0.580). The reason may be that the main working force that has contact with the animal sector is male, making them more susceptible to being infected with CCHF. A nearly similar male predominance result (56.6%) was observed in a study from Turkey [14], while a higher male percent was observed in studies from Afghanistan (75.2%) [12] and Pakistan (84%) [15]. The current study found that most of the affected patients were from urban areas (44.6%). This may be explained by the fact the fact that the majority of slaughtering activities during the Eid period were conducted in urban areas and large cities after being brought from rural areas. During the Eid-Al-Adha period in Pakistan, people living in urban areas were more likely to be infected by this event [16]. Despite the increased number of infected patients with CCHF in urban areas during the Eid period, the result was not significant (p= 0.051). The case fatality rate in this study was 10.3%, with no significant difference across the study periods (p= 0.918). According to the WHO, outbreaks of CCHF have a case fatality rate of up to 40% [2]. All regions, especially the highly affected ones, should practice preventive measures at all levels, primary, secondary, and tertiary, to counteract the impact of this dangerous disease [17]. After conducting a regression analysis, we found that the only significant predictor was the slaughtering activities conducted before Eid (p= 0.000) and after Eid (p= 0.029), compared to the Eid period. The study data was collected from the official national center responsible for reporting CCHF cases in the country. However, the study has certain limitations, such as incorrect responses from some cases regarding their occupation and an underestimation of tick bites, which may be painless and go unnoticed.

Conclusion

CCHF cases were obviously increased during the Eid-Al-Adha period, which may be due to activities related to animal sacrifice during this Islamic festival. Being a butcher and slaughtering an animal were significantly associated with increasing CCHF cases during Eid. Slaughtering an animal was found to be a significant predictor of the number of cases during Eid.

Recommendations

The study recommended focusing control actions before the Eid period to address animal trade and transport from both outside and within the country, conduct health checks on animals, control ticks, and increase public health awareness about proper and healthy animal slaughtering procedures. Confirmation of these findings requires further prospective studies.

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Conflict of interests

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Data sharing statement

Supplementary data can be shared with the corresponding author upon reasonable request.

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