



Detection Of Crimean-Congo Hemorrhagic Fever Seroprevalence Rate In Occupational Persons In Nineveh Province, Iraq

Raeed Idrees Mohammed¹ Nihad Abdulhussian Jafar² Abdullah A. Khaleel Sheehan³

^{1,2} Department of Microbiology, College of Veterinary Medicine, Tikrit University, Tikrit, Iraq.

³ Department of Microbiology, College of Veterinary Medicine, University of Mosul, Iraq

ARTICLE INFO.

Article history:

-Received: 22/3/ 2024

-Accepted: 23/ 5/ 2024

-Available online: 30/6/2024

Keywords

CCHF, Occupational persons, Incidence rate, ELISA, Ticks.

Corresponding Author:

Name: Raeed Idrees Mohammed

E-mail: ri230088pve@st.tu.edu.iq

Tel: :

© 2023 This is an open access article under the CC by licenses <http://creativecommons.org/licenses/by/4.0>



ABSTRACT

Crimean–Congo hemorrhagic fever (CCHF) one of zoonotic viral tick born disease can infect both animals and human. Occupational persons which they are in direct contact with animals were at high risk . The disease infect animals by silent form and humans by severe type. Butchers 120 samples and veterinarians 83 samples were two occupational person groups sera targeted in our study. Results showed positive seroprevalence rate for the sera of butchers (9/120) 7.5 % , veterinarians (6/83) 7.228 % to CCHF by ELISA test. The highest results recorded according to age : butchers (2/19) 10.526 % with ages <30 year while veterinarians recorded (4/36) 11.111 % with age 33-43 years. Education degree: uneducated and secondary graduate degree butchers (2/11) 18.181 % and veterinarians (5/43) 11.627 % with under graduate degree. Finally according to living type: butchers (8/78) 10.256 % and veterinarians (5/28) 17.857 % that were living in districts and townships gave the highest result on the contrary to those living in the center of the city. It was concluded that CCHF was present in Ninevah province in Iraq and distributed all over the province in two important occupational peoples groups including butchers and veterinarians that targeted in the study.

1. Introduction

One of the important viral disease is Crimean Congo [hemorrhagic fever](#) (CCHF) which was caused by virus called *arbovirus* that belong to genus of *Orthonairovirus*

under family of *Nairoviridae* and order of *Bunyavirales* (1). It is enveloped RNA virus negative-sense (2). The important thing that distinguishes this disease that is

its transmission through tick mainly *Hyalomma* genus so it was called tick born disease (1). The disease has worldwide occurrence it was reported each in Asia (3) and Africa (4) also in Europe (5). This disease can infect wide range of animal hosts including domestic and wild animals (6). In general cows, sheep, goats are mostly infected by the disease in addition to buffalos, horses, and pigs and other animals (7). These animals can be transmit the disease to human by direct contact with them or their secretions in addition to direct exposure to tick bite although human is not favored host of *Hyalomma* genus but it can be occur sometimes (8), or through handling of these ticks. But remain the direct contact between infected animals specially subclinical form (9) and human specially by viremic blood and tissues of infected animals in addition to direct contact between infected and non infected persons is the most important role of infection (1) (10). Also direct contact between infected and intact human was high risk infection of human person is considered one of the most important risk factors in the spread of the disease in humans (2). Occupational human such as butchers, shepherds, slaughterhouse workers, farmers, veterinarian are of great risk to infection with CCHF disease during close contact to livestock animals such as cows, sheep ,

goats , buffalos with (11, 12, 13, 14, 15, 16) and even in Eid-ul-Adha which was one of Muslims religious festivals the disease can be transmit to human by transporting of subclinical diseased animals from rural to urban regions in order to slaughter them (17, 18). In this article we focused to study incidence rate of CCHF in some occupational persons which they are closely contact with livestock animals in Ninevah province in Iraq.

2. Material and methods :

2.1 Sample collection:

2.1.1 Blood collection:

Blood collected from human from venipuncture vein after shaving and disinfecting the area by 70 % of alcohol the blood put in gel tube , the serum was separated then put in eppendorf tube and kept under deep freeze 20- C° until using it later.

The test used by this study was ELISA kits. In direct ELISA kits (iD-vet/ France) ID Screen® CCHF Double Antigen Multi-Species were obtained from the market and used in the study. It was used for detection of specific antibodies against CCHFV both in cows and human. This kit was prepared directly to detection specific antibodies against Nucleo Protein NP of CCHF virus in both animal species and human at all

3. Results

1- Seroprevalence rate of CCHF in different occupational persons

The results showed that seroprevalence rate of CCHF between different

occupational persons that direct contact with animals was a high rate among butchers which was reached to 7.5 % , then it was followed by the second group which was in the veterinarian doctors

that reached to 7.228% as shown in table (1).

Table (1) Seroprevalence rate of CCHF in different occupational persons

Occupations Samples	Total samples	Positive sample	%
Butchers	120	9	7.5
Veterinarians	83	6	7.228

2- Seroprevalence rate of CCHF in occupational persons according to the age

The results showed that veterinarian doctors at age between 33-43 years were with high seroprevalence rate that

reached to 11.111 % followed them group of butchers with age over 30 years with seroprevalence rate reached to 10.526 % seroprevalence rate results of other age groups mentioned as in table (2-A and 2-B)

Table (2-A) Seroprevalence rate of CCHF in butchers age

Years Occupations	Butchers		
	Total	positive	%
1-10 year	49	3	6.122
11-20 year	26	2	7.692
21-30 year	26	2	7.692
<30 year	19	2	10.526

Table (2-B) Seroprevalence rate of CCHF in veterinarian doctors age

Years Occupations	Veterinarians		
	Total	Positive	%
> 33 years	21	1	4.761
33-43 years	36	4	11.111
< 44 years	26	1	3.846

3- Seroprevalence rate of CCHF in occupational persons according to educational degree

The results showed that butchers with un educated groups and with secondary education degree were the highest seroprevalence rate that reached to 18.181 % ,in last degree each of butchers

seroprevalence rate that reached to 5.555 % while in veterinarians the result showed that sroprevallence rate in undergraduate university degree veterinarians group reached to 11.627 whereas in postgraduate university degree veterinarians group reached to 2.5 % only as in table (4).

Table (4) Seroprevalence rate of CCHF in occupational persons according to educational degree

Years Occupations	Butchers			Veterinarians		
	Total	positive	%	Total	positive	%
Uneducated	11	2	18.181			
Primary	90	5	5.555			
Secondary	11	2	18.181			
Preparatory school	4	0	0			
University	4	0	0	43	5	11.627
Post graduate				40	1	2.5

4- Seroprevalence rate of CCHF in occupational persons according to the region

The results showed that seroprevalence rate reached to 17.857 % and 10.256 % both in veterinarians and butchers groups that were living in districts and townships out of center city Mosul while in groups of

each of them living inside center city of Mosul seroprevalence rate reached to 1.818 % and 2.380 for each of them respectively as in table (5).

Table (5) Seroprevalence rate of CCHF in occupational persons according to the region

Region Occupations	Butchers			Veterinarians		
	Total	positive	%	Total	Positive	%
Mosul center	42	1	2.380	55	1	1.818
Districts and Townships	78	8	10.256	28	5	17.857

4. Discussion

It is known that many diseases affect humans are of animal origin which has increased significantly recently (19). Crimean-Congo hemorrhagic fever was one of highly contagious disease affecting both animals and human with high mortality rate in the last, it was tick born disease in addition to their direct transmission (20). The seriousness of the disease lies that CCHF infect animals by mild form or may appear in silent form without any clinical signs in these animals such as cows, sheep, goats and other domestic in addition to wild animals (21, 22, 23) giving the opportunity to infect people with direct contact with them specially occupational persons which they are in high risk and they appear sudden clinical signs after infection (24, 20). Ticks play an important role in spreading and wide

distribution of the disease all over the world due to their widespread as well (25). Also it can amplify the appearance of the disease in the environment because of their function as vector and reservoir of CCHFV leading to infect more animals in addition its ability to transmission the virus vertically rout from one generation to other (26). Outdoor workers such as animal breeders, farmers, butchers, health care workers, veterinarians and any person with direct contact with animals are in high risk to CCHF disease (27). The disease was recorded for the first time in Iraq at 1979 and repeated with recurrent small outbreaks at 2019, 2021 finally 2022 (20). Our study that targeted three occupational persons including veterinarians, animal breeders and butchers which they were in direct contact with cows explained positive result for each of them at different area

in Ninevah province in Iraq and this proves the hypothesis of wide distribution of disease. Many reasons can interpret this result the main one is presence of ticks with high distribution rate and absence of true plan to eradicate it with lack of lack of breeder education about the risk of ticks to each of animal and public health also lack of health awareness throughout society such as external slaughter outside the framework of the state and the law and neglecting regular monitoring of animals and treating sick or suspected animals. Also our result revealed that the highest prevalence rate were in uneducated people section that reached 18.181% also cases in districts and Townships rather than center of Mosul 17.857 % , male 8.333% , and butchers 7.5% all these results give an idea that lack of health awareness played an important role in these results. Also high prevalence rate of disease in veterinarians that reached to 7.228 % give a warning signal about the seriousness of the disease in this group of people as well. A manuscript at 2010 (28) showed that 11/44 serum samples were positive by ELISA test in eight different Iraqi provinces and Mosul city gave the highest value by 9/27 samples. Another manuscript at 2016 (29) showed that 46.87% (30/64) of human sera were positive in Sulaimani Province in Iraq by ELISA test with prevalence rate 36.7% (11/30) in females also 63.3% (19/30) in males while in butchers it reached to 18.75% (3/16). A recent study conducted by (30) at 2024 explained shocking results for distribution of CCHF in all Iraqi provinces with high case fatality rate

reached to 12.7 included 65 deaths out of 511 definitely proven cases that confirmed from 1827 suspected cases under study alarming the bell of danger about presence of CCHF in Iraq revealing to different prevalence rate between all provinces with highest rate in Erbil 38.5% and lower in Maysan 3.7% whereas Nineveh recorded 14.35 % revealing also that Confirmed cases were increased in 2021 from 33 to 219 in 2022 to 511 in 2023 according to results of this study. Also (31) revealed that deaths from the disease reached 18 out of 90 confirmed positive cases. In an analytical study conducted by (27) which they focused in a systemic review by meta-analysis they recorded data from some countries explained via pooled seroprevalence of CCHFV from 2006-2022 in occupational peoples they revealed prevalence rate in some countries also as: (Turkey 20.43% , Iran 15.15% , Greece 10.37% , Pakistan 7.45% , South Africa 7.07% , India 24.53% , Mainland China 8.21% , Spain 2.56% , Saudi Arabia 0.40%). All these results nowadays poses a great challenge to how of controlling this disease especially since there is another reason that is no less dangerous than the aforementioned reasons, which is the random and ill-advised importation of animals, through which the infection can enter the country continuously through animals carrying ticks or perhaps even silently infected ones, and this requires additional government effort in monitoring entry points at the borders and activating a quarantine for the animal to ensure its safety and freedom from diseases before bringing it into the country. We must always remember the

importance of caring for animal health and the environment as well as an integral part of human health. Many researchers have noted this as (31) which provided a recent review about mainly tick borne diseases among them CCHF they pointed out the importance of following the One Health System among animals, human and environment as a healthy procedure to prevent and control disease from human aspect.

5. Conclusion

It was concluded that CCHF was present in Ninevah province in Iraq and distributed all over the province in occupational peoples with direct contact with animals. Highest prevalence rate

recorded in uneducated people section that reached 18.181% also cases in districts and Townships rather than center of Mosul 17.857 % , male 8.333% , and butchers 7.5% in addition to veterinarians which they were in a warning prevalence rate 7.228 % .

6. Conflict of Interest

The authors declare that there is no conflict of interest.

7. Funding

The study was conducted by the researchers' self-funding, and there is no financial support for this research from any entity.

References

- 1- Shahhosseini, N., Wong, G., Babuadze, G., Camp, J. V., Ergonul, O., Kobinger, G. P., ... & Nowotny, N. (2021). Crimean-Congo hemorrhagic fever virus in Asia, Africa and Europe. *Microorganisms*, 9(9), 1907.
- 2- Hawman, D. W., & Feldmann, H. (2023). Crimean-Congo haemorrhagic fever virus. *Nature Reviews Microbiology*, 21(7), 463-477.
- 3- Al-Abri, S.S.; Al Abaidani, I.; Fazlalipour, M.; Mostafavi, E.; Leblebicioglu, H.; Pshenichnaya, N.; Memish, Z.A.; Hewson, R.; Petersen, E.; Mala, P. Current status of Crimean-Congo haemorrhagic fever in the World Health Organization Eastern Mediterranean Region: Issues, challenges, and future directions. *Int. J. Infect. Dis.* **2017**, *58*, 82–89. [[Google Scholar](#)] [[CrossRef](#)] [[PubMed](#)] [[Green Version](#)]
- 4- Temur, A.I.; Kuhn, J.H.; Pecor, D.B.; Apanaskevich, D.A.; Keshtkar-Jahromi, M. Epidemiology of Crimean-Congo hemorrhagic fever (CCHF) in Africa-Underestimated for decades. *Am. J. Trop. Med.*

- Hyg.* **2021**. [Google Scholar] [CrossRef] [PubMed]
- 5- Maltezou, H.; Andonova, L.; Andraghetti, R.; Bouloy, M.; Ergonul, O.; Jongejan, F.; Kalvatchev, N.; Nichol, S.; Niedrig, M.; Platonov, A. Crimean-Congo hemorrhagic fever in Europe: Current situation calls for preparedness. *Eurosurveillance* **2010**, *15*, 19504. [Google Scholar] [CrossRef]
 - 6- Spengler, J.R.; Bergeron, É.; Rollin, P.E. Seroepidemiological studies of Crimean-Congo hemorrhagic fever virus in domestic and wild animals. *PLoS Negl. Trop. Dis.* **2016**, *10*, e0004210. [Google Scholar] [CrossRef] [Green Version]
 - 7- Champour, M.; Chinikar, S.; Mohammadi, G.; Razmi, G.; Mostafavi, E.; Shahhosseini, N.; Khakifirouz, S.; Jalali, T. Crimean-Congo hemorrhagic fever in the one-humped camel (*Camelus dromedarius*) in East and Northeast of Iran. *J. Arthropod-Borne Dis.* **2016**, *10*, 168. [Google Scholar]
 - 8- Deubel, V.; Murgue, B.; Service, M. *Dengue. Service MW. The Encyclopedia of Arthropod-Transmitted Infections*; CAB International: Wallingford, UK, 2001; pp. 133–143. [Google Scholar]
 - 9- Bodur, H.; Akinci, E.; Ascioglu, S.; Öngürü, P.; Uyar, Y. Subclinical infections with Crimean-Congo hemorrhagic fever virus, Turkey. *Emerg. Infect. Dis.* **2012**, *18*, 640. [Google Scholar] [CrossRef]
 - 10- Ergönül O. Crimean-congo haemorrhagic fever. *Lancet Infect Dis.* (2006) 6:203–14. doi: 10.1016/S1473-3099(06)70435-2
 - 11- Balinandi, S. et al. Clinical and molecular epidemiology of Crimean-Congo hemorrhagic fever in humans in Uganda, 2013–2019. *Am. J. Trop. Med. Hyg.* **106**, 88–98 (2021).
 - 12- Midilli, K. et al. The first clinical case due to AP92 like strain of Crimean-Congo hemorrhagic fever virus and a field survey. *BMC Infect. Dis.* **9**, 90 (2009).
 - 13- Gunes, T. et al. Crimean-Congo hemorrhagic fever virus in high-risk population, Turkey. *Emerg. Infect. Dis.* **15**, 461–464 (2009).

- 14-Msimang, V. et al. Risk factors associated with exposure to Crimean-Congo haemorrhagic fever virus in animal workers and cattle, and molecular detection in ticks, South Africa. *PLoS Negl. Trop. Dis.* **15**, e0009384 (2021).
- 15-Elaldi, N. et al. Efficacy of oral ribavirin treatment in Crimean-Congo haemorrhagic fever: a quasi-experimental study from Turkey. *J. Infect.* **58**, 238–244 (2009).
- 16-Hoogstraal, H. Review article: the epidemiology of tick-borne Crimean-Congo hemorrhagic fever in Asia, Europe, and Africa. *J. Med. Entomol.* **15**, 307–417 (1979).
- 17-Mallhi, T. H., Khan, Y. H., Sarriif, A. & Khan, A. H. Crimean-Congo haemorrhagic fever virus and Eid-ul-Adha festival in Pakistan. *Lancet Infect. Dis.* **16**, 1332–1333 (2016).
- 18-Leblebicioglu, H. et al. Consensus report: preventive measures for Crimean-Congo hemorrhagic fever during Eid-al-Adha festival. *Int. J. Infect. Dis.* **38**, 9–15 (2015).
- 19-Belay ED, Kile JC, Hall AJ, Barton-Behravesh C et al. . Zoonotic disease programs for enhancing global health security. *Emerg Infect Dis.* 2017;23:S65–70.
- 20-Al-Rubaye, D., Al-Rubaye, T. S., Shaker, M., & Naif, H. M. (2022). Recent outbreaks of crimean–congo hemorrhagic fever (CCHF) In Iraq. *Sci Arch*, 3, 109-112.
- 21-Aslani, D., Salehi-Vaziri, M., Baniyadi, V., Jalali, T., Azad-Manjiri, S., Mohammadi, T., ... & Fazlalipour, M. (2017). Crimean-Congo hemorrhagic fever among children in Iran. *Archives of virology*, 162, 721-725.
- 22-Fatemian, Z., Salehzadeh, A., Sedaghat, M. M., Telmadarraiy, Z., Hanafi-Bojd, A. A., & Zahirnia, A. H. (2018). Hard tick (Acari: Ixodidae) species of livestock and their seasonal activity in Boyer-Ahmad and Dena cities of Kohgiluyeh and Boyer-Ahmad Province, Southwest of Iran. *Veterinary World*, 11(9), 1357.
- 23-Ertugrul, B., Uyar, Y., Yavas, K., Turan, C., Oncu, S., Saylak, O., ... & Sakarya, S. (2009). An outbreak of Crimean-Congo hemorrhagic fever in western Anatolia, Turkey. *International Journal of*

- Infectious Diseases*, 13(6), e431-e436.
- 24-Kuehnert, P. A., Stefan, C. P., Badger, C. V., & Ricks, K. M. (2021). Crimean-Congo hemorrhagic fever virus (CCHFV): a silent but widespread threat. *Current Tropical Medicine Reports*, 8, 141-147.
 - 25-Messina JP, Pigott DM, Golding N, Duda KA, Brownstein JS, Weiss DJ, et al. The global distribution of Crimean-Congo hemorrhagic fever. *Trans R Soc Trop Med Hyg.* 2015;109(8):503–13.
 - 26-Gargili A, Estrada-Peña A, Spengler JR et al. . The role of ticks in the maintenance and transmission of Crimean-Congo hemorrhagic fever virus: A review of published field and laboratory studies. *Antiviral Res.* 2017;144:93–119.
 - 27-Riccò, M., Baldassarre, A., Corrado, S., Bottazzoli, M., & Marchesi, F. (2023). Seroprevalence of Crimean Congo hemorrhagic fever virus in occupational settings: Systematic review and meta-analysis. *Tropical Medicine and Infectious Disease*, 8(9), 452.
 - 28-Abul-Eis, E. S., Mohammad, N. A., & Wasein, S. M. (2012). Crimean-Congo hemorrhagic fever in Iraq during 2010. *Iraqi. J. Vet. Med*, 36, 99-103.
 - 29-Aziz, T. A., Ali, D. J., & Jaff, D. O. (2016). Molecular and serological detection of Crimean-Congo hemorrhagic fever virus in sulaimani province, Iraq. *Journal of Biosciences and Medicines*, 4(4), 36-42.
 - 30-Atwan, Z., Alhilfi, R., Mousa, A. K., Rawaf, S., Torre, J. D., Hashim, A. R., ... & Tabche, C. (2024). Alarming update on incidence of Crimean-Congo hemorrhagic fever in Iraq in 2023. *IJID regions*, 10, 75-79.
 - 31-Sorvillo, T. E., Rodriguez, S. E., Hudson, P., Carey, M., Rodriguez, L. L., Spiropoulou, C. F., ... & Bente, D. A. (2020). Towards a sustainable one health approach to crimean-congo hemorrhagic fever prevention: Focus areas and gaps in knowledge. *Tropical Medicine and Infectious Disease*, 5(3), 113.

التحري عن معدل الانتشار المصلي لحمى القرم الكونغو النزفية في الأشخاص المهنيين في محافظة نينوى ،العراق

رائد ادريس محمد¹، نهاد عبد الحسين جعفر² ،عبدالله عبدالعزيز خليل شيحان³

فرع الاحياء المجهرية ، كلية الطب البيطري ، جامعة تكريت، تكريت، العراق^{1,2}

فرع الاحياء المجهرية ، كلية الطب البيطري ، جامعة الموصل، الموصل ، العراق³

الملخص

حمى القرم-الكونغو النزفية (CCHF) أحد الأمراض الفيروسية حيوانية المنشأ المنقولة بواسطة القراد والتي يمكن أن تصيب الحيوانات والبشر على حد سواء. كل الأشخاص ذوي المهن الذين هم على اتصال مباشر بالحيوانات معرضين لخطر كبير . يصيب المرض الحيوانات بالشكل الصامت والإنسان بالنوع الحاد. الجزارين 120 عينة والأطباء البيطريين 83 عينة كانت مجموعتان بشرية ذوي مهن تعمل مع الحيوانات كانت مستهدفة في دراستنا. أظهرت النتائج ان نسبة الانتشار المصلي الموجب كانت لأمصال الجزارين (120/9) 7.5% والأطباء البيطريين (83/6) 7.228% لمرض CCHF مقاسة بواسطة اختبار الاليزا. أعلى النتائج المسجلة كانت حسب العمر : الجزارين (19/2) 10.526% بأعمار أقل من 30 سنة سجل الأطباء البيطريون (36/4) 11.111% بعمر 33 سنة -43 سنة. حسب الشهادة العلمية: الجزارون الاميين وخريجي المتوسطة (11/2) 18.181% والأطباء البيطريين الحاصلين على الشهادة الجامعية الاولى (43/5) 11.627%. وأخيراً حسب نوع المعيشة: الجزارون (78/8) 10.256% والأطباء البيطريون (28/5) 17.857% الذين كانوا يعيشون في الأقضية والنواحي أعطوا أعلى النتائج على عكس أولئك الذين يعيشون في وسط المدينة. استنتج من هذه الدراسة ان مرض حمى القرم-الكونغو النزفية (CCHF) كانت موجودة في محافظة نينوى في العراق وتوزعت في جميع أنحاء المحافظة في مجموعتين مهنية شملت كل من الجزارين والأطباء البيطريين الذين استهدفوا في الدراسة.

الكلمات المفتاحية : CCHF ، الأشخاص المهنيون ، معدل الإصابة ، ELISA ، القراد