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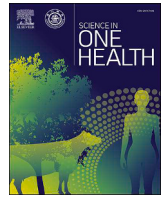
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Review

Tick threats in the context of climate change: One Health response strategies in the Middle East and North Africa region



Nighat Perveen^{a,b}, Olivier Sparagano^c, Mohamed Gharbi^{d,e}, Gulfaraz Khan^f, Moneeb Qablan^b, Daniil Iliashevich^b, Uday Kishore^{b,g}, Arve Lee Willingham^{b,*}

^a Department of Biology, College of Science, United Arab Emirates University, Al-Ain, P.O. Box 15551, United Arab Emirates

^b Department of Veterinary Medicine, College of Agriculture and Veterinary Medicine, United Arab Emirates University, Al-Ain, P.O. Box 15551, United Arab Emirates

^c UK Management College, Manchester, M11 1AA, UK

^d Ecole Nationale de Médecine Vétérinaire de Sidi Thabet Ariana, Sidi Thabet, Tunisia

^e UniLaSalle, IDEALISS ULR 7519, Université d'Artois, 76130, Mont-Saint-Aignan, France

^f Department of Microbiology & Immunology, College of Medicine and Health Sciences, United Arab Emirates University, Al-Ain, P.O. Box 15551, United Arab Emirates

^g Zayed Bin Sultan Center for Health Sciences, United Arab Emirates University, Al Ain, P.O. Box 15551, United Arab Emirates

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ABSTRACT

The Middle East and North Africa (MENA) region faces considerable challenges from ticks and tick-borne diseases (TBDs), exacerbated by climate change and its impact on human and animal health, as well as overall productivity. To address these interconnected issues, the United Arab Emirates University, located in Al Ain, Abu Dhabi Emirate, United Arab Emirates (UAE), hosted a multinational, transdisciplinary One Health symposium on climate change, ticks, and tick-borne diseases. The event brought together experts from across the region and beyond, featuring seven invited speakers who explored a wide range of topics, including climate change, TBDs of humans and animals, tick research in the UAE, and the One Health approach. The symposium highlighted major knowledge and research gaps, particularly in underexplored areas such as acaricide resistance, tick vaccine development, tick–pathogen interactions, wildlife–livestock interfaces, and the circulation and movement of tick-borne pathogens across the region. Discussions underscored the heavy burden of ticks and TBDs in the MENA region and their complex economic and public health implications. Participants emphasized the need for regional collaboration, enhanced tick surveillance, pathogen detection, and integrated management strategies. The symposium also encouraged the establishment of future alliances and partnerships among universities, government departments, and research institutions to foster joint research projects, resource sharing, and knowledge exchange. Within the One Health paradigm, participants concluded that regional priorities should focus on identifying and understanding tick-related problems, strengthening cross-sectoral cooperation, utilizing regional expertise and infrastructure, and engaging all stakeholders including the public in sustainable tick and TBD management. This collaborative approach is essential to mitigate the multifaceted challenges posed by ticks, tick-borne pathogens, and a changing climate in the MENA region.

1. Introduction

In December 2023, the United Arab Emirates University (UAEU)'s Department of Veterinary Medicine, College of Agriculture and Veterinary Medicine and Department of Biology, College of Science hosted a

multinational symposium entitled “Climate Change, Ticks and Tick-borne Diseases: A One Health Approach”, on the UAEU campus in Al Ain, Abu Dhabi Emirate, the United Arab Emirates (UAE).

The Symposium participants echoed the view that the One Health approach is of paramount importance to address various issues

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* Corresponding author.

E-mail addresses: nighat.p@uaeu.ac.ae (N. Perveen), olivier.sparagano@ukmc.ac.uk (O. Sparagano), gharbim2000@yahoo.fr (M. Gharbi), g_khan@uaeu.ac.ae (G. Khan), m.gablan@uaeu.ac.ae (M. Qablan), daniil_l@uaeu.ac.ae (D. Iliashevich), uday.kishore@uaeu.ac.ae (U. Kishore), awillingham@uaeu.ac.ae (A.L. Willingham).

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associated with ticks and tick-borne diseases, and endorsed the American Veterinary Medical Association's definition that "One Health is the integrative effort of multiple disciplines working locally, nationally, and globally to attain optimal health for people, animals, and the environment" [1]. The UAEU also recommends the One Health Commission's charter at local level, educate and create networks to improve health outcomes and well-being of humans, animals and plants and to promote environmental resilience through a collaborative, global One Health approach [2,3]. The aim of the symposium was to update on recent developments, foster potential future inter-disciplinary collaborations, and develop ideas leading to joint research projects in the field of ticks, tick-borne diseases (TBDs), and related areas.

The UAEU recognizes that One Health efforts in the Middle East and North Africa (MENA) region are required to combat the burden of zoonotic diseases and the threat to the region's biodiversity (terrestrial and marine). Thus, the speakers covered diverse topics including introduction to tick research at the local and regional levels, climate change impacts on ticks and TBDs, dromedary ticks and vector-borne pathogens in dromedary camels, Crimean-Congo hemorrhagic fever (CCHF), host-pathogen interaction in arthropod vectors, and the One Health Approach and a panel discussion (see the names of participants listed in Appendix A and symposium agenda in Appendix B). The dialogue centered on the way forward in the areas of environmental and climatic aspects in relation to tick-borne pathogens, animal health, and food safety in the region, and the implications of TBDs for human health in the MENA region.

2. Key themes and discussions

2.1. Environmental and climatic aspects of the MENA region and tick-borne pathogens

Arve Lee Willingham set the tone by highlighting the importance of conducting extensive research related to One Health (animal–human–environment interface, zoonoses, food safety, and antimicrobial resistance), food security (health management of food-producing animals: livestock, poultry, fish, and bees), and sustaining biodiversity (conservation medicine, wildlife health—terrestrial and aquatic). He emphasized that One Health is a collaborative, multisectoral, and transdisciplinary approach that operates across various levels to achieve optimal health and well-being by recognizing the interconnectedness of people, animals, plants, and their shared environment. The MENA region is widely regarded as one of the most climate-vulnerable parts of the world, confronting rapidly rising temperatures, worsening water scarcity, and more frequent and intense extreme weather events [4,5]. The region is already experiencing water stress, with climate change projected to exacerbate this problem through reduced precipitation and higher evapotranspiration rates. At the same time, heatwaves, droughts, and episodic floods are becoming more common, placing increased stress on agriculture, ecosystems, and human health [6]. As the MENA is a hyper-arid region, livestock have historically been maintained in the region at low levels due to the harsh environmental circumstances. However, with the recent increase in human population and availability of advanced technologies, especially in the Middle East, the livestock industry in the region is increasing dramatically. He further discussed that ticks and tick-borne pathogens in the MENA region are of increasing concern due to their potential impact on food security and public health. The example of the United States was used where incidences of TBDs have been on the rise possibly due to changes in climate (temperature, rainfall, and humidity), host populations, tick population densities, and geographic ranges, as well as health care provider awareness. The U.S. Centers for Disease Control and Prevention reported that in the United States in 2007, about 32,000 people were estimated to have had tick-borne infections, which rose to about 49,000 by 2016, and to about 59,000 in 2017—an increase of more than 20 % in just one year; nearly 70 % of these cases were Lyme disease [7–9]. Other diseases included

anaplasmosis/ehrlichiosis, spotted fever rickettsiosis, babesiosis, tularemia, and Powassan virus infection with tick-borne infections now accounting for more than 75 % of all reported vector-borne disease (VBD) cases in the United States [8,9]. While the United States has seen a clear upward trajectory in reported TBD cases—rising from ~32,000 in 2007 to ~59,000 in 2017, the majority of which are attributable to Lyme disease [7–9], the epidemiological profile in the MENA region is strikingly different in both scale and disease composition. In contrast to the dominance of Lyme disease in reports of the United States, MENA human TBD data are dominated by CCHF and rickettsial disorders [10,11]. For example, Iraq documented 986 confirmed CCHF cases between 2021 and 2023, with a case fatality rate of ~16.8 % [12,13]. In 2025 alone, Iraq has already reported 231 CCHF cases and 30 deaths [14]. On the veterinary side, theileriosis is a major burden: *Theileria annulata* infects cattle across the MENA region, putting an estimated 250 million bovines at risk [10,15]. High rates of infection and enzootic stability in many farms (carrier animals) are common in North Africa [16]. These MENA numbers, though serious, are much lower in magnitude compared to data from the United States—reflecting both differences in surveillance systems and disease ecology. Moreover, while TBD reporting in the United States is heavily centered on pathogens like *Borrelia burgdorferi*, the MENA region's priorities and research gaps revolve around tick-virus dynamics, acaricide resistance, vector control, and interspecies transmission—areas for which systematic, region-wide temporal trend data remain comparatively scarce. He concluded that to better understand the risk of emergence/re-emergence of TBDs requires continued research on ticks and tick-borne microbes in the UAE and MENA region, optimal environmentally friendly control measures to prevent disease transmission, and improved tick management and mitigation strategies. An interdisciplinary approach is required to investigate ecological determinants, deploy molecular tools using genetics and genomic approaches, as well as implement appropriate monitoring and surveillance methodology for ticks and tick-borne microbes.

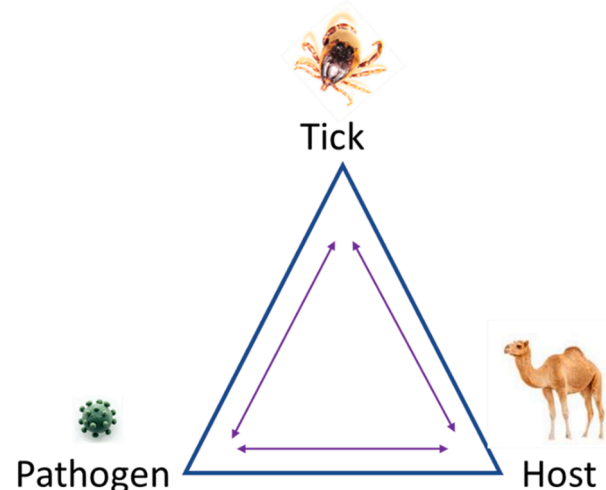


Fig. 1. The tick–host–pathogen triangle illustrating the relationship between ticks, their animal hosts, and transmitted pathogens. At the top of the triangle is the tick, serving as the vector that acquires and transmits pathogens. On the bottom right, the host (in this case, a dromedary camel) provides blood meals necessary for tick survival and reproduction. On the bottom left, the pathogen (bacteria, viruses, and parasites) are the disease-causing agents maintained and transmitted through tick–host interactions. The arrows between each component indicate bidirectional interactions—ticks transmit pathogens to hosts, hosts serve as reservoirs for pathogens, and environmental and biological factors influence tick populations and pathogen circulation. This model underscores the complex ecology of tick-borne diseases and the importance of One Health approaches in managing vector–host–pathogen dynamics.

Olivier Sparagano discussed the One Health tick–host–pathogen triangle (Fig. 1), host movements, control-treatment-prevention, and vectors with multiple infections. Ticks act as vectors, transmitting pathogens to animal and human hosts, their biology, behavior, and habitat are influenced by factors such as climate, vegetation, and environmental changes, affecting disease spread [17]. Host accessibility and vegetation significantly modulate the dynamics of tick populations [18]. Hosts, including wildlife, livestock, pets, and humans, are infected during tick feeding, while host movements such as migration, trade, or land-use changes spread ticks and tick-harbored pathogens to new areas [19–21]. Pathogen transmission and outbreak depend on interactions between ticks, hosts, and environmental or genetic factors [22–24]. Tick control involves habitat management, pesticide use, and biological measures to reduce tick population, and treatment includes medications like antibiotics or antivirals, with early diagnosis becoming critical. Prevention focuses on vaccines (if available), repellents, protective clothing, and public health campaigns, while animals are protected with acaricides [25–31]. He further discussed that tick species such as *Rhipicephalus sanguineus* can be infected with multiple pathogens such as *Babesia canis* (canine babesiosis), *Ehrlichia canis* (canine ehrlichiosis), *Rickettsia conorii* (Mediterranean spotted fever), *Rickettsia rickettsia* (Rocky Mountain spotted fever), and *Hepatozoon canis* [32–35]. He concluded that the One Health approach integrates efforts across disciplines to manage the tick-host-pathogen triangle, addressing environmental, behavioral, and socio-economic factors to combat TBDs in humans, animals, and ecosystems [36,37]. Such an effort is acutely required in the MENA region to be put in place that enables understanding of the interrelationships within the triangle.

2.2. Impact on animal health and food safety: how ticks and tick-borne pathogens can affect animal health and food safety in the MENA region

Mohamed Gharbi discussed that the dromedary camel (*Camelus dromedarius*) is the only domestic species that has preserved its rusticity as well as its adaptation to aridity. Dromedaries can be infested by ticks, the majority of them being exophilic and ditropic. These two specificities make controlling dromedary camel ticks difficult since the larvae and nymphs of the majority of these ticks infest micromammals (Rodentia, Eulipotyphla, and Lagomorpha), while the non-parasitic stages are found in large open spaces. From a One Health point of view, the impact of dromedaries' ticks on the health of animals (dromedaries and other species), humans, and the environment should be investigated. He described that the tick fauna infesting dromedaries in the Sahara Desert is diverse as evidenced by a survey of 1902 *Hyalomma* ticks found on Tunisian dromedaries [38]. In Tunisia, the seroprevalence of anti-CCHF virus antibodies in dromedary camels is very high (89.7 %; 245/273) and this high seroprevalence needs further investigation to understand the epidemiological role of dromedaries in CCHF [39]. The presence of ticks in arid regions has a negative impact on the environment; for example, in the Sahara, there are several endangered wild mammals (e.g. antelopes and gazelles); thus, infestation by ticks and their infection by tick-borne pathogens represent a supplementary threat [40]. He explained the use of acaricides to control ticks has a negative impact on the environment since it affects microfauna, mesofauna and avifauna of the Sahara. The impact is very high; on one hand, these molecules are remnant in the environment, and on the other hand, the biomass of animals in the Sahara is low. Moreover, using acaricides that require mixing with water on animals will induce a contamination of the phreatic water and could even reach the fossil water of the Sahara. The periodic treatment of large herds of dromedaries with acaricides requires large volumes of precious water. It is important to use adapted galenic forms of acaricides. To date, the pour on formulation is the most adapted to the arid context since no water is required. When this galenic form of acaricide is not available, animal owners could apply diluted acaricides on the preferential fixation sites. Indeed, ticks have preferential fixation sites, mainly in the perineum (36.2 % of the ticks) and the

udder (18.4 % of the ticks), thus targeting these anatomical regions will dramatically reduce the requested volumes of acaricides [38]. The acaricides could be used with parsimony, with clear indications, periods (during which period of the year) and aim. For the last recommendation, the practitioner could discuss with the animal owner about the aim of this acaricide application, e.g. is it for the elimination of the pathogen, the elimination of the disease (anti-disease action), the elimination of the tick vector itself, or only target a decrease of the direct effect of the ticks (blood spoliation). Anti-tick vaccines were successfully developed to immunize cattle against *Rhipicephalus (Boophilus) microplus* in Australia and Latin America. The tick fauna in dromedaries is not limited to this species and a potential “pan-species” anti-tick vaccine is the ideal solution. To reduce the use of different acaricides and their negative impact of the tryptic (human, animal, and environment health), an integrated pest management approach could be used involving the preservation of the ecosystem (several animal species are predators of ticks, they reduce the biomass of mainly the exophilic tick stages but also the ticks attached to animals) and manual removal of ticks (when the tick biomass is small). General recommendations to reduce the impact of ticks and tick-borne infections of dromedaries include reducing the negative side effects of tick control actions, improving diagnostic capacity of tick-borne infections in dromedaries, and actions targeting animal and human health sectors including agronomists and dromedaries' owners. An alternative to the use of acaricides in the MENA region is especially warranted given its widespread implications on the One Health ecosystem.

Moneeb Qablan discussed the occurrence of vector-borne blood pathogens in dromedary camels in the UAE. Dromedary camels play a crucial role in the UAE's economy, food security, and cultural heritage. VBDs pose formidable threats to animal health and production, as well as the well-being of human populations (zoonoses). Investigating VBDs in dromedary camels is essential for disease prevention, early detection, and effective control. He briefly discussed that there is a dearth of studies addressing these VBDs in dromedary camels in the UAE. A recent study aimed at determining the occurrence and prevalence of selected VBDs using molecular biology tools and investigating the association between several risk factors and the incidence of acquiring VBDs identified *Trypanosoma* spp. and *Anaplasma* spp. in dromedary camels [41]. He further discussed that settled dromedary camel herds live in controlled environments, whereas transhumant herds frequently come into contact with urban areas, thus increasing exposure to ticks. Further work is required to study tick seasonality and the prevalence of TBDs in a longitudinal study, the phylogeographic distribution of pathogens at national level, and utilization of new technologies (e.g. next generation sequencing) [42–44].

Night Perveen discussed tick research in the UAE, highlighting major research gaps. She emphasized ticks as key global arthropod vectors transmitting numerous pathogens to humans and animals and noted that microclimatic factors and host abundance strongly influence their seasonal activity and distribution. For example, temperature and relative humidity play crucial roles in determining tick host-seeking behavior and survival rates. In the UAE, dromedary camels are vital livestock whose health is threatened by the tick *Hyalomma dromedarii*, a vector harboring diverse endosymbiotic and pathogenic microbes including viruses, bacteria, and protozoa that can transmit infections across host species [45]. Metagenomic approaches enable a comprehensive analysis of the entire tick microbiota, providing a more accurate assessment of microbial diversity [46]. Therefore, understanding tick species identification, their activity patterns and diversity, as well as detecting associated microbes, is essential for elucidating the mechanisms of pathogen transmission to animals and humans. Regarding ticks and TBDs of livestock in the MENA region, she reported taxonomic records of 55 tick species infesting livestock and 15 pathogens of veterinary importance, with CCHF, theileriosis, babesiosis, and anaplasmosis being the most widely distributed diseases in the region [10]. A study was conducted to assess the prevalence of tick species on different hosts,

four species were confirmed namely, *H. dromedarii*, *Hyalomma anatolicum*, *Rhipicephalus sanguineus*, and *Amblyomma lepidum*. *H. dromedarii* (94 %) was the most abundant species, followed by *H. anatolicum* (33 %). Camels were heavily infested (94 %) with ticks as compared to cattle (38 %), sheep (37 %), and goats (14 %) [47]. She further stated that in the UAE, most studies have focused on livestock ticks, whereas ticks associated with small mammals remain largely unassessed. She concluded that adequate surveillance is required to identify tick species serving as reservoirs of key pathogens. Further studies on the *H. dromedarii* life cycle, immature stages, and alternative hosts are needed to improve tick management. Investigating the ecological and functional roles of bacterial communities associated with *H. dromedarii* is also important. Enhanced monitoring of key genera posing health risks to dromedary camels and the livestock industry is crucial.

2.3. Implications of TBDs for human health

Gulfaraz Khan discussed CCHF in the UAE and the Arab World. He explained that CCHF, an arboviral disease, is endemic in several countries across Africa, Eastern Europe, and Asia. Transmission to humans occurs through tick bites or direct contact with the blood, tissues, or bodily fluids of infected wild or domestic animals, or other humans. A recent review analyzed the reported incidence of CCHF across 22 Arab countries to assess its epidemiology, modes of transmission, geographic distribution, mortality rates, and clinical characteristics. Three hundred twenty-one cases of CCHF were reported from 9/22 Arab countries (Fig. 2) with a case mortality rate of 29 % [11]. Slaughterhouse workers, livestock farmers, and health care workers are also at risk. He discussed that between 1994 and 2010, a total of 60 CCHF cases (56 males and 4 females) were reported from Dubai (15) and Fujairah (27) Emirates, with Indian/Pakistani/Bengali expatriates being the most affected (65 %) with a mortality rate of 61 %. In Iraq, there has been an alarming rise in the incidence of CCHF in 2023. Cases surged from 33 in 2021 to

511 by August 2023, spiking during holidays, suggesting cultural practices contribute to its spread, linking outbreaks to such factors as vector movement, climate change, and free animal trade [48]. He concluded that CCHF is a re-emerging zoonotic disease. Although the number of cases in the Arab world is relatively low, the mortality rate is high. No approved vaccine or antiviral drug is currently available. Raising public awareness about the mode of CCHF transmission is crucial to reduce its spread in affected areas. Additionally, support staff should receive extensive training to recognize potential cases and respond appropriately to prevent nosocomial transmission. High biosafety level laboratories (BSL-4) are essential for the rapid confirmation of suspected cases using reliable and cost-effective testing methods. Multidisciplinary collaboration at local and regional levels is indispensable to identify critical research gaps to prevent and control CCHF [11].

Uday Kishore discussed host-pathogen interaction in arthropod vectors and viral infections with special focus on ticks. He briefly explained the insect innate immune system and pathogen clearance mechanisms [49]. When an insect's immune system detects pathogen-associated molecular patterns (PAMPs) through PAMP-recognizing receptors, the invading pathogens are met with a complex network of humoral and cellular immune responses. The humoral response includes the production of antimicrobial peptides, reactive nitrogen intermediates, superoxide radicals, and the activation of enzymatic cascades that regulate processes such as clotting and melanization. The cellular immune response involves various haemocytes that help eliminate pathogens from the haemolymph, often by releasing toxic substances to neutralize them [50]. These immune responses occur within the haemocoel of the tick and collectively represent its innate immune system. He discussed several mechanisms that restrict infections, including phagocytosis, encapsulation, melanization, nodulation, lysis, RNA interference (RNAi), autophagy, and apoptosis. He further discussed acquisition, development, and transmission of

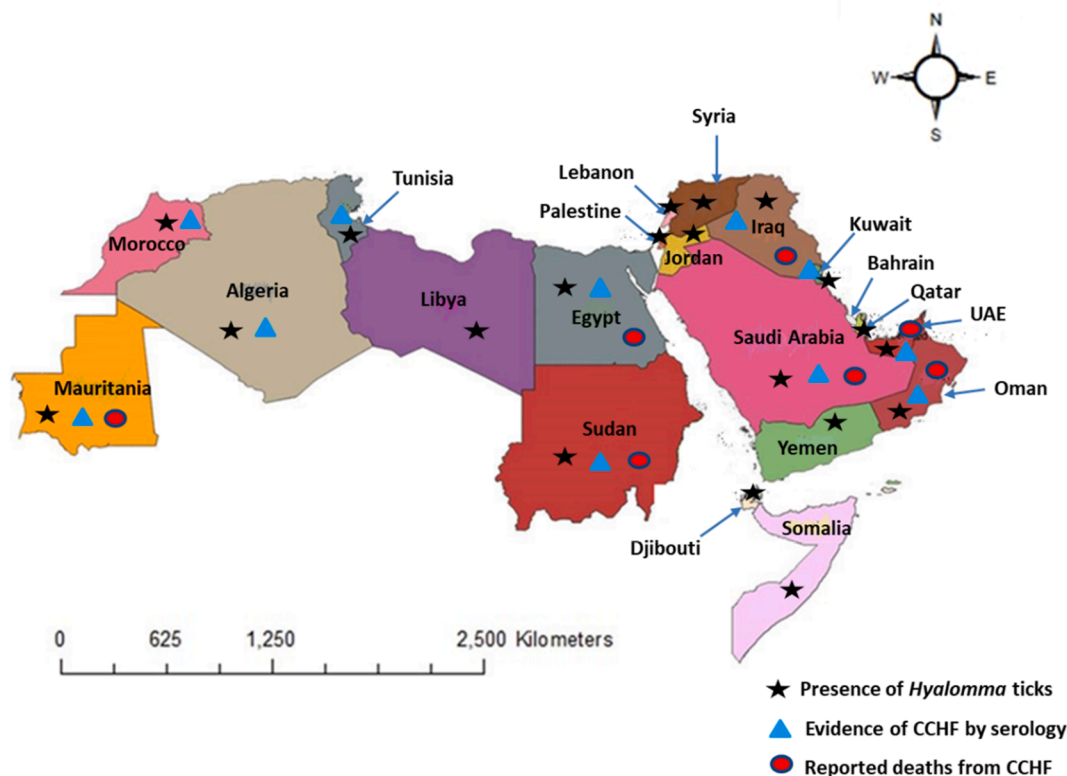


Fig. 2. Distribution of *Hyalomma* ticks, evidence of CCHF, and reported deaths from CCHF in the Arab world. The map is reused published under the Creative Commons Attribution 4.0 International (CC BY 4.0) License in our studies [10,11].

pathogens by ticks, cellular infiltration at the site of tick bite, immunomodulation of the host immune response by tick saliva, and acquired tick resistance [51]. He talked about serpins and host–tick interaction, tick salivary serpins versus host complement and coagulation pathways, anti-inflammatory activities of tick salivary serpins, and modulation of adaptive immune response by tick salivary serpins [52]. He concluded that vaccines are unavailable for the majority of tick-borne viral diseases. Therefore, efforts should prioritize accurate diagnosis, effective treatment, and comprehensive vector control strategies to prevent the transmission and spread of these viruses. The tick immune system and its antiviral defense mechanisms remain poorly understood. It is essential to investigate how the tick's innate immune system responds to viral infection and replication, as well as the mechanisms by which viruses are transmitted to healthy mammalian hosts.

3. Conclusion

In conclusion, the MENA region faces considerable challenges from ticks, TBDs, and climate change, all of which threaten the health of humans and animals. The One Health symposium brought together seven expert speakers who highlighted critical research gaps and opportunities for regional collaboration. Key underexplored areas identified included acaricide resistance, tick vaccine development, tick–pathogen interactions, wildlife–livestock interfaces, and the movement and circulation of tick-borne pathogens across borders. The discussions emphasized the need for stronger alliances in surveillance, pathogen detection, and integrated disease management. Participants also underscored the importance of fostering partnerships among institutions to share resources and expertise. Ultimately, the symposium aimed to raise awareness of the growing burden of TBDs and to promote a transdisciplinary One Health approach as the most effective pathway toward improved health, food security, and sustainability in the region.

CRedit authorship contribution statement

Nighat Perveen: Writing – review & editing, Writing – original draft, Methodology, Conceptualization, Investigation, Formal analysis. **Olivier Sparagano:** Writing – review & editing, Methodology, Investigation, Data curation. **Mohamed Gharbi:** Writing – review & editing, Methodology, Investigation, Formal analysis. **Gulfaraz Khan:** Writing – review & editing, Methodology, Investigation, Formal analysis. **Moneeb**

Appendix A. Participants

- Prof. Lee Willingham, Chair of Department of Veterinary Medicine, United Arab Emirates University, UAE
- Prof. Olivier Sparagano, UK Management College, Manchester M11 1AA, UK
- Prof. Mohamed Gharbi, Ecole Nationale de Médecine Vétérinaire de Sidi Thabet Ariana, Sidi Thabet, Tunisia
- Prof. Gulfaraz Khan, Department of Microbiology & Immunology, College of Medicine and Health Sciences, United Arab Emirates University, UAE
- Prof. Uday Kishore, Department of Veterinary Medicine, and Zayed Center for Health Sciences, United Arab Emirates University, UAE
- Dr. Moneeb Qablan, Department of Veterinary Medicine, United Arab Emirates University, UAE
- Dr. Nighat Perveen, Department of Biology, College of Science, United Arab Emirates University, UAE
- Daniil Iliashevich, Department of Veterinary Medicine, United Arab Emirates University, UAE

Appendix B. Symposium agenda

Symposium title: Climate Change, Ticks and Tick-borne Diseases: A One Health Approach.

Date: 05 December 2023.

Time: 9.00 am **Duration:** 3.30 h.

Platform: United Arab Emirates University.

Co-Organised by: Department of Veterinary Medicine, College of Agriculture and Veterinary Medicine, and Department of Biology, College of Science, United Arab Emirates University, UAE.

Qablan: Writing – review & editing, Methodology, Investigation, Formal analysis. **Daniil Iliashevich:** Writing – review & editing, Methodology, Investigation, Conceptualization. **Uday Kishore:** Writing – review & editing, Methodology, Investigation, Formal analysis. **Arve Lee Willingham:** Writing – review & editing, Resources, Project administration, Funding acquisition, Conceptualization.

Authors' contributions

NP, ALW, OS, MG, and UK conceived the study. NP, ALW, UK and DI designed the study. NP wrote original draft. NP, ALW, UK, OS, MG, GK, and MQ reviewed and edited the manuscript. ALW supervised, administered the project and acquired funding.

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Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

Arve Lee Willingham reports financial support was provided by United Arab Emirates University College of Agriculture and Veterinary Medicine Department of Veterinary Medicine. Serves as Editorial Board Member of Science in One Health but given his role as Editorial Board member, had no involvement in the peer review of this article and had no access to information regarding its peer review. Full responsibility for the editorial process for this article was delegated to another journal editor. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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UAE Time	Presentation title	Speaker
9.00am–9.10am	Welcome Speech	Dr. Mohamad Abdul Muhsen Al-Yafei, Dean College of Agriculture and Veterinary Medicine, United Arab Emirates University, UAE
9.10am–9.30am	Introduction to the symposium	Prof. Arve Lee Willingham, Chair of Department of Veterinary Medicine, College of Agriculture & Veterinary Medicine, United Arab Emirates University, UAE
9.30am–10.15am	Climate change, ticks and tick-borne diseases: a One Health approach	Prof. Olivier Sparagano, UK Management College, Manchester M11 1AA, UK
10.15am–11.00am	Dromedary ticks—a One Health vision	Prof. Mohamed Gharbi, Ecole Nationale de Médecine Vétérinaire de Sidi Thabet Ariana, Sidi Thabet, Tunisia
11.00am–11.20am	Crimean-Congo hemorrhagic fever: UAE and the Arab world	Prof. Gulfaraz Khan, Department of Microbiology & Immunology, College of Medicine and Health Sciences, United Arab Emirates University, UAE
11.20am–11.40am	Host-pathogen interaction in arthropod vectors	Prof. Uday Kishore, Department of Veterinary Medicine, College of Agriculture & Veterinary Medicine and Zayed Center for Health Sciences, United Arab Emirates University, UAE
11.40am–12.00pm	The occurrence of vector-borne blood pathogens in dromedary camels in the United Arab Emirates	Dr. Moneeb Qablan, Department of Veterinary Medicine, College of Agriculture & Veterinary Medicine, United Arab Emirates University, UAE
12.00pm–12.15pm	Tick research in the UAE and the way forward	Dr. Nighat Perveen, Department of Biology, College of Science, United Arab Emirates University, UAE

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