



Case Report



The Outbreak of Foot and Mouth Disease Serotype Sat-2 Infection in Al-Muthanna Province of Iraq

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ABSTRACT

Introduction: Foot and mouth disease (FMD) is a highly viral contagious disease and is prevalent in the majority of developing nations.

Case report: The present study reported a foot and mouth disease Sat-2 outbreak in Al-Muthanna province in southern Iraq in March 2023. Three male Holstein Friesian cows, aged between 1 and 1.5 years and weighing approximately 550 ± 15 kg each, were affected. Clinical examination revealed symptoms, including fever, severe lameness, anorexia, depression, frothy salivation, and vesicular lesions on the mouth and feet. Confirmation of the Sat-2 serotype was achieved through serological testing and genotyping of the virus, conducted by the FMD Institute, Ankara, Türkiye. The Sat-2 serotype was recognized by genotyping the virus and submitting SAT-2 VP1 sequences. The treatments for secondary infection prevention included Ceftifur (2.2 mg/kg) for 5 days, and flunixin meglumine (2.2 mg/kg) for 2 days. The other animals that were not exposed to infected animals were vaccinated against FMD. Rigorous biosecurity measures were implemented, involving thorough disinfection of the environment and quarantine of the infected animals. Direct contact between the farmer and other animals, particularly the sick ones, was completely avoided. After 2 weeks, all infected animals began to eat normally again, and clinical signs disappeared. Notably, other animals on the farm did not exhibit any signs of FMD.

Conclusion: In conclusion, the findings of this study underscore the importance of biosecurity measures and vaccination in FMD prevention. Additionally, administering antibiotics and non-steroidal anti-inflammatory drugs for the prevention of secondary infections proves to be crucial.

1. Introduction

Foot and mouth disease (FMD) is a highly contagious global livestock disease that causes significant losses in livestock production across Asia, the Middle East, and Africa¹. It is a viral disease that affects more than 70 animal species, including cattle, pigs, sheep, goats, water buffalo, and wild ruminants. It is clinically recognized by lesions in the mouth and feet of ungulates². The causative agent of FMD is the *aphthovirus*, a genus of the Picornaviridae family³. Serologically, seven serotypes have been recognized, including A, O, C, Asia 1, Sat 1, 2, and 3; each serotype contains some subgroups^{3,4}. Diagnosis typically involves methods, such

as the isolation of the FMD virus, PCR, ELISA, and sequencing the genome of the virus⁵. Foot and mouth disease is endemic in many countries and causes outbreaks that impact the economy⁶. To effectively eliminate and control FMD, a comprehensive approach is required, including the implementation of vaccination plans and the enforcement of restrictions on animal transportation. It is crucial to recognize that current FMD vaccines must be continuously enhanced to bolster their protective efficacy, given the diverse range of FMD serotypes^{7,8}. Foot and mouth disease has been increasing in the majority of Iraq provinces⁹⁻¹¹. According to the World

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Reference Laboratory website produced by FAO, FMD serotypes detected in Iraq included A, O, C, Asia 1, Sat-1, and recently Sat-2¹². It should be noted that SAT 1, SAT 2, and SAT 3 are the only three serotypes found exclusively in Africa⁶. The Sat-2 serotype was described in January 2023¹³ for the first time in northern Iraq, and then in February 2023, FMD cases appeared in many provinces in the north, middle, and south of Iraq, however, O serotype was not reported at this time¹³. In mid-March, FMD cases appeared in al-Muthanna, affecting cattle and sheep with severe clinical signs. The current case report aimed to determine the clinical characteristics of a newly identified FMD serotype and develop treatment strategies to treat the infected animals.

2. Case report

In March 2023, three male Holstein Friesian cows aged 1-1.5 years, with an average weight of 550 ± 15 kg, were observed with clinical signs suggestive of FMD infections at the veterinary hospital of Al-Muthanna province, Iraq. These signs included fever, severe lameness, anorexia, depression, frothy salivation, and vesicular lesions on the mouth and feet (Figures 1 and 2).

Foot and mouth disease cases were identified through physical examinations and history-taking. The serological and confirmatory tests for the outbreaks occurring in various Iraqi provinces were conducted by the FMD Institute, Ankara, Türkiye. The Sat-2 serotype was identified by genotyping the virus and submitting SAT-2 VP1 sequences. Detailed information on each animal, including age, sex, breed, body condition score, rectal temperature, clinical signs, and treatment were all documented⁹. Pathognomonic clinical symptoms and lesions were used to distinguish FMD from other diseases, such as vesicular stomatitis, bovine viral diarrhea, actinobacillosis, rinderpest, blue tongue, and foot rot¹⁹. Other animals that were not exposed to infected animals were vaccinated (Vetall, turkey) against FMD. Biosecurity measures were rigorously adhered to, ensuring that the environment was thoroughly disinfected and the infected animals were placed under quarantine. Additionally, all contact between the farmer and other animals, particularly



Figure 1. Foot and mouth disease lesion at the heel bulb of a male Holstein Friesian cow aged 1 year old



Figure 2. Burst vesicle in the inner aspect of the lower lip in the mouth of a male Holstein Friesian cow with age 1.5 years old

the sick animals, was completely severed. After 2 weeks, all infected animals started to eat and clinical signs disappeared. Foot and mouth disease is a viral disease with no specific treatment, so treatment depends on the alleviation of clinical signs and the prevention of secondary infections in infected animals. The treatment plan involved administering Ceftiofur (2.2 mg/kg once daily; Fortis Pharma, Ukraine) IM for 5 days and Flunixin Meglumine (2.2 mg/kg body weight; Uvedco, Jordan) intramuscularly twice a day for 3 days^{19,26,27}. For hoof disinfection, 5% copper sulfate salts (Vapco, Jordan) were used as a dipping solution applied after cleaning the area. After 2 weeks, the animals returned to feeding gradually and clinical signs disappeared.

3. Discussion

Foot-and-mouth disease is prevalent in many developing countries and is considered one of the global diseases that impact the economy of livestock significantly¹⁴. The Veterinary Directorate in Iraq immediately notified the World Organization for Animal Health about new FMD outbreaks, suggesting the possibility of a new sublineage or the emergence of a local sublineage due to insufficient immunological coverage, based on clinical findings. Subsequently, the SAT-2 serotype was confirmed by gene sequencing and real-time PCR¹⁵. Test results for samples obtained from Egypt, Ethiopia, Iraq, and Jordan have been announced by the World Reference Laboratory for Foot-and-Mouth Disease (WRLFMD). A total 36 outbreaks of FMD type SAT-2 were documented across the country in January 2023. The FMD Institute, Ankara, Turkey, submitted five FMD-type SAT 2 VP1 sequences in total between February 2 and February 14, 2023. Samples taken from water buffalo and cattle in the Nineveh and Baghdad governorates in December 2022 and January 2023 revealed the emergence of FMD SAT-2 cases. Subsequently, additional cases of FMD SAT-2 were isolated from cattle and water buffalo in six provinces, as reported by the Central Veterinary Laboratories in Baghdad, Iraq¹⁶. The clinical signs detected in this report are in agreement with the study of Lyons et al. (2015)¹⁷.

Foot and mouth disease has no specific treatment although clinical and supportive therapy are typically used to limit the complications of infection¹⁸. Preventive medications are used to treat secondary bacterial infections, such as antibiotics like amoxicillin, sulphonamide, oxytetracycline, ampicillin, cloxacillin, and metronidazole^{18,20-22}, in combination with Flunixin Meglumine that decrease body temperature in infected cattle^{19,21}. Pheniramine maleate has been used in another study¹⁶ to decrease irritation and relief symptoms of stomatitis, sore lip, and mouth, and decrease salivation and mucus secretion²⁷. Severe laminitis as a result of FMD vesicles treated with Copper sulfate 5% used as an antiseptic solution^{18,23}. Vaccines become less effective as the FMD virus often undergoes ongoing alterations that lead to antigenic diversity and the emergence of new FMDV topotypes and lineages^{24,25}.

4. Conclusion

The obtained results of the study indicated that some animals on the farm did not show any sign of FMD. As indicated, biosecurity measures and vaccination are very important in the prevention of FMD. In addition, treatment with antibiotics and non-steroidal anti-inflammatory drugs for the prevention of secondary infection is highlighted as crucial. Given these findings, further studies are warranted to develop comprehensive prevention strategies for FMD.

Declarations

Competing interests

There is no competing interest to declare.

Authors' contributions

Each author has directly contributed to the design of this work. Ali Nasser and Husien Abbas took part in clinical examination, treatment, and gathering data. Muna Tawfeeq and Ghasaq Sami writing up the completed manuscript and text editing. The final manuscript was read and approved by all authors.

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Availability of data and materials

All data and materials applicable to this article are available in this study.

Ethical Considerations

The authors affirm that this work is original and hasn't been submitted for publication anywhere else. The authors further state that no falsified data was used or reported in this study.

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References

- Nikiforov V, Shcherbakov A, Chvala I, Kremenchugskaya S, Korennoy F, Mayorova T, et al. Insights into the molecular epidemiology of foot-and-mouth disease virus in Russia, Kazakhstan, and Mongolia in terms of O/ME-SA/Ind-2001e sublineage expansion. *Viruses*. 2023; 15(3): 598. DOI: [10.3390/v15030598](https://doi.org/10.3390/v15030598)
- Garcia ML, and Romanowski V. *Viral genomes*. Rijeka: IntechOpen; 2012. Available at: [10.5772/1346](https://doi.org/10.5772/1346)
- Grubman MJ, and Baxt B. Foot-and-mouth disease. *Clin Microbiol Rev*. 2004; 17(2): 465-493. DOI: [10.1128/cmr.17.2.465-493.2004](https://doi.org/10.1128/cmr.17.2.465-493.2004)
- Carrillo C, Tulman ER, Delhon G, Lu Z, Carreno A, Vagnozzi A, et al. Comparative genomics of foot-and-mouth disease virus. *J Virol*. 2005; 79(10): 6487-504. DOI: [10.1128/jvi.79.10.6487-6504.2005](https://doi.org/10.1128/jvi.79.10.6487-6504.2005)
- Longjam N, Deb R, Sarmah AK, Tayo T, Awachat VB, and Saxena VK. A brief review on diagnosis of foot-and-mouth disease of livestock: Conventional to molecular tools. *Vet Med Int*. 2011; 2011: 905768. DOI: [10.4061/2011/905768](https://doi.org/10.4061/2011/905768)
- Brito BP, Rodriguez LL, Hammond JM, Pinto J, and Perez AM. Review of the global distribution of foot and mouth disease virus from 2007 to 2014. *Transbound Emerg Dis*. 2017; 64(2): 316-332. DOI: [10.1111/tbed.12373](https://doi.org/10.1111/tbed.12373)
- Xiao C, Rajput ZI, Liu D, and Hu S. Enhancement of serological immune responses to foot-and-mouth disease vaccine by a supplement made of extract of cochinchina momordica seeds. *Clin Vaccine Immunol*. 2007; 14(12): 1634-1639. DOI: [10.1128/CI.00339-07](https://doi.org/10.1128/CI.00339-07)
- Arzt J, Juleff N, Zhang Z, and Rodriguez LL. The pathogenesis of foot-and-mouth disease I: Viral pathways in cattle. *Transbound Emerg Dis*. 2011; 58(4): 291-304. DOI: [10.1111/j.1865-1682.2011.01204.x](https://doi.org/10.1111/j.1865-1682.2011.01204.x)
- Mansour KA, Naser HH, and Hussain MH. Clinical, molecular detection and phylogenetic analysis study of local foot-and-mouth disease virus in Al-Qadisiyah province of Iraq. *Vet World*. 2018; 11(9): 1210-1213. DOI: [10.14202/2Fvetworld.2018.1210-1213](https://doi.org/10.14202/2Fvetworld.2018.1210-1213)
- Sheikh MB, Rashid PA, Raheem Z, Marouf AS, and Amin KM. Molecular characterization and phylogenetic analysis of foot and mouth disease virus isolates in Sulaimani province, Iraq. *Vet Res Forum*. 2021; 12(2): 247-251. DOI: [10.30466/2Fvfr.2019.101755.2424](https://doi.org/10.30466/2Fvfr.2019.101755.2424)
- Abd Hatem A, Ahmed Abdul Wahid Al Anbagi N, Al-Alo KZK, and Sabah Bustani G. Detection of antibody against non-structural proteins of foot-and-mouth disease virus in cattle in Najaf, Iraq. *Arch Razi Inst*. 2022; 77(3): 1185-1189. DOI: [10.22092/ARI.2022.357621.2074](https://doi.org/10.22092/ARI.2022.357621.2074)
- Westren and Central Asia (WRLFMD). Republic of Iraq. 2023; Available at: <https://www.wrlfmd.org/western-and-central-asia/iraq>
- Freath L, King D, Pacey A, and Bacigalupo S. Foot and mouth disease in the Middle East and North Africa. 2023; 2022: . Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1135999/Foot_and_Mouth_Disease_in_the_Middle_East_and_North_Africa.pdf
- Woldemariyam FT, Kariuki CK, Kamau J, De Vleeschauwer A, De Clercq K, Lefebvre DJ, et al. Epidemiological dynamics of foot-and-mouth disease in the Horn of Africa: The role of virus diversity and animal movement. *Viruses*. 2023; 15(4): 969. DOI: [10.3390/v15040969](https://doi.org/10.3390/v15040969)
- World Reference laboratory for foot-and-mouth disease (WRLFMD). Foot-and-mouth disease January-March 2023 quarterly report. 2023. p. 1-36. Available at: https://www.wrlfmd.org/sites/world/files/quick_media/WHOAH-FAO_FMD_Ref_Lab_Report_Jan-Mar_2023.pdf
- Alvi A, Javaid MK, Qamar W, Ahmed MH, and Ahmed A. Research article unusual case of foot and mouth disease in a ram (*Ovis aries*) in Pakistan and evaluation of symptomatic and supportive therapy. 2018; 7(3): 1342-1344. Available at: <https://journalijcrs.com/sites/default/files/issues-pdf/00937.pdf>
- World animal health information (WOAH). WAHIS portal: Animal health

- data. WAHIS events management, event 4856 Iraq – Foot and mouth disease virus. 2023. p. 1-3. Available at: <https://wahis.woah.org/#/in-review/4856?reportId=158900&fromPage=event-dashboard-url>
18. Lyons NA, Alexander N, Stärk KDC, Dulu TD, Rushton J, and Fine PE. Impact of foot-and-mouth disease on mastitis and culling on a large-scale dairy farm in Kenya. *Vet Res.* 2015; 46(1): 41. DOI: [10.1186/s13567-015-0173-4](https://doi.org/10.1186/s13567-015-0173-4)
 19. Radostits OM, Gay CC, Hinchcliff KW, Constable PD, Jacobs DE, Ikede BO, et al. *Veterinary medicine: A textbook of the diseases of cattle, sheep, pigs, goats and horses.* London: Elsevier Saunders; 2007. p. 966-994.
 20. Gakuya DW, Mulei CM, and Wekesa SB. Use of ethnoveterinary remedies in the management of foot and mouth disease lesions in a dairy herd. *Afr J Tradit Complement Altern Med.* 2011; 8(2): 165-169. DOI: [10.4314/ajtcam.v8i2.63204](https://doi.org/10.4314/ajtcam.v8i2.63204)
 21. Misk NA, Misk TN, and Rateb HZ. Assessment and topical treatment of lesions of foot and mouth disease in cattle. *Assiut Vet Med J.* 2015; 61(145): 75-81. DOI: [10.21608/avmj.2015.170185](https://doi.org/10.21608/avmj.2015.170185)
 22. Fakhrul-Islam KM, Shah Jalal M, Podder S, Quader N, Sahidur-Rahman, and Dutta A, et al. Short communication clinical investigation of foot and mouth disease of cattle in Batiaghata Upazilla veterinary hospital, Bangladesh. 2017; 2(3): 76-81. DOI: [10.17582/journal.vsrp/2016.2.3.76.81](https://doi.org/10.17582/journal.vsrp/2016.2.3.76.81)
 23. Trif E, Cerbu C, Olah D, Zăblău SD, Spînu M, Potârniche AV, et al. Old antibiotics can learn new ways : A systematic review of florfenicol use in veterinary medicine and future perspectives using nanotechnology. 2023; 13(10): 1695. DOI: [10.3390/ani13101695](https://doi.org/10.3390/ani13101695)
 24. Ilott MC , Salt JS, and Gaskell RMKR. Dexamethasone inhibits virus production and the secretory IgA response in oesophageal – pharyngeal fluid in cattle persistently infected with foot-and-mouth disease virus. 1997; 181-187. DOI: <https://doi.org/10.1017/S0950268896007376>
 25. Damaty HMEI, Fawzi EM, Neamat-allah ANF, Elsohaby I, Abdallah A, Farag GK, et al. Characterization of Foot and mouth disease virus serotype SAT-2 in swamp water buffaloes (*Bubalus bubalis*) under the Egyptian smallholder production system. 2021; 11(6): 1697. DOI: [10.3390/ani11061697](https://doi.org/10.3390/ani11061697)
 26. Apley MD. Clinical evidence for individual animal therapy for papillomatous digital dermatitis (hairy heel wart) and infectious bovine pododermatitis (foot rot). *Vet Clin Food Anim Pract.* 2015;31(1):81–95. <https://doi.org/10.1016/j.cvfa.2014.11.009>
 27. Joshi V., VikramR., Chamuah J. K., Vupru K., Khate K. and Khan M.H. Foot and Mouth Disease (FMD) in Mithun: Clinical Presentation and Management. Technical Bulletin, ICAR-National Research Centre on Mithun, Nagaland. 2021.<https://nrcmithun.icar.gov.in>.