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REVIEW

History and Prevention of Foot-and-Mouth Disease Virus in Iraq: A Review

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ABSTRACT

Foot-and-mouth disease Virus (FMDV) is an extremely transmittable viral illness that affects cloven-hoofed faunae, such as cattle, goats, sheep, and pigs. This study aimed to demonstrate the history and prevention of foot-and-mouth disease (FMD) in Iraq. This virus poses a significant threat to the economy, necessitating strict measures to control and prevent its spread, particularly due to its high morbidity and mortality rates, especially in young faunae. It is one of the most contagious diseases as it is transmitted directly or indirectly from a diseased fauna to a healthy one through contact with resources contaminated with the virus, such as saliva, feces, urine, and milk. As well extent by cars, birds, then humans, in addition to being spread by domestic and wild faunae that transport the causes for a lengthy period after their convalescence. It is also diffused via wind under proper climate situations. The FMD is endemic in Iraq, generally taking place since the late 19th then the primary 20th century. Avoidance of FMDV depends on immunization via the dominant serotype(s) otherwise the butchery in addition damage of affected faunae. Moreover, managing antibiotics and non-steroidal anti-inflammatory medications to stoppage of subordinate infections demonstrates as vital.

Keywords: Foot-and-mouth disease virus (FMDV), vaccination strategy, surveillance, veterinary public health, biosecurity

1. Introduction

Foot-and-mouth disease (FMD) is a greatly transmissible transboundary illness extensive to the Asian area, causes illness for overland and domestic artiodactyls [1]. This highly spreadable illness influences an extensive variety of cloven-hoofed faunas, for instance piglets, sheep, goats, camels, cattle, besides deer, initiating extensive economic harm in the farming subdivision global [2]. The disease is as result of a virus regard to the genus of Aphthovirus which is characterized by seven serotypes: C, O, A, SAT1, SAT2, SAT3, and Asia-1. Ongoing development of numerous FMDV serotypes is anticipated to activate several outbreaks with simultaneous infections in endemic areas [3]. The seven FMDV serotypes are

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change in their virulence, antigenic property, in addition host variety [4]. in India during 2001, some studies have indicated that the new strain may have Originated from a common breed in the region. It later converted pandemic elsewhere nation for instance Iran, Pakistan, Turkey, Jorden, UAE, Kuwait, Bahrain, possibly Lebanon also Egypt. Prior articles around genetic distinctive of FMD kind A in addition kind Asia-1 was achieved in Iraq [5]. FMD is a illness that has a chief effect on animal husbandry, regard to its greatly transmittable nature, as it possible to simply spread via interaction with diseased faunae, contaminated apparatuses of farm, vehicles, sartorial, or nutrient, in addition to wild and domesticated predators. FMD results in danger economic sufferers regard to decreased animal yield, trade limitations, and controller prices [1]. The disease can extend quickly via direct or indirect interaction through diseased faunae otherwise resources via midair. FMD is present as general within Africa, part position of South America, the Middle East then Asia, FMD-free nations lacking vaccination are permanently at outbreaks hazard. FMD avoidance and controllers are expensive then frequently bear via little- also lesser middle-income states [6].

FMD identification was significant for effective control, then avoidance of illness, in addition to avoiding social and economic influences. For trading blocks, was imposed via FMD-free states [7]. The recent diagnostic procedures for FMD, for example ELISA-based techniques in addition molecular techniques. FMD identification is possible to perform via identifying FMDV otherwise its particular antibodies for numerous tasters taking from faunae with medical marks or exposure of illness, such as liquid or biopsy of blisters, fluid of throat, saliva, milk or blood [8]. FMD avoidance relies on capability for identifying the illness primary, to caution states of other in addition to areas, and to observe the animal inhabitants for marks of contagion [9]. FMDV illnesses be long by antibiotics, nonetheless they do not free FMDV from the body. Antibiotics assistance diseased faunae stay longer, but they likewise rise the danger of virus stay and diffusion [1]. FMD has no particular drag while medical and helpful drug are characteristically utilized for limitation diseased problems [10]. FMDV can persistence in the epithelia of pharyngeal for not all faunae to extended time, creating them transporters of the illness. These transporters can pass on a disease to other animals via their secretions, either directly or indirectly [11]. Blocking measures vital; vaccine development challenges; precautionary running is essential in Asia [3]. The virus has in height genetic diversity, which decreases the efficacy of vaccination [12].

2. Symptoms

The clinical symptoms change depending on virulence of the virus, serotype, breed, besides immune defense of animal originated with fever then and there founding of vesicles or blisters, ulcers sores, in addition eruptions initiate in tongue, the mouth, lips, and muzzle/nostrils follows by hyper-salivation, the saliva hangs in long ropelike strings, when the animal are infected between the interdigital or above the hooves the reasons lameness, moreover when the teats infected usually lead to danger mastitis. The morbidity degree in height in adult faunae but mortality rate may be elevated in young regard to acute myocarditis [13]. The incubation period of FMD is vary also rely on the host, situation, method of acquaintance, and virus strain. It is significant to be conscious that faunae can spread the virus before the presence of clinical signs because animals have viruses in the pharynx and in the blood before illness is detected [14].

3. The transmission methods

The spread mechanism is revealed in the Fig. 1. FMD is principally spread via breath virus atoms from the inhalation of diseased faunae. Yet, the sickness can also extend via the air below definite circumstances. The virus can transport via the air below promising surroundings and also pass on a disease to faunae external separation districts, production hard for controller processes [15]. The virus can also extend non-directly via the situation if it is polluted by diseased faunae. The virus can stay alive for an elongated period lower than positive situations, for instance, lower than 50 ˚C of temperatures and relative moisture up to 55% [16]. This creates FMD epidemiology in addition controller difficult, by way of the virus can have numerous sources of contagion. The eliminations and discharges of diseased faunae can spread the illness and assist as not invasive examples for identification and investigation [16]. This rises the hazard of FMD outbreaks, mainly in the dehydrated time when water also fallow is uncommon. The virus can also persist well in the environs through the waterless time [1]. Keeping unalike kinds of livestock together may rise the hazard of FMD spread, as altered species may have different susceptibilities and resistance to FMDV [1].

4. Causes of foot-and-mouth disease

FMD is a result of a virus bearing the same name, with a size of 25 to 30 nanometers, having a

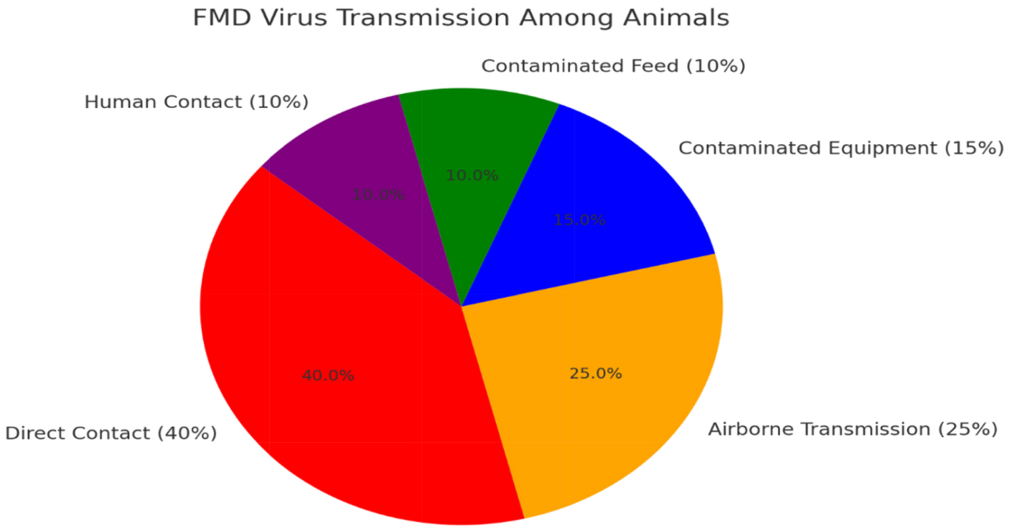

Fig. 1. The transmission mechanism of MDF.

lone-stranded ribonucleic acid (RNA) with a plus charge. The virus belongs to the Picornaviridae family and is regarded as having a high ability to extend via direct contact between diseased and healthy faunae, through the air, or through contaminated tools such as clothing, shoes, and agricultural equipment [17]. There are seven serological types of FMD:

- O
- A
- C
- SAT-1
- SAT-2
- SAT-3
- Asie-1.

These serological kinds appear with different characteristics depending on the region [18]. Through a study of [5] which mention that serotype O of foot-and-mouth disease virus (FMDV) was recognized in cattle in the Sulaymaniyah region since 2016. Phylogenetic research, focusing on the occupied-length VP1 gene, provided data for the detection of closely related viruses, enabling the researcher to accurately define the epidemiology of the virus in the region. The study also recommended hereditarily identical inoculation strains to the circulating strain for FMD controller plans in Iraq. Source Laboratory website made via FAO, FMD serotypes distinguished in Iraq involved A, O, C, Asia 1, Sat-1, and in recent times Sat-2 [10].

5. History of the disease in Iraq

The disease was first documented in 1870 [12]. The epidemiological characteristics generally related to FMD hazard are generally categorizable into themes, for example, (a) faunae demographics besides communications, (b) occupation, and (c) ecological factors and others (Fig. 2) [19]. FMD highly contagious viral animal disease that influence cloven-hoofed animals which endemic in Iraq and appear as outbreak off and on. Serotypes O/A and Asia1 were previously responsible for the outbreaks, but it was confirmed that the new strain SAT2 was responsible for the present outbreak in Iraq for the first time [13]. It was clear that molecular detection of the FMD virus by RT-qPCR gave real indicator and confirmed the diagnosis of disease in different governorates in Iraq. When compared to other studies in Iraq, the outcome [62.37%] of the current study was higher than that of [20], who found that the total occurrence in Nineveh governorate was 40.43% based on conventional RT-PCR but lower than that acquired by [21], who reported that the seropositivity of FMD in feedlot calves in Al-Mosul in Iraq was high percent. When compared to the prevalence rate of the current study [17] with other studies in Iraq, it appeared to be lower than that of [22], who found the prevalence rate of disease for buffalo and cattle in 2015 was 19.9% and 18.4%, respectively, but in 2016 was 46.6% and 68.7%, respectively. Likewise, the present prevalence rate was lower than that acquired by [23] who informed that FMD Sero frequency in Diyala 25.33%, and [24] who declared that the occurrence of disease in cattle in Al-Qadisiya was 73.3% based on conventional RT-PCR, while [25] found in Al-Najaf governorate higher rate than above results which reached to 75%. The FMD is commonly occurring in Iraq since the late time of 19th in addition first time of 20th, in 1937 the first case was reported in Sulaymaniyah governorate, while the first outbreak occurs in other governorates,

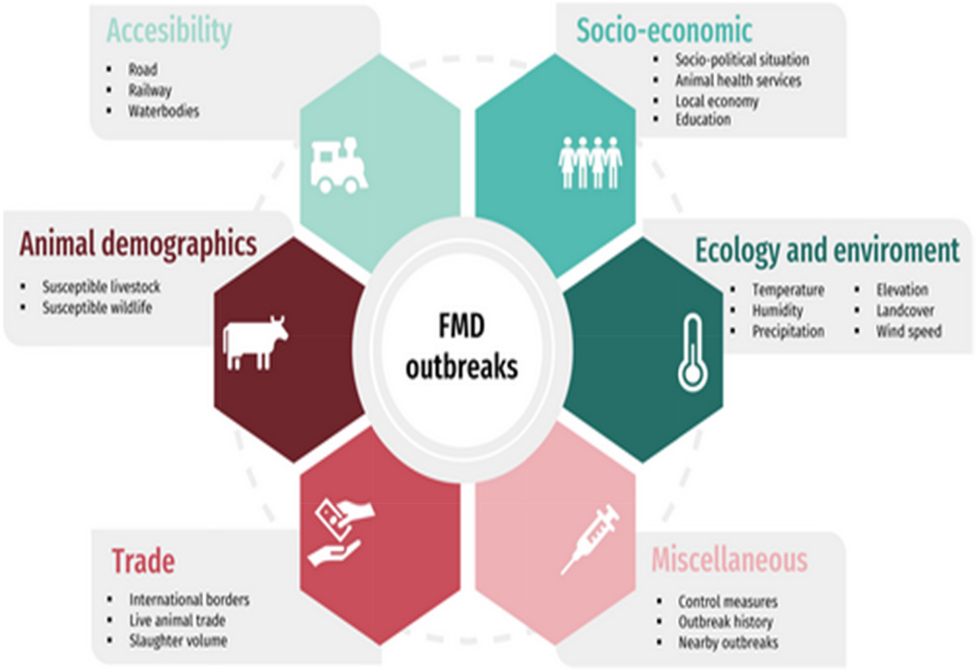

Fig. 2. Factor of FMD outbreaks.

Diala, Missan and Basra in 1938, and then other outbreaks occurred in 1945 and 1957. Serotype A was FMD strain the primarily authorized best of in Iraq during 1952, whereas serotypes O, SAT-1 besides Asia1 during 1957, 1962, also 1975. During 1998, the dangerous FMD epidemic outbreak occurred in 13 governorates, with mainly serotypes O and A. In 2007, only serotype O of FMD was described in the South also Central of Iraq. Eleven areas of Iraq were detected with the serotype A, O, and Asia1 of FMDV. The number of infected animals was decline in 2013, 2014, and 2015. In contrast, the noticeable increase was observed in 2016 in 15 governorates [13]. Currently, an unexpected outbreak occurs in cattle and buffalo in Iraq and cases number still increase since May 2022 to date. This study aims to investigate the FMD and uncover the serotype beyond this outbreak [26]. The Sat-2 serotype was designated in January 2023, during the primary period in northern Iraq. In February 2023, FMD was observed in various areas of southern, central, and northern Iraq; however, the O serotype was not described during this period. In the middle of the third month of same year, FMD performed in al-Muthanna, cows and sheep affecting through dangerous medical marks [13].

6. Identification

It is chief to reflect all relatable medical, epidemiological, also test center outcomes after confirming a circumstance of FMD. Medical indicators are used to make clinical identification. For laboratory confirmation/identification take in the occurrence of a definite Ag or genetic material through procedures similar microarray, recombinant Ag-founded discovery, biosensors, nucleotide sequencing, and nucleic-acid-based analytic are run to correct recognition in addition to documentation of FMDV serotypes.

1. Neutralization Test (VNT)
2. Complement Fixation Test (CFT
3. Enzyme-Linked Immuno-Sorbent Assay (ELISA)
4. Virus isolation
5. Reverse Transcriptase Polymerase Chain Reaction (RT-PCR)
6. Real-time/Quantitative RT-PCR (rRT-PCR) [3].

In Iraq, the enzyme-linked immunosorbent assay and polymerase chain reaction are used to detect viral infections.

7. Prevention

Foot-and-mouth disease (FMD) characterizes international faunae health issues, predominantly in South-east Asia. This trans-border livestock sickness affects both wild and domesticated artiodactyls, such as cattle, pigs, buffalo, sheep, and goats. FMD attitudes are a substantial hazard to local and national economies, resulting in decreased faunae production,

amplified making expenses, and also restricted admittance to marketplaces. In developing economies, consequence of these belongings is of worsening smallholder agricultural' economic no constant. Preventive measures vital; vaccine development challenge; precautionary management is crucial in Asia [3]. Immunization is the chief controller plan in endemic states, whereas in illness-free nations, outbreaks are accomplished via controlling animal transport also slaughtering affected in addition to supposed faunae. Immunity to FMDV can progress via serotype-definite immunization, prior exposure to FMDV, or motherly antibodies. It is of paramount importance to progress inoculations that are specific to different strains and that are combined to avoid the spread of the foot-and-mouth virus and mitigate its devastating consequence on the economies of Asian countries [3]. Recent inoculations have a variability of restrictions and involve the production of large amounts of infectious virus before its inactivation. This must be achieved at a cost in elevation-containment services [14]. Quarantine and monitoring include immediately isolating infected animals and preventing their transfer to other areas, examining new animals before introducing them to farms, and border control to prevent the entry of infected animals. In addition to disinfection and sterilization, strong disinfectants such as formaldehyde, sodium hypochlorite, and citric acid should be used to disinfect barns and equipment, and carcasses and animal waste should be disposed of properly to avoid the continued spread of the virus [17]. The controller of FMD can be effectively realized by a good veterinary service area, permitting quick identification and operation of controller events, counting, and in some situations, the use of inoculations [14]. Others have mentioned that inoculations become less active because the FMD virus frequently suffers ongoing modifications, resulting in antigenic variety and the appearance of new FMDV topotypes [10].

8. Treatment and management

To date, the treatment that eliminates this virus is not specific, but supportive measures are being taken to reduce the effect of the disease on infected animals and to reduce its spread. This includes:

a. Supportive treatments for infected animals
   - Painkillers and anti-inflammatories
   - Ulcer care:
     - Rinse the mouth with an antiseptic solution, such as potassium permanganate or boric acid, to prevent secondary infections.
     - Use topical antibacterial ointments to keep the ulcerated hooves clean.
   - Provide special nutrition: Provide soft food or nutritious fluids to animals that have difficulty chewing because of mouth ulcers.
   - Secondary antibiotics do not affect the virus itself but are used to prevent secondary bacterial infections that may further complicate the condition.

b. Modern methods to reduce the spread of disease
   - Use of immunomodulatory drugs: Some research is being conducted on the use of immunostimulant substances to help the animal immune system fight the virus.
   - Genetic techniques: Some studies are attempting to develop drugs that target the genes responsible for virus reproduction inside the body [18].

Protective drugs are used for subordinate bacterial illness, for instance, antibiotics like amoxicillin, sulphanomide, oxytitracycline, ampicillin, cloxacillin, and metronidazole, in grouping with Flunixin Meglumine that lessens fever in diseased cattle. Danger laminitis, a consequence of FMD, on affected tissues cured with 5% copper sulfate, is utilized as a disinfectant [10].

9. Conclusions

FMD is widespread in various developing countries and is considered an international disease that affects animal wealth economy. Therefore, adherence to preventive measures and periodic vaccination are among the most important means of combating the spread of the disease and protecting the livestock. It was concluded that FMD is a highly contagious viral animal disease that influences cloven-hoofed animals, is endemic in Iraq, and appears as an outbreak off and on. Serotypes O/A and Asia1 were previously responsible for the outbreaks, but it was confirmed that the new strain SAT2 was responsible for the present outbreak, which entered Iraq for the first time.

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Conflict of interest

The author declares there is no conflict of interest.

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