Epizootiology of foot and mouth disease in Saudi Arabia: I. Analysis of data obtained through district field veterinarians

S.M. HAFEZ *, M.A. FARAG *, A. AL-SUKAYRAN * and D.M. AL-MUJALLI **

Summary: Data on the epizootiological status of foot and mouth disease (FMD) in all districts of Saudi Arabia were obtained through responses to a specifically-designed questionnaire from field veterinarians working in different Directorates of Agriculture throughout the country. Suspected clinical occurrence of the disease was reported in seventeen of the twenty-three Directorates. The animal species affected were mainly cattle (in fifteen Directorates) and sheep (in eight Directorates). The disease was suspected among goats and camels in only two Directorates. Some animal owners were unwilling to notify suspicion of the disease. Laboratory diagnosis was not performed in all cases. Vaccination using an appropriately-formulated quadrivalent vaccine incorporating FMD virus serotypes O, A, C and Asia 1 was mainly applied to dairy animals. Limited numbers of locally-bred cattle and sheep were vaccinated in eight and four Directorates, respectively. The data obtained and the recommendations of field staff for improving control of FMD at the national level in Saudi Arabia are discussed.

KEYWORDS: Cattle – Epizootiology – Foot and mouth disease – Saudi Arabia – Sheep.

INTRODUCTION

Foot and mouth disease (FMD) is enzootic in all countries of the Middle East (5). However, detailed information on the epizootiology of the disease in this region is not available (2, 11). Relevant information is usually provided by brief country reports to the Office International des Epizooties (OIE) or through cumulative reports of the OIE/Food and Agriculture Organisation of the United Nations (FAO) World Reference Laboratory (WRL) for FMD in Pirbright, United Kingdom. Current FMD control measures vary from one country to another and are usually related to the socio-economic situation of each country.

Recently, it was recommended that a regional FMD control strategy should be developed for the Middle East along similar lines to the European and South American...
models (4). However, the effectiveness of such regional strategy will be mainly dependent on the seriousness of the Middle East countries in developing national control programmes.

In order to improve national control of FMD in Saudi Arabia, the Government has decided to initiate long-term investigations in collaboration with the WRL (7). Prior to commencement of these investigations, it was necessary to increase understanding of the epizootiology of FMD in Saudi Arabia. Consequently, a questionnaire was distributed to governmental field veterinarians working in the twenty-three Directorates of Agriculture within the country. The purpose of this questionnaire was to collect basic data on some epizootiological aspects of the current FMD status within each Directorate and to stimulate field staff to initiate recommendations to improve national FMD control. The field staff of all Directorates responded positively to the questionnaire and the obtained data are presented and interpreted in the present communication.

DESIGN OF THE QUESTIONNAIRE

The questionnaire was designed to collect the most important data which might influence the control of FMD in each of the twenty-three Directorates. The following data was requested:

a) Had there been previous occurrence of FMD (based on clinical suspicion)? Which animal species were affected (based on clinical suspicion)?

b) Had the suspected FMD outbreaks been officially notified to the Central Veterinary Authority?

c) Were samples collected from suspected FMD outbreaks and submitted for laboratory diagnosis?

d) Was vaccination against FMD currently applied? For which species of animals? What was the percentage of vaccinated animals?

e) What proposals could field staff make to improve current FMD control measures?

The questionnaire was distributed in October 1989 through the Department of Animal Resources to the twenty-three Directorates of Agriculture throughout the country.

ANALYSIS OF THE DATA

The basic data which reflect the current status of FMD at the time of completion of the questionnaire are summarised in Table I. The locations of the Directorates of Agriculture are shown in Figure 1.

Previous occurrence of FMD was suspected in seventeen of the twenty-three Directorates of Agriculture, indicating that occurrence of the disease was more or less nationwide. The disease was mainly suspected among locally-bred cattle and sheep (in fifteen and eight Directorates, respectively). The disease was suspected among both
<table>
<thead>
<tr>
<th>Geographical region</th>
<th>Directorate of Agriculture</th>
<th>Cattle</th>
<th>Sheep</th>
<th>Goats</th>
<th>Camels</th>
<th>Disease notified?</th>
<th>Laboratory diagnosis</th>
<th>Vaccination of conventional animals</th>
<th>Species</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern</td>
<td>Arar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Jouf</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tabouk</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hail</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Central</td>
<td>Qassim</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>Sheep, sheep</td>
<td>Cattle, sheep</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Unaiza</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>Cattle</td>
<td>Cattle</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Zolfi</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sedeer</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>Sheep</td>
<td>Cattle, sheep</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Washm</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td></td>
<td>Cattle, sheep</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Dawadmi</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td></td>
<td>Cattle</td>
<td>5-75</td>
</tr>
<tr>
<td></td>
<td>Riyadh</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Khari</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dawasir</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td></td>
<td>Cattle</td>
<td>18-22</td>
</tr>
<tr>
<td>Eastern</td>
<td>Dammam</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>Cattle</td>
<td>Cattle</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Ihsaa</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Western</td>
<td>Medina</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gharbia</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Taif</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Southern</td>
<td>Baha</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Beesha</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aseer</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Najran</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gizan</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

* no laboratory diagnosis was made to confirm suspected FMD outbreaks
** suspicion of FMD was not officially notified
FMD suspected in cattle and sheep in six Directorates (Figure 1). Details of the epizootiological status of the disease in Saudi dairy farms are discussed by Hafez and colleagues (10). Only two Directorates reported the suspicion of FMD among goats and camels. However, no samples were collected for laboratory diagnosis to confirm the suspicion of FMD occurrence among camels.

Of the seventeen Directorates in which FMD was suspected, fourteen (82%) notified the Central Veterinary Authority and two (12%) indicated that the disease was not always notified. Suspicion of the disease in one Directorate (6%) was not notified. In addition, it was emphasised that many animal owners were not keen to inform the provincial veterinary officials of the occurrence of a disease similar to FMD.
Samples for laboratory diagnosis of suspected FMD outbreaks were collected by only eight (47%) of the seventeen Directorates in which the disease was suspected (Table I). The remaining nine Directorates indicated that samples were not collected due to the lack of resources necessary for sampling, especially sterile glycerine buffer.

Routine FMD vaccination was applied only to cattle on commercial dairy farms (10). Vaccination of locally-bred animals was reported by only nine Directorates. The vaccinated animals were mainly cattle (in eight Directorates) and sheep (in four Directorates). The proportions of locally-bred vaccinated animals varied from 5% to 75% (Table I). FMD vaccination was practised when the vaccine was freely provided by the Ministry of Agriculture. However, some owners of locally-bred animals were persuaded to buy vaccine from commercial sources. In most cases, animals were vaccinated only once. There was no standard vaccination programme for either dairy or conventional animals.

Current control measures differed between Directorates. The recommendations of field staff concerning the improvement of present FMD control measures might reflect the importance of establishing standard national control regulations for the disease.

RECOMMENDATIONS OF FIELD STAFF TO IMPROVE CONTROL MEASURES

Proposals of field staff to improve current FMD control measures were carefully studied, because such proposals can indirectly highlight deficiencies in facilities for control of the disease in Saudi Arabia. Different proposals were made by the staff of each Directorate but the following cumulative recommendations demonstrate the most important proposals which can actually help the Central Veterinary Authorities to decide on the optimal national control strategy:

a) Establishing standard national FMD control regulations which impose disease notification, collection of samples for laboratory diagnosis, strict quarantine measures in infected regions, application of animal health measures, etc.

b) Increasing the awareness of animal owners of the nature and economic importance of FMD, in order to convince owners to protect animals by vaccination and to notify the local animal health staff of the occurrence of a disease similar to FMD. Awareness could be increased through the use of television, radio, newspapers, etc., as well as by the Outreach Service of the Ministry of Agriculture.

c) Organising training programmes for field staff on the current standard preventive measures for the control of infectious animal diseases, with special emphasis on FMD.

d) Providing field staff with the resources required for the collection of samples for laboratory diagnosis of FMD (e.g. glycerine buffer, “vacutainer” tubes, ice boxes, etc.).

e) Establishing a standard national FMD vaccination programme and supplying the Directorates of Agriculture with sufficient amounts of the appropriate vaccine.

f) Improving the quarantine regulations for live animals imported from countries where FMD is enzootic to ensure freedom from infection with FMD virus.

g) Vaccination of ruminants in the country of origin before export to Saudi Arabia, using a vaccine incorporating FMD virus strains which can stimulate protection against Saudi field strains.
h) Providing the Directorates of Agriculture with sufficient numbers of experienced technical staff (veterinarians and veterinary assistants), vehicles and funds for per diem expenses, as well as establishing new veterinary clinics in remote areas.

i) Strengthening the application of disease surveillance, especially in the yards of animal merchants, animal markets and abattoirs, as well as among range animals.

j) Exchanging information between veterinary staff working in the Ministry of Agriculture and those in the Ministry of Municipalities (Department of Environmental Health) who are responsible for the management of abattoirs, merchant yards and animal markets.

k) Producing FMD vaccine in Saudi Arabia using local field isolates and/or appropriate recognised vaccine strains of the virus.

**DISCUSSION**

The implementation of national FMD control programmes in the countries of the Middle East should be based on complete understanding of the epizootiology of the disease in each individual country (2). Accordingly, as a prerequisite for improving FMD control in Saudi Arabia, it is very important to investigate the actual situation of the disease in the various regions of the country.

Analysis of data received from field staff on the current status of FMD in response to specifically-designed questionnaires is a practical procedure for the collection of basic epizootiological information on the disease in different regions. However, most of the veterinarians working in the field in Saudi Arabia are foreigners and may have incomplete information on FMD status in the region where they have been assigned. For example, positive diagnosis for FMD was reported at the WRL in the 1970s and early 1980s (1) for samples collected from districts which present field veterinarians (in response to the questionnaire) considered to be without previous history of clinical occurrence of FMD. Despite such limitations, the following observations can be made on the basis of the data received:

* a) The occurrence of FMD was suspected in Directorates of Agriculture in all regions (Table I and Fig. 1). Prevalence of FMD in all Directorates was confirmed by further virological and serological investigations (8, 9).

* b) FMD was suspected among various species of ruminants, mainly cattle and sheep (Table I and Fig. 1). The nationwide prevalence of FMD among sheep was confirmed by sero-epizootiological studies (9). Accordingly, further studies are required on the current status of the disease among sheep (and goats) in Saudi Arabia, in order to identify the epizootiological role of small ruminants in the transmission of FMD to dairy farms. Such studies will also help policy-makers to determine the optimal national strategy for control of FMD among different species of animals.

* c) Some animal health field staff and many animal owners do not notify the relevant veterinary authority of the occurrence of clinical cases similar to FMD among species of ruminants. Therefore, it should be assumed that many outbreaks or foci of the disease were present in most or all regions without notification.

* d) Due to the lack of resources for collection of samples, laboratory diagnosis was not always practised. Therefore, it is possible that the strains of FMD virus which were...
incriminated as a causative agent of these outbreaks may vary from the FMD virus serotypes or subtypes previously isolated in the field in Saudi Arabia since 1980 (serotypes O, A, C and Asia 1). It is therefore possible that the vaccine currently recommended may not protect against these unidentified FMD virus strains.

e) Vaccination is mainly performed on dairy animals. The number of vaccinated locally-bred animals is limited and not based on a standard programme.

f) There is an urgent need to improve the quarantine system for live animals imported from countries in which FMD is enzootic.

g) Disease surveillance, supported by laboratory investigations, forms the basis for understanding the current epizootiological status of the disease in Saudi Arabia, and this will subsequently help in adopting appropriate control programmes.

The recommendations made by field staff to improve the control of FMD in Saudi Arabia are logical and realistic and are in accordance with Government policy. Recently, the Department of Animal Resources of the Ministry of Agriculture issued official national FMD control regulations (3). The importance of disease notification, collection of samples for laboratory diagnosis and the application of quarantine and other animal health measures are highlighted in these new regulations. In addition, several recommendations are proposed to improve the Animal Quarantine Services in Saudi Arabia (12).

The proposed investigations for long-term studies – confined mainly to improving the control of FMD in Saudi dairy farms (7) – are consistent with the above recommendations from field staff. For these investigations to be successful, it is necessary to collaborate with field staff in the current collection of the required data and samples. For this purpose, a manual was prepared in Arabic and distributed to all field veterinarians (6). The objective of this manual is to increase awareness of field staff regarding the economic importance of FMD control in improving the performance of animal production in Saudi Arabia, and to demonstrate basic standards for the collection of samples required for laboratory diagnosis. In addition, the manual summarises the scientific methods applicable to the control of FMD. The distribution of this manual to field veterinarians working in different sectors (practitioners, quarantine, municipalities, abattoirs and dairy farms) – together with provision of the resources required for collection of samples – has helped in increasing the numbers of samples collected for laboratory diagnosis (8). Also, serum samples required for a nationwide FMD serological survey are currently being collected by field staff throughout the country (9). Animal quarantine veterinarians are helping in the collection of samples from animals imported from countries in which FMD is enzootic, in order to investigate the possible role of these animals in transmitting exotic strains of FMD virus to Saudi Arabia.

In conclusion, the present study has clearly demonstrated the importance of interpreting the current epizootiological status of FMD in Saudi Arabia as a means of planning to improve national control. The use of feedback data provided by field veterinarians should be encouraged in order to maintain constant interaction and communication between personnel in the field and the Central Veterinary Services. Such interaction will obviously help in adopting effective national control programmes for infectious animal diseases.
ACKNOWLEDGEMENTS

The authors gratefully acknowledge the positive response to the FMD questionnaire of field staff working in Directorates of Agriculture and Water throughout the Kingdom of Saudi Arabia. The authors also wish to thank Dr R.P. Kitching for reading the manuscript.

This study was funded by Research Grant No. AR-10-14 of the King Abdul-Aziz City for Science and Technology.

* *


* *


Resumen: Las respuestas a un cuestionario específico por parte de los veterinarios de campo que trabajan en las distintas direcciones de Agricultura de Arabia Saudí permitieron obtener datos importantes sobre la situación epizootiológica de la fiebre aftosa en todos los distritos de este país. Se señalaron casos clínicamente sospechosos en distintos distritos de dichas direcciones de Agricultura. Se trataba esencialmente de bovinos.
En sólo dos direcciones se señalaron cabras y dromedarios sospechosos. Algunos propietarios de animales se manifestaron reticentes a señalar los animales sospechosos. Los diagnósticos de laboratorio no fueron sistemáticos. La inmunización mediante una vacuna cuadrivalente adecuada, que incluye los serotipos O, A, C y Asia 1 del virus de la fiebre aftosa, se realizó esencialmente en los rebaños lecheros. Se vacunó una cantidad limitada de bovinos y ovinos de origen local (respectivamente ocho y cuatro direcciones de Agricultura). Los autores analizan los datos así recogidos así como también las sugerencias de quienes trabajan en el terreno para aumentar la eficacia de la lucha contra la fiebre aftosa en todo el territorio del país.


* * *

REFERENCES


