Animal health constraints to livestock exports from the Horn of Africa

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Summary

The Horn of Africa (Djibouti, Ethiopia, Somalia, Eritrea) is home to the largest population of livestock in Africa and is the historic centre of the livestock trade to the Middle East and northern Africa. The recent resumption of livestock exports from the region has resulted in the handling of over one million head of cattle, sheep, goats and camels at one quarantine facility during a single year. Several of the importing countries for which the facility operates have differing hygiene requirements for the same diseases. Most of the animals handled in the facility come from pastoralist areas, which lack state Veterinary Services. The pathological conditions encountered during one year of monitoring were recorded and the impacts of some of the endemic diseases are discussed, together with particular import-limiting hygiene requirements on this trade.

Keywords

Diagnosis – Horn of Africa – Livestock trade – Quarantine – Vaccination.

Introduction

The Horn of Africa comprises a large area of predominantly arid or semi-arid lands divided politically among several countries: Djibouti, Ethiopia, Somalia and Eritrea. In addition to those countries, the greater Horn of Africa also includes Kenya, Uganda and Sudan. The region is livestock rich, holding about 10% of the global livestock population and 40% of that of the entire African continent (1). Pastoralism is the predominant pattern of livestock husbandry and herds are often trekked for long distances to arrive at seasonal pastures or watering points (2, 3, 4). Despite extensive national and international efforts aimed towards pastoralist development, the situation has remained almost unchanged for many decades (5). The livestock trade has an important role in the region and could perhaps be viewed as the principal economic activity in the entire Horn of Africa. Intra-regional and cross-border trade is largely unrecorded, but estimates are that its value exceeds US$60 million per annum (6, 7). Though highly unofficial, this trade plays a major role in meeting the demand for meat throughout the greater Horn of Africa.

The livestock trade from the Horn to the Middle East, supplying live animals for religious festivities (Haj, Ramadan) in Saudi Arabia, has developed over hundreds of years. Annually, this market alone requires about six million head of animals (mainly sheep and goats but also camels and cattle), of which about 42% (2.5 million) come from the Horn of Africa and Sudan (8) and about 43% and 16% from Australia and Eastern Europe, respectively (1). Arabian Gulf countries, particularly the United Arab Emirates, are also emerging as large-scale importers of live animals from the region. Trade between the Horn and the Middle East has been estimated to be around US$0.6 billion per year, and is, therefore, ten times greater than intra-regional trade (8).

Historically, the livestock trade between the Horn of Africa and the Middle East was largely unregulated. Animals were transported across the Gulf of Aden into Yemen, from where they were trekked deeper into Saudi Arabia. A small proportion of the trade went directly to the

ports of Jeddah and Muscat. However, in recent years, livestock importers have become more aware of potential health risks and therefore more concerned about the origin and health status of imported animals. The 2001/2002 outbreak of Rift Valley fever (RVF) in Saudi Arabia resulted in a ban on livestock imports from the Horn of Africa to the entire Arabian Peninsula (8, 9, 10, 11, 12). The ban was lifted in 2007 after extensive efforts by national, regional and international institutions succeeded in building capacity for the flow of livestock, with the necessary measures for the exclusion of known transboundary animal diseases. Paramount among the necessary conditions for the resumption and continuation of the trade were:

– the adoption of World Organisation for Animal Health (OIE) guidelines for the export/import of animals (13, 14, 15, 16)

– the provision of adequate quarantine facilities

– the availability of state Veterinary Services to monitor quarantine performance.

Experience at one quarantine facility in the Horn of Africa in the export of livestock (sheep, goats, cattle, camels) to the Middle East and North Africa is presented, highlighting the importance of this trade, recording its constraints and recommending future research and development for its sustainability.

Materials and methods

Source of data

The presented data were derived from records at the regional livestock quarantine facility in Djibouti, close to the border with Somalia. The total allocated area is 605 hectares, about 60% of which is currently used. The infrastructure includes 40 cattle pens (50 × 40 m^2), 30 camel pens (50 × 40 m^2) and 140 sheep and goat pens (35 × 55 m^2); the total daily holding capacity for quarantine is 230,000 head, comprising 180,000 sheep/goats and 50,000 camels/cattle. All pens are supplied with water and, with the exception of the camel pens, are provided with shading that covers 40% of the pen area. There are seven loading and unloading ramps, two of each for cattle and camels, three for

sheep and goats. Ramps are fitted with crushes (stanchions) that permit the inspection and handling of individual animals. All ramps are fitted with spray units for ectoparasite control; in addition, a shower race and a concrete-lined dip are annexed to camel and sheep stations, respectively. The quarantine facility has a slaughterhouse with a capacity for handling 35 sheep/goats and 15 cattle/camels per day, and also has a thermoelectric incinerator.

Feed is supplied in concrete or metallic feeding troughs built on the external perimeter of each animal pen. Only veterinary personnel are allowed to come into direct contact with quarantined animals. Biosecurity measures include protective clothing (washable boots, face mask, gloves, overalls) and a disinfectant footbath at the quarantine entrance.

The facility receives only male animals intended for export as slaughter animals; they originate mainly from Ethiopia and Somalia (Table I) and arrive by a variety of modes of transport (Table II).

Primary inspection is carried out at the point of entry for animals arriving by ships, trucks and trains. Animals arriving on the hoof are inspected at a pre-quarantine station on the Somali/Djibouti border, at a distance of 3 km from the main quarantine facility. After primary inspection, the animals are accepted for quarantine, subject to passing a final individual examination in the following one or two days. Each consignment of animals is allocated to a specific pen that, for economic reasons, accommodates a minimum number for each species (250 for camels/cattle, 600 for sheep/goats).

Records

Animals are examined individually and identified with ear tags on the first or second day after admission into the quarantine facility. A daily record is kept of the quarantine observations and activities, such as mortality, cull, prophylaxis, samples, vaccinations and treatments. Post-mortem examinations are made on a sample of dead or severely diseased animals and all such animals are incinerated. Animals with

fractures and other diseased animals considered suitable for human consumption are slaughtered and the carcasses inspected before use.

Data are processed electronically and analysed statistically using Microsoft Excel (Maxell, United Kingdom).

Prophylaxis and hygiene

On arrival all animals are treated for ectoparasites by spraying or dipping with diazinon (Ectocidal, Astra Agricultural Company, Riyadh, Saudi Arabia) or cypermethrin (Ectothrin100, Mobedco-Vet, Amman, Jordan). After a consignment of animals leaves the quarantine facility, pens are sprayed (quaternary ammonium compound [Aldekol], GmbH, Germany; glutaraldehyde and iodine [Ground Zero®], Cove, Nevada, United States of America) and the surface layer removed. Sulphonamides and anthelmintics are provided to the animals in their drinking water when necessary. The quarantine facilities and perimeter are fog-sprayed twice weekly for control of mosquitoes and other flying insects. Camels, sheep and goats are vaccinated for camel pox and sheep/goat pox (Biopharma, Rabat, Morocco) at the quarantine entrance. Cattle, except for those destined for Egypt and the United Arab Emirates, are vaccinated for foot and mouth disease (FMD) with a bivalent (serotypes O/A) vaccine (National Veterinary Institute, Debre Zeit, Ethiopia). All animals, except for those destined for the Sultanate of Oman, are vaccinated for RVF (Smithburn live attenuated vaccine, Onderstepoort, South Africa) one week after admission to the quarantine facility.

Laboratory procedures

Blood samples are taken from the animals by jugular venipuncture and collected in plain vacutainer tubes. Sera are separated and either tested immediately or stored at –20°C.

Foot and mouth disease

Antibodies against the 3ABC non-structural polyproteins of FMD virus in cattle sera were determined using an indirect enzyme-linked immunosorbent assay (ELISA) according to De Diego *et al*. (17).

Plates pre-coated with the polyproteins (Chekit-FMD-3ABC, IDEXX Laboratories, the Netherlands) were used.

Rift Valley fever

Two ELISA test protocols according to Paweska *et al.* (18) were used for the detection of anti-RVF virus antibodies:

– immunocapture IgM ELISA to investigate recent infection in cattle, sheep and goats

– sandwich IgG ELISA to detect seroconversion resulting from past infection in sheep and goats.

Commercial kits (National Institute for Communicable Diseases, NICD-SPU, South Africa) were used for both tests.

Contagious bovine pleuropneumonia

A competitive ELISA to detect antibodies against small colony-forming *Mycoplasma mycoides mycoides* (MmmSC) in cattle sera was used according to the procedure of Le Goff and Thiaucourt (19). A commercially available test kit (Pourquier Institute, France) was used.

Brucellosis

Sera from all animals were screened with the spot agglutination Rose Bengal test using buffered *Brucella abortus* antigen (Rosa Bengala, CZ Veterinaria, Spain) on flat glass plates. Samples showing any degree of agglutination were considered positive (20).

Results

A total of 1,383,435 head of animals (1,272,779 sheep/goats; 57,941 cattle; 52,715 camels) were admitted to the quarantine facility during a one-year period from May 2007 to April 2008 (Table III). The animals arrived in a total of 522 consignments: 371 for sheep/goats, 90 for camels and 61 for cattle. Overall, 40 consignments were rejected because of signs of clinical disease and were not admitted (Table IV): 16 of 371 (4.3%) sheep/goat consignments, 22 of 90

(24.4%) camel consignments and 2 of 61 (3.2%) cattle consignments. Pox in camels and small ruminants was the leading cause of rejection. Other conditions leading to rejection of whole consignments included orf (contagious pustular dermatitis), mange (≥10% of animals affected), contagious skin necrosis in camels (≥5% of animals affected), pneumonia (≥10% of animals affected), and severe stress and injuries resulting from poor shipping conditions.

Post-mortem findings on a sample of animals of each species are shown in Table V. Pneumonia was the predominant finding in all species; enterotoxaemia, endoparasitism and fasciolosis were the leading pathological observations in sheep and goats. Stress resulting from bad shipping conditions was a common observation: such conditions included overcrowding in trucks and boats, tying animals while on board, delays at border checkpoints and transport during rainy weather. An outbreak of peste des petits ruminants (PPR) in small ruminants was encountered in one consignment of very young goats and led to a group mortality rate of 30%. The overall mortality rate of all species combined was 1.95% and ranged between 0.22% in camels to 2.07% in sheep. The leading causes of mortality were pneumonia, enterotoxaemia (small ruminants) and shipping stress.

The overall culling rate during the study year was 3.5% among 1,383,435 animals admitted to the quarantine facility, leading to the eventual export of 1,334,828 animals. Reasons for culling included sub-optimum body condition, signs of clinical disease, and positive test results for certain diseases as required by the importing countries (Table VI). Foot and mouth disease was a leading cause of culling on the basis of serological tests: of 3,373 bovine sera tested, 504 (16.3%) were positive. There was minimum intervention for contagious bovine pleuropneumonia (CBPP) and RVF in animals traded through the quarantine facility. Antibody prevalence for RVF ranged between 0.3% and 1.2%; the prevalence of CBPP was 5.2%. Seroprevalence for brucellosis was 5.8% in bovines, 6.8% in camels and 1.8% in sheep/goats (Table VII).

Animals brought to the facility on the hoof from Somali markets had the best transport conditions. The several routes used by traders involved in the border trade in the region follow traditional tracks with watering points and some grazing or browsing possibilities. Cattle and camels coming from Ethiopia on trains appear to have relatively good transport conditions, even though they suffer from respiratory diseases when transported during rainy weather. However, this route was abandoned, after a very brief experience, when the Djibouti–Ethiopia Railway Company ceased to operate. Cattle transported by trucks from Ethiopia suffered appreciably from overcrowding and related injuries, and when transported during the summer they suffered from severe heat stress. These problems become complicated when delays occur at checking points or as a result of vehicle malfunctioning and bad roads. In at least one incident, 15% of a cattle consignment arrived at the quarantine facility with signs of severe dehydration and hyperthermia. About one-half of the affected animals died but the rest were rescued after being successfully treated with intravenous fluids (data not shown). Camels coming on boats from Somalia had poor transport conditions. The boats were rarely cleaned or disinfected and several biosafety measures were deficient.

Most of the animals (51.1%) were exported to Saudi Arabia during the Haj season (November to December). A total of 623,301 sheep and goats, representing 92% of the total sheep/goat exports, were exported during the Haj, thus constituting the major export group.

Discussion

The resumption of the livestock trade from the Horn of Africa to the Middle East and North Africa through the regional quarantine facility in Djibouti has offered a great opportunity to livestock producers in the region. However, the rush to exploit this opportunity has put tremendous pressure on the quarantine facility in efforts to conform with the animal health requirements of importing countries. Most of the traded animals originate from pastoralist herds with no or minimal veterinary supervision. In addition, the various importing countries have differing health requirements for the same disease; for example,

whereas some countries demand vaccination, others require a test-and-cull policy for the same disease (Table VI).

The admission of large numbers of animals into a single quarantine facility for a period of time ranging from ten to 30 days offered an excellent opportunity to study animal diseases prevalent in the Horn of Africa. Although this was not the main purpose of the present paper, a few observations are worthwhile. Screening large numbers of sera (cattle, sheep, goats, camels) using tests recommended by the OIE for international animal trade demonstrated the prevalence of some diseases in the area (Table VII) (21). The 3ABC ELISA for FMD differentiates between vaccinated and infected animals, provided that highly purified vaccines are used. The test is considered a reliable indicator of infection with any FMD virus serotype whenever there is no history of vaccination (22). The seroprevalence of FMD virus reported here is in line with previous observations in the region (23, 24, 25, 26, 27). There is no official policy for FMD control in the region, although the issue has been stressed several times (28, 29). In order to fulfil export requirements, vaccination against diseases is practised widely in quarantine facilities throughout the region, even though the best option would be to vaccinate earlier, preferably in farms or holding places (29). The CBPP ELISA is based on competition between antibody in the test serum and a monoclonal antibody raised against MmmSC, to block target epitopes on pre-coated plates. This technique has been used successfully to monitor CBPP control programmes in Africa (30). Low antibody activity was detected for both CBPP and RVF, in line with the extreme aridity of the region supplying livestock to the quarantine facility, namely northern Somalia and the north-eastern parts of Ethiopia, including the Ogaden desert.

Certain other diseases require greater surveillance and organised and regionally implementable control. This applies to FMD (cattle), pox, mange and pasteurellosis (camels), and orf, PPR and pox (sheep, goats). Pox and orf were the leading causes of rejection of entire consignments of camels and sheep; PPR resulted in appreciable mortality (Table IV). The rejection of consignments at the quarantine

facility or at the port of the destination country causes considerable difficulties for traders: rejected animals have to be returned to the country of origin or, when applicable, housed and cared for outside the facility for several weeks. Both options entail considerable cost. Several diseases, such as mange, helminthosis and contagious skin necrosis (camels), could be controlled in the herd or at the farm of origin, so that both producers and traders could realise better value for the animals and avoid losses (31). The poor veterinary infrastructures in the Horn of Africa region in general are a major constraint to the overseas livestock trade. The need for mobilisation of new resources and concepts for delivery of veterinary services in pastoral areas has been emphasised several times (8, 32, 33, 34, 35, 36, 37). The requirement by some importing countries for brucellosis testing (and culling) of male animals intended for slaughter needs reconsideration, even more so after the overall seroprevalence rate of the disease was determined at 2% to 7% after testing more than one million sera (Table VII). Minor violations to the hygiene requirements demanded by importing countries can and do result in the rejection of entire shipments. Such requirements should be in accordance with the prevailing epidemiological conditions in the importing countries and should be robust enough to allow the flow of trade with minimum risk (13, 15, 38).

There is also a need to emphasise issues of animal welfare in the Horn of Africa livestock trade, particularly in animal transport (16, 39). The ships and trucks used for transport are not designed for the purpose and lack many biosafety measures. Most boats did not have adequate space for camel shipment, apparently because the need emerged only after the trade was rechannelled via Djibouti. It was common practice to tie camels down while on board and they often arrived at the quarantine facility with bruises, fractures, myositis and pneumonia as a result of inappropriate transport conditions (Tables IV, V). There is an urgent need for regional institutions involved in the livestock sector to address these issues more effectively. Animals arriving on the hoof from Somalia had the best transport conditions. Animal drovers or trekkers are usually highly experienced and strive to maintain the animals in good body condition (7, 40). They follow well-established

routes with reliable watering points and good potential for grazing or browsing (41).

Livestock export from the Horn of Africa is vital for the survival of thousands of families in this region. Most inhabitants depend on livestock for their livelihood and food security (37, 42, 43, 44, 45, 46, 47, 48, 49). The flow of animals from the region into North Africa and the Gulf countries also contributes significantly towards reducing meat prices. In order for this trade to continue, there is a need for organised efforts:

– to strengthen Veterinary Services
– to standardise the hygiene requirements of importing countries
– to invest in livestock transport infrastructures.

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Table I
Sources of livestock intake at Djibouti regional quarantine facility (May 2007 to April 2008)

Species	Source (%)		Live weight range (kg)
	Somalia	Ethiopia	
Sheep and goats	92	8	25–40
Cattle	32	68	Ethiopia: 300–450 Somalia: 150–300
Camels	61	39	Ethiopia: >400 Somalia: <300

Table II
Means of livestock transport to Djibouti regional quarantine facility

Means of transport	Percentage	Type of animal
On the hoof	63.7	Sheep/goats and camels from Somalia, few cattle
Truck	19.5	The majority of camels and cattle from Ethiopia, few sheep/goats
Ship	13.6	Camels and sheep/goats from Somalia, few cattle
Train	3.2	Camels and cattle from Ethiopia only

Table III
Animal flow and mortality at Djibouti regional quarantine facility (May 2007 to April 2008)

Species	Admitted	Mortality (%)		Leading causes of mortality
Sheep/goats	1,272,779	26,365	(2.07)	Pneumonia, enterotoxaemia, shipping stress, parasitism
Cattle	57,941	521	(0.90)	Pneumonia, shipping stress, trauma, foreign bodies
Camels	52,715	116	(0.22)	Pneumonia, shipping stress
Total	1,383,435	27,002	(1.95)	

Table IV
Diseases detected upon inspection of animal consignments at Djibouti regional quarantine facility
Between May 2007 and April 2008 there were a total of 522 consignments: 371 of sheep and goats, 61 of cattle, and 90 of camels

Disease	No. of consignments in which disease was detected					
	Sheep and goats		Cattle		Camels	
Pox	8	(2.2%)	-	-	-	-
Camel pox	-	-	-	-	16	(17.8%)
Orf	2	(0.5%)	-	-	-	-
Mange	12	(3.2%)	8	(13.1%)	11	(12.2%)
Endoparasites	30	(8.1%)	-	-	-	-
Lameness	8	(2.2%)	-	-	-	-
Miayasis	-	-	-	-	3	(3.3%)
Dermatophillosis	-	-	-	-	3	(3.3%)
CSN	-	-	-	-	2	(2.2%)
Trypanosomosis	-	-	-	-	2	(2.2%)
Wounds	6	(1.6%)	9	(14.7%)	4	(4.4%)
Pneumonia	6	(1.6%)	6	(9.8%)	5	(5.5%)
Gastroenteritis	8	(2.2%)	-	-	-	-
Stress	3	(0.8%)	4	(6.5%)	4	(4.4%)
Ringworm	-	-	3	(4.9%)	4	(4.4%)
Miscellaneous conditions	7	(1.9%)	-	-	6	(6.6%)
Total	90	(24%)	30	(49.2%)	60	(59.7%)
No. of consignments rejected	16	(4.3%)	2	(3.2%)	22	(24.4%)

Table V
Post-mortem findings in a sample (*n* = 1,007) of quarantined animals

Cause of death	Sheep and goats		Cattle		Camels	
	No.	%	No.	%	No.	%
Pneumonia	318	35.9	28	40	20	42.5
Enterotoxaemia	176	19.8	-	-	-	-
Gastroenteritis	-	-	12	17.1	-	-
Endoparasites	91	10.2	-	-	8	17
Paratuberculosis (Johne's disease)	19	2.1	-	-	-	-
Septicaemia	36	4.0	-	-	4	8.6
Foreign bodies	14	1.6	3	4.3	3	6.4
Meningitis	19	2.1	-	-	-	-
Oestrus ovis	19	2.1	-	-	-	-
Orchitis (brucellosis negative)	10	1.1	-	-	-	-
Bighead (*Clostridum* spp.)	24	2.7	-	-	-	-
Fasciolosis	67	7.5	-	-	-	-
Tetanus	35	3.9	-	-	-	-
Pest des petits ruminants	25	2.8	-	-	-	-
Wounds/trauma	16	1.8	6	8.6	2	4.3
Impaction/bloat	21	2.4	6	8.6	-	-
Shipping stress	-	-	15	21.4	10	21.3
Total	890		70		47	

Table VI
Hygiene requirements for the import of live animals from the Horn of Africa

Country	RVF	FMD	CBPP	PPR	Brucellosis	Pox	Quarantine period (days)
Egypt	Vaccination	Test	Test	n.r.	n.r.	n.r.	30
United Arab Emirates	Vaccination	Test	n.r.	n.r.	Test	n.r.	21
Kuwait	Vaccination	Vaccination	n.r.	n.r.	n.r.	Vaccination	10
Lebanon	Test	Test	Test	Test	Test	Vaccination	21
Oman	Test	Vaccination	n.r.	Test	Test	Vaccination	21
Saudi Arabia	Vaccination	n.r.	n.r.	Vaccination	Test	Vaccination	30
Yemen	Vaccination	Test	n.r.	n.r.	n.r.	Vaccination	10
Qatar	Vaccination	n.r.	n.r.	n.r.	Test	Vaccination	21

CBPP: contagious bovine pleuropneumonia

FMD: foot and mouth disease

PPR: peste des petits ruminants

n.r.: no requirement

RVF: Rift Valley fever

Table VII
Serological tests on cattle, camels, sheep and goats at Djibouti regional quarantine facility

Test	No. of animals tested (% positive)			Reference
	Cattle	Camels	Sheep/goats	
FMD 3ABC ELISA	3,373 (16.3)	n.d.	n.d.	(17)
RVF IgM ELISA	432 (0.3)	n.d.	588 (1.2)	(18)
RVF IgG ELISA	n.d.	n.d.	730 (50)	(18)
CBPP c-ELISA	1,144 (5.2)	n.d.	n.d.	(19)
Rose Bengal test for brucellosis	72,684 (5.8)	41,989 (6.8)	1,120,508 (1.8)	(20)

CBPP: contagious bovine pleuropneumonia

c-ELISA: competitive ELISA

ELISA: enzyme-linked immunosorbent assay

FMD: foot and mouth disease

n.d. not done

RVF: Rift Valley fever