



UNIVERSITI PUTRA MALAYSIA

***CATTLE IMPORTATION IN RELATION TO OCCURRENCE OF
FOOT AND MOUTH DISEASE IN PENINSULAR MALAYSIA***

UMMI NOORHAKIMAH BINTI ABDULLAH

FPV 2014 29



**CATTLE IMPORTATION IN RELATION TO OCCURRENCE OF FOOT AND MOUTH
DISEASE IN PENINSULAR MALAYSIA**

By

UMMI NOORHAKIMAH BINTI ABDULLAH

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in
Fulfilment of the Requirements for the Degree of Master of Science**

December 2014

COPYRIGHT

All material contained within the thesis, including without limitation text, logos, icons, photographs and all other artwork, is copyright material of Universiti Putra Malaysia unless otherwise stated. Use may be made of any material contained within the thesis for non-commercial purposes from the copyright holder. Commercial use of material may only be made with the express, prior, written permission of Universiti Putra Malaysia

Copyright © Universiti Putra Malaysia



© COPYRIGHT UPM

DEDICATION

This thesis is specially dedicated to my parents, Abdullah bin Mukhtar and Saloma binti Hamzah.

To my lovely husband, Hamdan bin Mohamed for the support and endless love

To my children, Hadif Zuhran al Hakim bin Hamdan and Adruja Damia binti Hamdan..

May Allah bless you all..

Thank you so much



Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master of Science

CATTLE IMPORTATION IN RELATION TO THE OCCURRENCE OF FOOT AND MOUTH DISEASE IN PENINSULAR MALAYSIA

By

UMMI NOORHAKIMAH ABDULLAH

December 2014

Chair: Assoc. Prof. Latiffah Hassan DVM, PhD

Faculty: Veterinary Medicine

Foot and Mouth Disease (FMD) in Peninsular Malaysia continue to be a challenge for the cattle industry. FMD is a transboundary disease and considered as one of the most contagious disease among domestic and wild cloven-hoofed animals. The disease causes a significant negative economical impact throughout Peninsular Malaysia through production losses and inaccessible export market. Malaysia has been highly dependent on cattle importation to increase the live cattle population and to maintain adequate beef and milk supply. Importation and movement of animals have been constantly linked to FMD outbreaks. This study aimed to find the relation between the importation of live cattle and its contribution to the FMD occurrences in Peninsular Malaysia. The specific objectives of the study were to: describe the cattle importation trends and statistics from year 2000 to 2010 and to suggest its relationship with the local FMD occurrences within the same time frame, describe the import protocol for cattle imposed by the veterinary authority of Malaysia, the Department of Veterinary Services (DVS) so as to achieve a better understanding on the procedure and to identify the presence of gaps or weaknesses that may contribute to the FMD occurrence among local animals and describe the distribution of the government animal quarantine stations (GQS) and temporary animal quarantine stations (TQS) in Malaysia for the year 2012-2013 and to examine the temporary quarantine station's managers awareness on the requirements and procedures for quarantine stations.

Between 2004 and 2006, the numbers of live cattle imported to Peninsular Malaysia markedly decreased due to the suspension of cattle importation from Thailand by the DVS, Malaysia following several outbreaks of FMD from cattle consignments received in this country. The increase in the volume of cattle imported between

2007 and 2009 appeared to be consistent with the marked increase of FMD outbreaks within the same time frame. The study also found that several consignments between 2009 and 2010 contained cattle that were non-structural protein (NSP) positive indicating subclinical infection or previous exposure to the virus. The findings suggested that importation and animal movements are indeed contributors of FMD outbreaks in the country.

The cattle import protocol has been developed by the DVS according to the Office International Epizootics (OIE) recommendations in the Terrestrial Codes. DVS import protocols are established to complement the efforts of FMD control in the country and also to prepare Malaysia towards achieving FMD free status by year 2016. This study examined relevant official documentations and limited accessible data from various sources in order to describe and highlight potential issues in the import protocols in Malaysia. The study focused on the protocols for cattle imported from Thailand and Australia because these two countries are the largest live cattle exporter to Malaysia. The study found that DVS import protocols contains potential discrepancies from the recommendation by the OIE that could increase the risk of disease importation via cattle consignments. The quarantine period of 10 days recommended at the local quarantine station as opposed to 14 days as recommended by the OIE could result in animals with longer incubation period to be released among the local cattle herds and spread the infection. In addition, the level of compliance to the DVS import protocols among the exporters especially from Thailand was poor. Laboratory serological findings from quarantined cattle discovered evidence that trivalent FMD vaccination as required by the import protocol was not performed. In a consignment of cattle received in 2012, 84% of the cattle within the consignment had less than 50 percent inhibition (PI) for serotype A, 32.3% had less than 50 PI for serotype Asia 1 and 11.7% had less than 50 PI for serotype O. Another consignment had 2.5% cattle with less than 50% PI for serotype O, 84% had less than 50% PI for serotype A and 12% cattle had less than 50% PI for serotype Asia 1. This indicated possibilities that monovalent or bivalent vaccine was used instead of trivalent or the trivalent vaccine used was not potent.

The activities and management of the animal quarantine stations can be a good indicator of the level by which disease can be prevented from entering the country. Eight temporary quarantine station (TQS) were selected and visited with the aim of assessing the awareness of managers and operators on the biosecurity requirements for quarantine station stated in *Arahan Prosedur Tetap Veterinar Malaysia (APTVM) Pendaftaran Stesen Kuarantin Haiwan Sementara 2011 (SKH(S))*. On average, 11.8% of the managers ignored the importance of biosecurity and operational requirement. On the other hand, 82.5% of them were confident that they had a good level of biosecurity and operational knowledge. A quarter (25%) of the respondents agreed that they did not have a good knowledge on how to manage a TQS. More than 37% did not understand the requirements based on the *APTVM SKH(S)*. In addition, 25% did not have any systematic importation documentation and records while more than 37% were not aware that the

consignment proven to be exposed to FMD could only be released to the DVS-approved destination.

In conclusion, it was suggested that importation and animal movements are major contributors to the FMD outbreaks in the country. Issues and gaps in the import protocols and regulations may result in increase risk of FMD introduction. TQS which was allowed for reasons to improve animal quarantine efficiency may in fact contribute to more damage since the study found that most facilities had poor biosecurity, did not comply with basic infrastructure requirements and station operators/managers have poor level of understanding about basic quarantine station management and operations.



Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
Sebagai memenuhi keperluan untuk ijazah Master Sains

**HUBUNGKAIT ANTARA PENGIMPORAN LEMBU DAN KEJADIAN PENYAKIT KUKU
DAN MULUT DI SEMENANJUNG MALAYSIA**

Oleh

UMMI NOORHAKIMAH ABDULLAH

Disember 2014

Pengerusi : Prof. Madya. Latiffah Hassan (DVM, PhD)

Fakulti : Perubatan Veterinar

Penyakit Kuku dan Mulut (FMD) di Semenanjung Malaysia masih terus menjadi satu cabaran bagi industri ternakan lembu. FMD adalah penyakit yang merentasi sempadan negara dan dianggap sebagai salah satu penyakit yang paling mudah berjangkit di kalangan haiwan domestik dan liar yang memiliki struktur kuku yang keras dan terbelah di tengah. Penyakit ini menyebabkan kesan negatif yang ketara dari sudut ekonomi di seluruh Semenanjung Malaysia iaitu penurunan tahap produktiviti dan tiada akses untuk pasaran eksport. Malaysia amat bergantung kepada pengimportan lembu untuk meningkatkan bilangan populasi lembu bagi mengekalkan bekalan daging lembu dan susu yang mencukupi. Pengimportan dan pergerakan haiwan seringkali dikaitkan dengan kejadian wabak FMD. Kajian ini bertujuan mencari hubungkait antara pengimportan lembu hidup dan kejadian FMD di Semenanjung Malaysia. Objektif khusus kajian ini adalah untuk: menerangkan statistik dan corak pengimportan lembu dari tahun 2000 hingga 2010 dan mencadangkan hubungannya dengan kejadian FMD tempatan dalam tempoh masa yang sama, menerangkan protokol import yang dikenakan oleh pihak berkuasa veterinar Malaysia, Jabatan Perkhidmatan Veterinar (DVS) untuk memahami dengan lebih baik mengenai prosedur berkaitan. Selain itu ia juga untuk mengenal pasti kehadiran jurang atau kelemahan yang boleh menyumbang kepada berlakunya FMD dalam kawanan haiwan tempatan. Taburan stesen kuarantin haiwan kerajaan (GQS) dan stesen kuarantin haiwan sementara (TQS) di Malaysia bagi tahun 2012-2013 turut diterangkan selain mengkaji tahap kesedaran pengurus TQS mengenai kepatuhan terhadap prosedur untuk stesen kuarantin.

Bermula tahun 2004 hingga 2006, bilangan lembu hidup menurun dengan ketara kerana Jabatan Perkhidmatan Veterinar (DVS) telah menggantung pengimportan lembu dari Thailand. Perkara ini dilakukan berikutan kejadian beberapa wabak FMD dari kalangan konsainan lembu yang diterima dari negara tersebut. Peningkatan

dalam jumlah lembu yang diimport antara tahun 2007 dan 2009 kelihatan konsisten dengan peningkatan wabak FMD dalam tempoh masa yang sama. Kajian ini juga mendapati bahawa beberapa konsainan dalam tempoh tahun 2009 dan 2010 telah membawa masuk lembu yang positif ujian *Non Structural Protein* (NSP). Ini menunjukkan jangkitan subklinikal atau terdapat pendedahan sebelumnya kepada virus wabak sebenar. Hasil kajian mencadangkan bahawa pengimportan dan pergerakan haiwan adalah penyumbang kepada wabak FMD di negara ini.

Protokol import lembu telah dibangunkan oleh DVS berdasarkan Kod Terrestrial yang dicadangkan oleh *Office International des Epizooties* (OIE). Protokol import DVS diwujudkan selaras dengan usaha mengawal penyakit FMD di negara ini dan juga untuk mempersiapkan Malaysia mencapai status bebas penyakit FMD pada tahun 2016. Kajian ini turut meneliti dokumen rasmi yang berkaitan dan data yang terhad dari pelbagai sumber untuk menerangkan dan mengetengahkan isu-isu yang berkaitan dalam protokol import di Malaysia. Kajian menumpukan pada protokol import untuk lembu yang diimport dari Thailand dan Australia sahaja kerana kedua-dua negara adalah pengeksport lembu hidup terbesar ke Malaysia. Kajian ini mendapati bahawa protokol import mengandungi sedikit percanggahan dengan syor yang dikemukakan oleh OIE yang boleh meningkatkan risiko kemasukan penyakit melalui pengimportan lembu. Tempoh kuarantin 10 hari yang disyorkan di stesen kuarantin tempatan tidak bertepatan dengan tempoh 14 hari seperti yang disyorkan oleh OIE. Ini boleh menyebabkan haiwan dengan tempoh inkubasi penyakit yang lebih panjang akan dilepaskan dan bercampur dengan kawanan lembu tempatan seterusnya menyebarkan jangkitan. Di samping itu, didapati tahap pematuhan kepada protokol import DVS di kalangan pengeksport terutama dari Thailand adalah rendah. Penemuan makmal serologi terhadap sampel yang diambil daripada lembu yang dikuarantin menunjukkan bahawa kehendak protokol import daripada segi kewajipan melaksanakan pemvaksin primer menggunakan vaksin FMD trivalen oleh pengeksport tidak dipatuhi sepenuhnya. Dalam satu konsainan lembu yang diterima pada tahun 2012, 84% daripada lembu dalam konsainan itu mempunyai kurang daripada 50 Peratus Perencatan (PI) untuk serotip O, 32.3% mempunyai kurang daripada 50 PI untuk serotip Asia 1 dan 11.7% mempunyai kurang daripada 50 PI untuk serotip A. Manakala satu konsainan yang lain mempunyai 2.5% lembu yang mempunyai kurang daripada 50 PI untuk serotip O, 84% mempunyai kurang daripada 50 PI untuk serotip A dan 12% lembu mempunyai kurang daripada 50 PI untuk serotip Asia 1. Ini menunjukkan kemungkinan vaksin monovalen atau vaksin bivalen yang biasanya digunakan dan bukan vaksin trivalen. Terdapat juga kemungkinan vaksin trivalen digunakan tetapi tidak memberikan tahap perlindungan yang sepatutnya.

Aktiviti dan pengurusan stesen kuarantin haiwan boleh menjadi indikator yang baik akan tahap sesuatu penyakit yang boleh dihalang daripada memasuki negara ini. Lapan TQS dipilih dan dilawati bertujuan untuk memahami tahap kesedaran pengurus atau pengendali terhadap keperluan biosekuriti bagi stesen kuarantin seperti yang dinyatakan dalam Arahan Prosedur Tetap Veterinar Malaysia (APTVM) Pendaftaran Stesen Kuarantin Haiwan Sementara (SKH(S)). Borang soal selidik turut

digunakan bagi mendapatkan gambaran tahap kepatuhan pengurus TQS terhadap APTVM SKH(S). Secara purata, 11.8% daripada pengurus mengabaikan keperluan dan kepentingan pengurusan operasi dan biosekuriti. Sebaliknya, 82.5% daripada mereka yakin bahawa mereka mempunyai tahap pengetahuan pengurusan operasi dan biosekuriti yang baik. Manakala 5.6% dari pengurus tersebut tidak pasti jika mereka mempunyai pengetahuan dan pengalaman yang mencukupi untuk mengendalikan TQS. Daripada set soal selidik yang sama, (25%) daripada responden bersetuju bahawa mereka tidak mempunyai pengetahuan yang baik tentang pengurusan TQS. Lebih daripada 37% tidak memahami kehendak APTVMSKH(S). Di samping itu, 25% tidak mempunyai dokumentasi dan rekod pengimportan yang sistematik manakala lebih daripada 37% tidak menyedari bahawa konsainan yang terbukti telah terdedah kepada jangkitan FMD hanya boleh dilepaskan ke destinasi yang dibenarkan oleh DVS.

Kesimpulannya, kajian ini menunjukkan bahawa pengimportan dan pergerakan haiwan merupakan penyumbang utama kepada wabak FMD di negara ini. Isu dan jurang dalam protokol import dan peraturan yang boleh mengakibatkan risiko yang lebih tinggi terhadap kemasukan wabak FMD. TQS yang diluluskan atas faktor untuk meningkatkan kecekapan proses kuarantin haiwan mungkin sebenarnya lebih menyumbang kepada kesan buruk. Ini selari dengan hasil kajian mendapati bahawa kebanyakan kemudahan biosekuriti yang terdapat di stesen-stesen tersebut tidak mematuhi syarat-syarat asas infrastruktur seperti yang ditetapkan dalam APTVM SKH(S). Selain itu didapati pengurus stesen mempunyai tahap kefahaman mengenai asas pengurusan dan operasi stesen kuarantin yang rendah.

ACKNOWLEDGEMENTS

First and foremost, along with humblest feeling I would like to express the most gratitude to Almighty Allah, Who gives me life, health and strength to further the master study which I never thought. Alhamdulillah, with the permission of Allah, this research study was completed after various ordeal and gibe.

Secondly, my earnest thankful goes to my mother, father, siblings and family who always be my side every time either cheery or sorrow especially during the course of this study and the preparation of this thesis. And the most special my husband who always inspire me to finish everything I have started. To my children, both of you are my success trigger. Without all of them, I will not be at this point right now.

Next, my utmost appreciation and thankfulness goes to Assoc. Prof. Dr. Latiffah Hassan, Department of Veterinary Pathology and Microbiology, Faculty of Veterinary Medicine, Universiti Putra Malaysia, the chairman of Supervisory Committee for her earnest in guidance, advice, support, patience and hopes.

I am indebted to supervisory committee members, Assoc. Prof. Dr. Ong Bee Lee, Faculty of Veterinary Medicine, Universiti Putra Malaysia who never neglect me by giving assistance in terms of ideas, recommendation, build critics and support throughout studies and research work. Finally to DVS for allowing me to use the data for this study. Thank you.

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Veterinary Science. The members of the Supervisory Committee were as follows:

Latiffah binti Hassan, PhD

Associate Professor
Faculty of Veterinary Medicine
Universiti Putra Malaysia
(Chairman)

Ong Bee Lee, PhD

Associate Professor
Faculty of Veterinary Medicine
Universiti Putra Malaysia
(Member)

BUJANG BIN KIM HUAT, PhD

Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

Declaration by graduate student

I hereby confirm that:

- this thesis is my original work;
- quotations, illustrations and citations have been duly referenced;
- this thesis has not been submitted previously or concurrently for any other degree at any other institutions;
- intellectual property from the thesis and copyright of thesis are fully-owned by Universiti Putra Malaysia, as according to the Universiti Putra Malaysia (Research) Rules 2012;
- written permission must be obtained from supervisor and the office of Deputy Vice Chancellor (Research and Innovation) before thesis is published (in the form of written, printed or in electronic form) including books, journals, modules, proceedings, popular writings, seminar papers, manuscripts, posters, reports, lecture notes, learning modules or any other materials as stated in the Universiti Putra Malaysia (Research) Rules 2012
- there is no plagiarism or data falsification/fabrication in the thesis, and scholarly integrity is upheld as according to the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012) and the Universiti Putra Malaysia (Research) Rules 2012. The thesis has undergone plagiarism detection software.

Signature: _____ Date: _____

Name and Matric No.: Ummi Noorhakimah Abdullah GS30796

Declaration by Members of Supervisory Committee

This is to confirm that:

- the research conducted and the writing of this thesis was under our supervision;
- supervision responsibilities as stated in the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) are adhered to
-

Signature: _____
Name of
Chairman of
Supervisory
Committee: _____

Signature: _____
Name of
Member of
Supervisory
Committee: _____



TABLE OF CONTENTS

	Page
ABSTRACT	i
ABSTRAK	iv
ACKNOWLEDGEMENTS	vii
APPROVAL	viii
DECLARATION	x
LIST OF TABLES	xv
LIST OF FIGURES	xvi
LIST OF PLATES	xvii
LIST OF ABBREVIATIONS	xviii
CHAPTER	
1 INTRODUCTION	
1.1 Background	1
2 LITERATURE REVIEW	
2.1 History of Foot and Mouth Disease in Peninsular Malaysia	3
2.2 Transboundary Animal Diseases (TADs)	3
2.3 Foot and Mouth Disease	4
2.3.1 Aetiology	4
2.3.2 Mode of spread	4
2.3.3 Pathogenesis and development of clinical signs	5
2.3.4 Differentiation between Foot and Mouth Disease carrier animals and Foot and Mouth Disease vaccinated animals	6
2.3.5 Prevalence in Peninsular Malaysia for the past 10 years	6
2.4 Foot and Mouth Disease control policy	7
2.4.1 Office International Epizooties recommendation	7
2.4.2 Southeast Asia	7
2.4.3 Malaysia	7
2.5 Live cattle importation procedure in Malaysia	8
2.6 Quarantine process	11
2.6.1 Animal quarantine process in Malaysia	11
2.6.2 Establishment of the quarantine station	12
2.6.3 Cattle importation and quarantine in Malaysia	13
2.6.4 Quarantine period	14
2.6.5 Temporary quarantine station	15

3	IMPORTATION OF CATTLE INTO PENINSULAR MALAYSIA AND THE TREND OF FOOT AND MOUTH DISEASE OCCURRENCE FROM 2000-2010	
3.1	Introduction	16
3.2	Materials and method	17
3.3	Results	18
3.4	Discussion	26
3.5	Conclusion	29
4	IMPORTATION PROTOCOL IN MALAYSIA AND THE RISK OF FOOT AND MOUTH DISEASE INTRODUCTION VIA CATTLE IMPORTATION	
4.1	Introduction	30
4.2	Materials and method	32
4.3	Results	32
4.3.1	Live cattle importation protocol	32
4.3.2	National animal import protocol and potential gaps in the system	34
4.3.2.1	Exporting country compliance to the Malaysian importation protocol	37
4.4	Discussion	42
4.5	Conclusion	45
5	TEMPORARY QUARANTINE STATIONS AWARENESS ON THE REQUIREMENTS AND PROCEDURES FOR QUARANTINE STATIONS AND THE DISTRIBUTION OF THE TEMPORARY ANIMAL QUARANTINE STATIONS AND GOVERNMENT ANIMAL QUARANTINE STATIONS IN MALAYSIA FOR THE YEAR 2012-2013.	
5.1	Introduction	46
5.2	Materials and methods	47
5.3	Results	49
5.3.1	The distribution of government quarantine stations in Peninsular Malaysia	49
5.3.2	Level of awareness and knowledge on the requirement and procedures for quarantine stations among the temporary quarantine station managers	62
5.4	Discussion	70
5.4.1	Animal quarantine laws and regulations	70
5.4.2	The awareness among the temporary quarantine station managers and operators on basic quarantine station operations and management	72
5.5	Conclusion	73

6	GENERAL DISCUSSION AND RECOMMENDATIONS	74
	REFERENCES/BIBLIOGRAPHY	79
	APPENDICES	84
	BIODATA OF STUDENT	91
	LIST OF PUBLICATIONS	92



LIST OF TABLES

Table		Page
1.1	The list of government quarantine stations together with specific specification and the quarantine capacity	13
4.1	Comparison between exporting country's compliance to the Malaysian import protocols	37
5.1	Availability of good biosecurity demands in selected TQS during on site visit	61
5.2	Level of awareness on the quarantine station requirements and procedures for quarantine stations among the temporary quarantine station managers	63
5.3	The auditors evaluation during the temporary quarantine station annual auditing	66

LIST OF FIGURES

Figure		Page
1.1	DVS live cattle importation procedure	9
3.1	Live cattle population in Peninsular Malaysia from 2004 to 2008	18
3.2	Beef consumption (MT) in Peninsular Malaysia from 1999 to 2008	18
3.3	Self-sufficiency level (%) in beef in Peninsular Malaysia from 1999 to 2008	19
3.4	Liquid milk consumption (Million Litres) in Peninsular Malaysia	20
3.5	Self-sufficiency level (%) in liquid milk in Peninsular Malaysia	20
3.6	Statistic of live cattle importation into Peninsular Malaysia starting 2000 to 2010 from various countries	21
3.7	Live cattle importation from Thailand from 2000 to 2010	22
3.8	Number of FMD outbreaks in Peninsular Malaysia from 2000 to 2010	22
3.9	Foot and Mouth Disease occurrences at GQS A in 2009	24
3.10	Foot and Mouth Disease occurrences at GQS A in 2010	25
5.1	The distribution of government quarantine stations in Peninsular Malaysia	49
5.2	The distribution of approved temporary quarantine station in Peninsular Malaysia	50
5.3	Approved temporary quarantine stations in Perlis	51
5.4	Approved temporary quarantine stations in Kedah	52
5.5	Approved temporary quarantine stations in Johor	53
5.6	Approved temporary quarantine stations in Kelantan	54
5.7	Approved temporary quarantine stations in Perak	55

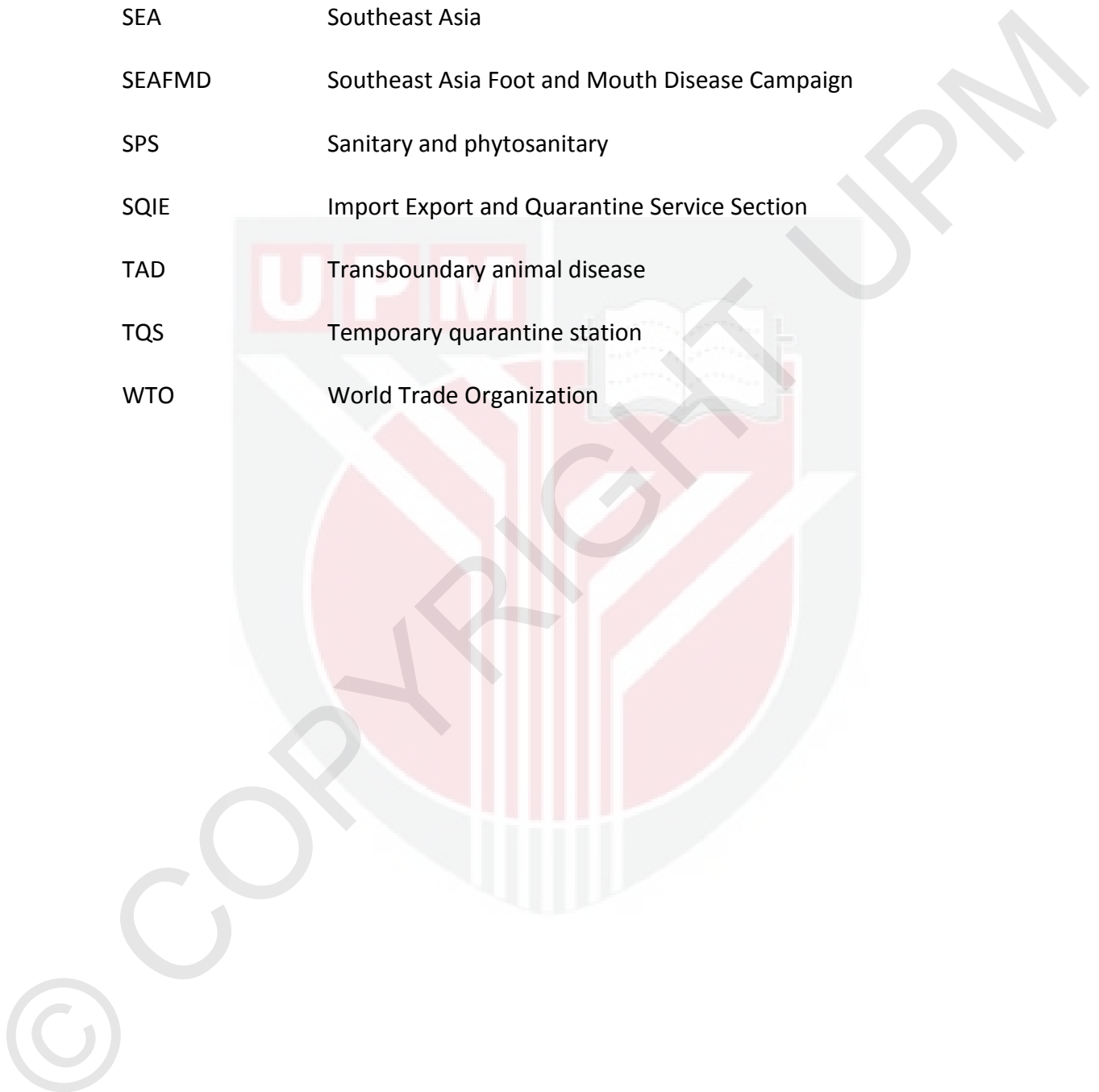
LIST OF PLATES

Plate		Page
5.1	DVS signboard used at an approved temporary quarantine stations	56
5.2	Poorly maintained vehicle dip facility at one of the temporary quarantine stations visited.	56
5.3	Poorly constructed sewage drainage and the waste pond at a temporary quarantine stations	57
5.4	Temporary quarantine stations built at unsuitable location and next to an occupied house	57
5.5	Temporary quarantine station shows the cattle faecal materials on the floor due to poor hygiene and drainage	58
5.6	Poorly structure built in a temporary quarantine station	58

LIST OF ABBREVIATIONS

DOA	Department of Agriculture
DOF	Department of Fisheries
DVS	Department of Veterinary Services
EA-1	East Africa 1
EA-2	East Africa 2
ELISA	Enzyme Linked Immunoassay
Euro-SA	Europe – South America
FMD	Foot and Mouth Disease
GQS	Government quarantine station
ISA-1	Indonesia - 1
ISA-2	Indonesia - 2
JPPH-MOA-01	<i>Jawatankuasa Prosedur Pengimportan Haiwan dan produk haiwan – Kementerian Pertanian dan Industri Asas Tani – 01</i>
LPBE	Liquid phase blocking ELISA
MAQIS	Malaysian Agriculture Quarantine and Inspection services
ME-SA	Middle East-South Asian
MOA	Ministry of Agriculture
MOSTI	Ministry of Science Technology and Innovation
MTM	Malaysia –Thailand-Myanmar
NSP	Non structural protein
OIE	Office International Epizooties
P1	Primary 1

P2	Primary 2
RNA	Ribonucleic acid
SAT	South African Trait
SEA	Southeast Asia
SEAFMD	Southeast Asia Foot and Mouth Disease Campaign
SPS	Sanitary and phytosanitary
SQIE	Import Export and Quarantine Service Section
TAD	Transboundary animal disease
TQS	Temporary quarantine station
WTO	World Trade Organization



CHAPTER 1

INTRODUCTION

1.1 Background

Foot and mouth disease (FMD) is endemic in Peninsular Malaysia whilst East Malaysia is declared free FMD without vaccination (OIE 2014). The main economic implication of the occurrence of FMD to a country is the limited livestock trade opportunities whereby FMD-endemic countries have restricted access to the animal products trade markets (Paton et al. 2009). FMD is a highly contagious viral disease and is considered as one of the most serious transboundary animal diseases (TAD) (FAO 2014). TAD is defined as those diseases that have significant economic, trade and/or food security importance for many countries which can spread internationally via various routes (Otte et al. 2004). FMD has occurred in almost two thirds of the OIE member countries causing significant economic loss (Rweyemamu et al. 2008). Since FMD is a transboundary animal disease, cooperation between neighbouring countries at the local, national and regional level is needed (Sumption 2007). In Malaysia, the cattle industry only contributes to 20.7% of Malaysia's self-sufficiency for beef which is far less than the amount required by the local population (DVS 2009a). Local fresh meat supply in Malaysia could not meet the local consumer demand, thus Malaysia remains a major livestock importer in the region (Wongsathapornchai et al. 2008). In a recent paper by Ramanoon et al (2013), FMD in Malaysia affects many species including cattle (86%) buffalo (7.3%), sheep (2.8%), goats (2.8%) and pigs (0.8%) and is widely distributed throughout the peninsula (Ramanoon et al. 2013). Malaysia is strongly dependent on importation of live cattle to improve the cattle industry because of the inability to sustain the breeding and rearing activities (DVS 2011).

The Malaysia-Thailand-Myanmar (MTM) zone was established in 2003 following the decision by the South-East Asia FMD Campaign in 2001 to establish an FMD free zone within South East Asia based on favourable geographic features and strong political support from the proposed member countries (Cocks et al. 2012). The MTM zone consists of the southern division of Myanmar, regions eight and nine of Thailand and the whole Peninsular Malaysia. However since its conceptualization, FMD remained to occur on regular basis (Hueston et al. 2011). Importation of livestock has been identified as an important risk factor for the emergence of several diseases in previous studies (Gleeson 2002) in Malaysia and elsewhere. The risk of FMD through importation may be reduced by decreasing the risk source such as importing livestock from areas that are FMD-free or that have low prevalence of FMD (Wongsathapornchai et al. 2008). Unfortunately for South East Asia, the pattern of livestock movement from the northern to the southern parts is dictated by the gradient of price and supply and demand.

Rationale of the current study

There are limited scientific publications on FMD epidemiology in South East Asia. When available, most came from studies conducted in Thailand but none have thoroughly examined the role of importation on FMD epidemiology in the region. FMD is endemic in Peninsula Malaysia and the extent of endemicity appears to have increased over the last decade. It has often been suspected that animal movement and importation are the major contributors of local FMD outbreaks, unfortunately the work that examined this risk is lacking. This study suggests animal importation (including quarantine procedures and processes) as a hazard for animal health in Malaysia.

The specific objectives of the study were:

1. To describe the cattle importation trends and statistics from year 2000 to 2010 and to suggest its relationship with the local FMD occurrences within the same time frame
2. To describe the import protocol for cattle imposed by the veterinary authority of Malaysia, the Department of Veterinary Services (DVS) so as to achieve a better understanding on the procedure and to identify the presence of gaps or weaknesses that may contribute to the FMD occurrence among local animals.
3. To describe the distribution of the government animal quarantine stations (GQS) and temporary animal quarantine stations (TQS) in Malaysia for the year 2012-2013 and to examine the temporary quarantine station's managers awareness on the requirements and procedures for quarantine stations.

The information gained from this study will assist in the understanding of possible risks caused by the live cattle importation to the FMD occurrence which, in turn, will help in tightening the system and reducing wherever possible the possibility of importing disease along with new animal consignments.

REFERENCES

- Abdul-Hamid, Nor Faizah, Müge Firat-Saraç, Radford, A.D., Knowles, N.J., and Donald P. K., 2011. "Comparative Sequence Analysis of Representative Foot-and-Mouth Disease Virus Genomes from Southeast Asia." *Virus Genes* 43 (1): 41–45
- OIE - World Organisation for Animal Health. Retrieved 26 May 2014 from <http://www.oie.int/international-standard-setting/terrestrial-code/access-online/>.
- Alexandersen, S., Zhang,Z., Donaldson,A. I., and Garland,A. J. M., 2003. "The Pathogenesis and Diagnosis of Foot-and-Mouth Disease." *Journal of Comparative Pathology* 129 (1): 1–36.
- Babjee, Mustaffa. 1994. *History, Development and Prospects of the Animal Industry and Veterinary Services in Malaysia*. Kuala Lumpur: Department of Veterinary Services
- Belsham, G J. 1993. "Distinctive Features of Foot-and-Mouth Disease Virus, a Member of the Picornavirus Family; Aspects of Virus Protein Synthesis, Protein Processing and Structure." *Progress in Biophysics and Molecular Biology* 60 (3): 241–60.
- Bruckner, G.K. 2011. "Managing the Risks of Disease Transmission through Trade: A Commodities-Based Approach?" *Revue Scientifique et Technique-Office International Des Épizooties* 30 (1): 289–96.
- Chong, S.K. "Control of Foot and Mouth Disease: Slaughter or Vaccination., Annual Conference 24th Malaysian Veterinary Association. Kuala Lumpur." 1979.
- Cleland, Paul C., F. Baldock C., Chamnanpood, P., and Gleeson,L.J., 1996. "Village Level Risk Factors for Foot-and-Mouth Disease in Northern Thailand." *Preventive Veterinary Medicine* 26 (3–4): 253–61.
- Cocks, P., Robertson,I., Abila,R., BlackP., and Edwards,J., 2012. "Foot-and-Mouth Disease in the Malaysia-Thailand-Burma Peninsula: Addressing Disease at the Source." *Australian Centre for International Agricultural Research, Animal biosecurity in the Mekong: future directions for research and development* : 104.
- Dent, Siobhan K., John P. S., Philip D. A., and Mark H. O., 2002. "Foot-and-Mouth Disease Outbreak: Modelling Economic Implications for Queensland and Australia." <http://search.informit.com.au/documentSummary;dn=028622799867471;res=IELHSS>.

Donaldson, A.I, Alexandersen,S., Sørensen,J.H., and Mikkelsen,T., 2001. “Relative Risks of the Uncontrollable (airborne) Spread of FMD by Different Species.” *The Veterinary Record* 148 (19): 602–4.

DVS. 2009a. “Populasi Ternakan Di Malaysia”. In: “*Status Pembangunan Industri Ternakan*”. Department of Veterinary Services Malaysia, Putrajaya.

DVS, 2009b. “Mesyuarat Kawalan Penyakit Kebangsaan. In: *Department of Veterinary Services, M.* (Ed.) Department of Veterinary Services Putrajaya.”

DVS, 2011. *Import and Export and Quarantine Services Section Annual Report.*

Edwards, J.R. 2004. “Strategy for the Control of Foot-and-Mouth Disease in Southeast Asia (SEAFMD).” *Developments in Biologicals* 119: 423–31.


Ferguson, N.M., Donnelly, C.A., Anderson, R.M., 2001. “Transmission intensity and impact of control policies on the foot and mouth epidemic in Great Britain”.
<http://www.nature.com/nature/journal/v413/n6855/abs/41354a0.html>
413(6855) p542-548

FMD Portal: OIE - World Organisation for Animal Health. Retrieved 24 May 2014 from <http://www.oie.int/animal-health-in-the-world/fmd-portal/>.

Garland, A.J.M, and den Clercq, K., 2011. “Cattle, Sheep and Pigs Vaccinated against Foot and Mouth Disease: Does Trade in These Animals and Their Products Present a Risk of Transmitting the Disease?” *Revue Scientifique et Technique-Office International Des Épizooties* 30 (1): 189–206.

Gleeson, L. J. 2002. “A Review of the Status of Foot and Mouth Disease in South-East Asia and Approaches to Control and Eradication.” *Revue Scientifique et Technique-Office International Des Épizooties* 21 (3): 465–72.

Government of Canada, Agriculture and Agri-Food Canada. 2011. “Competitive Industry Report on Brunei Darussalam’s Livestock Industry and Its Demand for Genetics.” <http://www.ats-sea.agr.gc.ca/ase/5674-eng.htm>.

 *The Nation*. Retrieved 16 August 2014 from <http://www.nationmultimedia.com/aec/Myanmar-bans-live-cattle-export-30190365.html>.

Hueston, W., Travis, D., van Klink, E. 2011. “Optimising import risk mitigation: anticipating the unintended consequences and competing risks of informal trade”. *Rev. Sci. Tech* 30(1): 309-316

- Jebara, B.K., 2004. "Surveillance, Detection and Response: Managing Emerging Diseases at National and International Levels." *Revue Scientifique et Technique (International Office of Epizootics)* 23 (2): 709–15.
- Kitching, R P. 2002. "Identification of Foot and Mouth Disease Virus Carrier and Subclinically Infected Animals and Differentiation from Vaccinated Animals." *Revue Scientifique et Technique (International Office of Epizootics)* 21 (3): 531–38.
- Kitching, R. P., and Alexandersen, S. 2002. "Clinical Variation in Foot and Mouth Disease: Pigs." *Revue Scientifique et Technique (International Office of Epizootics)* 21 (3): 513–18.
- Knowles, N. J., and Samuel, A.R., 2003. "Molecular Epidemiology of Foot-and-Mouth Disease Virus." *Virus Research* 91 (1): 65–80.
- Knowles, N. J., Samuel, A.R., Davies, P.R., Midgley, R. J., and Jean-François Valarcher. 2005. "Pandemic Strain of Foot-and-Mouth Disease Virus Serotype O." *Emerging Infectious Diseases* 11 (12): 1887–93.
- Loh, T. C. 2004. "Livestock Production and the Feed Industry in Malaysia." : 329–39. Food and Agriculture Organization of the United Nations (FAO).
- MacDiarmid, S.C., 2011. "Introduction the Spread of Pathogens through International Trade." *Revue Scientifique et Technique (International Office of Epizootics)* 30 (1): 13–17.
- Mokopasetso, M., 2011. "Digital Pen Technology for Animal Disease Surveillance in Southern Africa," Challenges of animal health information systems and surveillance for animal diseases and zoonoses. Proceedings of the international workshop organized by FAO, 23-36 November 2010, Rome, Italy : 39-40.
- "MOSTI : Ministry of Science, Technology and Innovation." Retrieved 10 June 2014 from <http://www.mosti.gov.my/>.
- Murray, J. G., and Abila, R.C., 2011. "The Roadmap for Foot and Mouth Disease Freedom with Vaccination by 2020 in Southeast Asia - SEAFMD 2020." : 56–64. OIE (World Organisation for Animal Health).
- Musser, J.M. B., 2004. "A Practitioner's Primer on Foot-and-Mouth Disease." *Journal of the American Veterinary Medical Association* 224 (8): 1261–68.
- Otte, M.J, Nugent, R., McLeod, A. 2004. "Transboundary Animal Diseases: Assessment of socio-economic impacts and institutional responses" Livestock Policy Discussion Paper No.9 , Food and Agriculture Organization

- Pastoret, P.-P, and Chaisemartin,D., 2011. "The Importance of Governance and Reliable Veterinary Certification." *Revue Scientifique et Technique (International Office of Epizootics)* 30 (1): 347–52.
- Paton,D.J, Sumption, K.J, Charleston, B. 2009. "Options for control of foot and mouth disease: knowledge, capability and policy" *Phil. Trans. R. Soc.B* 364 :2657-2667
- Pereira, H G. 1976. "Subtyping of Foot-and-Mouth Disease Virus." *Developments in Biological Standardization* 35: 167–74.
- "Portal Rasmi Jabatan Perkhidmatan Veterinar." Retrieved 24 May 2014 from <http://www.dvs.gov.my/>.
- "Portal Rasmi Kementerian Pertanian & Industri Asas Tani Malaysia;" Retrieved 24 May 2014 from <http://www.moa.gov.my/>.
- Ramanoon, S.Z, Robertson,I.D.,Edwards, J., Latiffah Hassan, and Kamaruddin Md Isa. 2013. "Outbreaks of Foot-and-Mouth Disease in Peninsular Malaysia from 2001 to 2007." *Tropical Animal Health and Production* 45 (2): 373–77.
- Rangsun, C., Knorr, C., Brenig B., and Gatphayak, K., 2013. "Thai Pigs and Cattle Production, Genetic Diversity of Livestock and Strategies for Preserving Animal Genetic Resources." <http://www.mijst.mju.ac.th/vol7/113-132.pdf>.
- Rweyemamu, M., Roeder,P., Mackay,D., Sumption, K., Brownlie, J., Leforban, Y., 2008. "Epidemiological Patterns of Foot-and-Mouth Disease Worldwide." *Transboundary and Emerging Diseases* 55 (1): 57–72.
- Salt, J S. 1993. "The Carrier State in Foot and Mouth Disease--an Immunological Review." *The British Veterinary Journal* 149 (3): 207–23.
- Schneider, H. 2011. "Good Governance of National Veterinary Services." *Revue Scientifique et Technique (International Office of Epizootics)* 30 (1): 325–38.
- Senawi, Jamaliah Binti. 2012. "Epidemiology of Foot and Mouth Disease in Cattle in Pahang, Malaysia". Mresearch, Murdoch University. <http://researchrepository.murdoch.edu.au/10695/>.
- Smith, L. P., and Hugh-Jones,M. E., 1969. "The Weather Factor in Foot and Mouth Disease Epidemics.", *Published Online: 16 August 1969*
- Sugiura, K., and Murray,N., 2011. "Risk Analysis and Its Link with Standards of the World Organisation for Animal Health." *Revue Scientifique et Technique (International Office of Epizootics)* 30 (1): 281–88.

- Sumption, K. 2007. "Foot-and-Mouth Disease Situation Worldwide and Major Epidemiological Events in 2005-2006." *EMPRES FAO*.
- Sutmoller, P., and Gaggero, A., 1965. "Foot-and Mouth Diseases Carriers." *Veterinary Record* 77 (33): 968–69.
- Wallace, W.R. 1939. *Report on the Veterinary Departments, Malaya. In: Department of Veterinary, M. (Ed.) Federated Malay States Government Press, Kuala Lumpur.*
- Wallace, W.R. 1936. *Foot and Mouth Disease Situation, In: Annual Report of the Veterinary Department S.S and F.M.S Fo the State. In: Department of Veterinary, M. (Ed.) Federated Malay States Government Press. Kuala Lumpur.*
- Wongsathapornchai, K., and Salman, M.D., 2003. "Development of risk assessment for foot and mouth disease within the Myanmar-Thailand-Malaysia (MTM) Peninsular, International Symposia on Veterinary Epidemiology and Economics, (ISVEE 10) Proceedings of the 10th Symposium of the International Society for Veterinary Epidemiology and Economics p272
- Wongsathapornchai, K., and Salman, M.D., 2008. "Assessment of the Likelihood of the Introduction of Foot-and-Mouth Disease through Importation of Live Animals into the Malaysia-Thailand-Myanmar Peninsula." *American Journal of Veterinary Research* 69 (2): 252–60.
- Wongsathapornchai, K., Weber, S., and Premasathira, S., 2008. "Use of Epidemiologic Risk Modeling to Evaluate Control of Foot-and-Mouth Disease in Southern Thailand." *American Journal of Veterinary Research* 69 (2): 240–51.
- "World Agriculture: Towards 2015/2030 - An FAO Perspective." Retrieved 24 May 2014 from <http://www.fao.org/docrep/005/y4252e/y4252e05b.htm>.
- "WTO Sanitary and Phytosanitary Measures - Text of the Agreement." Retrieved 28 May 2014 from http://www.wto.org/english/tratop_e/sps_e/spsagr_e.htm.