UNIVERSITI PUTRA MALAYSIA

SEROPREVALENCE OF SMALL RUMINANT LENTIVIRUS (SRLV) AMONG SMALL RUMINANT IN FOSTER FARM PROGRAMME, FPV, UPM.

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A project submitted to the

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In partial fulfilment of the requirement for the

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It is hereby certified that we have read this project paper entitled “Seroprevalence of Small Ruminant Lentivirus (SRLV) Among Small Ruminant in Foster Farm Programme, FPV, UPM ”, by Veenosha Nehru Raju and in our opinion it is satisfactory in terms of scope, quality, and presentation as partial fulfilment of the requirement for the course VPD 4999 – Final Year Project

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DEDICATION

This project dedicated to

all veterinarians and future veterinarians,

my parents, sisters and DVM 2017.

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ABSTRAK

Abstrak daripada kertas projek yang dikemukakan kepada Fakulti Perubatan Veterinar untuk memenuhi sebahagian daripada kursus VPD 4999- Projek Ilmiah Tahun Akhir

Oleh

Veenosha Nehru Raju

2017

Penyelia: Prof. Madya Dr. Faez Firdaus Jesse Abdullah

Penyakit kambing Caprine Arthritis-Ensefalitis Virus (CAEV) merupakan penyakit yang tidak boleh diubati dan meberi impak terhadap kesan sosial dan ekonomi. Tanda-tanda klinikal boleh diperhatikan pada anak kambing iaitu encephalitis, dan artritis kronik, mastitis radang dan penyakit pernafasan progresif di kalangan kambing dewasa.Kes pertama CAE yang dilaporkan di Malaysia adalah pada tahun 2010, dan satu lagi kes CAE disyaki telah dilaporkan pada tahun 2013.Sejak itu, tiada pemeriksaan serolgi dilakukan. Oleh itu, kajian ini bertujuan untuk menentukan seroprevalance CAE dalam kalangan kambing di Ladang Angkat FPV, UPM serta faktor-faktor risiko yang dikaitkan dengan penyakit ini. Sampel darah telah dikumpul daripada 91 kambing melalui kaedah persampelan mudah. Serum darah telah

digunakan untuk ELISA kit yang kompetitif untuk mengesan antibodi terhadap virus CAE. Dari 91 sampel kambing, 8 sampel (8.8%) adalah positif.Pengurusan biosekuriti, sumber asal kambing dan jantina haiwan merupakan factor risiko yang penting bagi kelaziman penyakit CAE di Program Ladang Angkat, FPV, UPM. Oleh itu, dapat disimpulkan bahawa kelaziman CAE di kalangan kambing di Program Ladang Angkat, FPV, UPM adalah rendah. Walau bagaimanapun langkah-langkah kawalan seperti ujian serologi dan pemusnahan haiwan positif atau pengasingan haiwan yang dijangkiti dari ujian haiwan negatif boleh menjadi amalan yang penting untuk mengawal penyebaran mendatar di kalangan kambing.

Kata kunci: Caprine arthritis encephalitis (CAE), kambing, ladang angkat, kelaziman

Abstract

An abstract of the project paper presented to the Faculty of Veterinary Medicine, UPM in partial fulfillment of the course VPD 4999-Project.

SEROPREVALANCE OF SMALL RUMINANT LENTIVIRUS (SRLV) AMONG SMALL RUMINANT IN FOSTER FARM PROGRAMME OF FPV,UPM.

By

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2017

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Co-supervisors: Prof. Dr Abdul Rahman Omar, Prof Dr Noordin Mohamed Mustapha

Caprine Arthritis-Encephalitis Virus (CAEV) is an incurable disease of goats that has both social and economic impacts. Clinical disease in goats includes encephalitis in kids; chronic arthritis, inflammatory mastitis and progressive respiratory disease in adults. The first reported case of CAE in Malaysia was in year 2010, and another suspected case of CAE was reported in year 2013.Since then no screening was done. Therefore the study was designed to determine the seroprevalance of CAE among goat population in

Foster Farm Programme of FPV, UPM and the risk factors associated with this disease. Blood samples were collected from 91 goats via convenient sampling method. The blood serums were used for the competitive ELISA kit to detect antibody towards CAE virus. From the 91 goat samples, 8 samples (8.8%) were positive for CAE.Biosecurity management, source of origin and sex of the animal were important risk factors for the prevalance of CAE in Foster Farm Programme, FPV, UPM. Therefore it can be concluded that seroprevalance of CAE among goat population in Foster Farm Programme, FPV, UPM is low. However control measures such as testing and culling positive animals or segregation of infected animals away from test negative animals can be an important practice for control of horizontal spread among goat population.

Keywords : Caprine arthritis encephalitis (CAE), goats, foster farm,seroprevalance

Chapter 1.0: Introduction

Caprine arthritis encephalitis virus (CAE) is a single-stranded, icosahedral, RNA virus of the family *Retroviridae* and the sub-family *Lentivirinae* **(Shelly,2004).**The lentiviruses compose a taxonomic group of pathogens that include the human immunodeficiency viruses, HIV-1 and HIV-2, visna-maedi virus of sheep (visna), caprine arthritis-encephalitis virus (CAEV), equine infectious anemia virus (EIAV), feline immunodeficiency virus (FIV), bovine immunodeficiency virus (BIV) and immunodeficiency viruses of Asian macaques and several species of African monkeys (SIV) **(Shelly, 2004).**

CAEV is closely related to the viruses that cause Ovine Progressive Pneumonia (OPP) and meadi-visna in sheep, and together these are referred to as small ruminant lentiviruses (SRLVs) **(Christine, 1990).** The ability of lentiviruses to cause lifelong infections is due to their tropism for cells of the immune system, particularly cells of monocyte-macrophage lineage **(Christine, 1990).** The CAE virus has a predilection to infect mononuclear cells, specifically tissues macrophage of the lung, central nervous system, synovium and mammary gland **(Shelly, 2004).**

CAE virus infects goat primarily through horizontal transmission which is via ingestion of infected milk and through direct contact between goats via shedding of virus in the saliva and other body fluids secretions **(Dyson and Linklater, 1979).**

Most goats infected with CAE virus are asymptomatic, but there are five major clinical presentations associated with viral infections including arthritis, encephalitis, interstitial pneumonia, mastitis and progressive weight loss **(Matthews, 1999).** The most common clinical manifestation seen in adults is arthritis in any joints, most notably the carpal joints(‘big knee) and encephalitis in kids less than 6 months of age

(Nathanson,1985). The encephalitic form is more common in kids between 2 and 6 months of age where they may show signs of in coordination, gradual paresis and paralysis affecting the hind limbs and progressing to the forelimbs **(Shelly, 2004; Christine, 1990).**

A combination of history, clinical signs, positive serology tests, post-mortem lesions, histopathological lesions, and exclusion of all other possible diseases is necessary to diagnose CAE **(Anderson, 1985).**

Prevention of CAEV is based on the removal of kids from their dam at birth, and feeding the kids heat-treated colostrum and pasteurized milk until weaning. Serologic testing and segregation or culling of seropositive goats is necessary to minimize horizontal transmission of CAEV **(Anderson, 1985).**

The first reported case of CAE outbreak in Malaysia was in 2010; however since then there is no data being collected **(Noordin, 2010)**.However, there was a suspected CAE case in Ladang Angkat reported by **Jesse et al, 2013** but no screening was done. This study was designed to screen the disease among small ruminant in Ladang Angkat FPV , UPM and to have a better Herd Health Programme (HHP).Therefore, this study was proposed to achieve following objectives:

1. To determine the seroprevalence of small ruminant lentivirus (SRLV) among small ruminant in Ladang Angkat FPV, UPM.
2. To record the risk factors that are associated with seroprevalance of small ruminant lentivirus (SRLV) among small ruminant in Ladang Angkat FPV, UPM.

Chapter 2.0 Literature Review

2.1 Agent

Caprine arthritis and encephalitis results from infection by caprine arthritis encephalitis virus (CAEV) which is a single-stranded, icosahedral, RNA virus in the family of Retroviridae and member of the genus Lentivirus (Anderson , 1985; Shelly,2004).

The lentiviruses compose a taxonomic group of pathogens that include the human immunodeficiency viruses, HIV-1 and HIV-2, visna-maedi virus of sheep (visna), equine infectious anemia virus (EIAV), feline immunodeficiency virus (FIV), bovine immunodeficiency virus (BIV) and immunodeficiency viruses of Asian macaques and several species of African monkeys (SIV) **(Shelly, 2004).**

Caprine arthritis-encephalitis virus (CAEV) infection is a persistent lentiviral infection of goats **(Rowe and East, 1997)** as the infections are frequently not apparent, with no obvious pathological sequel for periods that approximate the normal lifespan of the host **(Haase,1986)**. The best explanation for the persistence of lentiviruses is the immunologically silent nature of the infection **(Haase, 1986).** Most infected cells harbour the virus in a latent state in which viral antigens are not produced in sufficient quantities for detection and destruction of the infected cell by immune- surveillance mechanisms **(Haase et al., 1986).**

Lentiviruses are known for their tropism for cells of monocyte-macrophage lineage, their dependence on exchange of body fluids for transmission, and for causing persistent infection and chronic disease **(Zink, Yager and Myers,1990).** The CAE virus has a predilection to infect mononuclear cells, specifically tissues macrophage of the lung, central nervous system, synovium and mammary gland **(Shelly, 2004).**

2.2 Mode of transmission

Ingestion of virus-laden colostrum or milk from the infected does is a highly efficient natural route of CAEV transmission **(Crawford et al,.1981, Ellis et al,.1986).**According to a study conducted by Ellis et al, she isolated CAEV from cells in colostrum.Kids fed raw colostrum either at birth **(Adams et al., 1980)** or from 1 to 5 days of age as the only source of goat milk became infected **(Rowe and East,1997).**Horizontal transmission can also occur by direct contact and exposure to contaminated milk in milking parlors **(Smith, 1994).**

Other potential routes of transmission is via perinatal and postnatal.Perinatal infection of kids can occur via four possible routes such as in-utero transmission, transmission from the dam by vaginal contact during birth, accidental ingestion of colostrum from CAEV-infected does or transmission from the dam by exposure to respiratory secretions during licking of the kid **(Rowe and East,1997).**

2.3 Clinical signs

CAE is a multi-organ-system disease which primarily affects the central nervous system (CNS) and connective tissues **(Crawford *et al*.,1980)**. The CNS component are usually seen in kids of age 2 to 6 months which are described as leukoencephalomyelitis **(Cork et al,.1980)** also accompanied by diffuse interstitial pneumonia **(Zink, Yager and Myers,1990).** Lesions in the nervous system are restricted primarily to the white matter and include perivenous accumulations of mononuclear cells and varying degrees of myelin destruction **(Cork, Hadlow, Crawford, Gorham and Piper, 1974**).Affected kids usually shows signs of rear-leg paresis**(Rowe and East,1997)** that progresses to tetra paresis within a few days to

several weeks **(Stoskopf *et al*., 1985)**.Some affected kids also show signs of head tilt, circling, blindness, nystagmus, opisthotonus , torticollis and facial nerve deficits **(Anonymous, 2007**). Neurological signs are rarely reported in adults.

The connective tissue form of CAE presents clinically as chronic progressive arthritis **(Crawford *et al*., 1980)** with proliferative lymphoplasmocytic synovitis **(Zink, Yager and Myers, 1990)** in mature goats. The carpal joints are always affected with variable involvement of the stifle, hock, and coxofemoral and alanto-ocipital joints **(Rowe and East, 1997).**

Indurative mastitis is also one of the clinical sign that can be seen in does **(Anonymous, 2007).** A study conducted by **Stoskopf *et al*,** confirmed that mammary gland is an important target organ for CAE virus infection and dissemination. Presence of subclinical viral mastitis has a great impact on the dairy goat industry as it reduces the milk production.

2.4 Risk factors

2.4.1 Farm management

2.4.1.1 Cross-transmission

Animal lentivirus infections are transmitted between animals by virus inside monocytes and macrophages in body secretions (Haase,1986). Rearing goats with SRLV seronegative with sheep which are SRLV seropositive support the cross-species transmission between sheep and goat (Brulisauer, F. et al., 2005).

2.4.1.2 Large Herd size

When there is a higher number of goats in a farm, the probability of finding seropositive in that farm will increase, as high stock density of animal has a tendency to have poor biosecurity and sanitary management **(AlQudah, K. et al., 2006).**

2.4.1.3 Introduction of new animals

CAE is an infectious disease which are asymptomatic and has a long incubation period.Tus newly imported can be carries and can spread the disease to the herd before it can be detected.

2.4.1.4 Contact with other goat herds

Direct contact with other goat is via body fluid secretion from respiratory system and breeding.

2.4.2 Animal factor

2.4.2.1 Age

In a study done by Al-Qudah et al, it was reported that goats older than 3 years were more likely to be CAEV seropositive than younger goats. Similar findings were reported by **(Dawson and Wilesmith, 1985; Greenwood et al., 1995**). An increase in seroprevalence with age was found in a few studies which may be explained by lifelong infection plus continued transmission, resulting in increasing cumulative proportion infected with age **(Rowe and East, 1997).**

2.5 Control and preventive measures

Management practices can influence the prevalence of infection and, thus, the frequency of disease. Clinical signs are not usually seen in herds with a low prevalence of infection.

2.5.1 Vaccination

An efficient vaccine is not yet available due to the different responses from each host (Adebayo, I. A. et al., 2002). Possible explanations for lack of protection from homologous virus challenge are that neutralizing antibody was not induced by vaccination **(Cheevers et al., 1994).**

2.5.2 Quarantine

Newly imported live goats need to be quarantined and tested before adding them into the herd. The new animals need to be quarantined and tested within 60 days of arrival before mixing with the pre-existing population **(Reilly, L. K. et al., 2002).**

2.5.3 Isolating kids from seropositive dams

Immediate removal of kids from their dam at birth is to prevent contact between kids and secretions of the dam and separate the kids from the dam at least 2 metres away **(Adams et al.,1980).**

2.5.4 Pasteurized feeding

Kids can be fed heat-treated colostrums at 56°C (133°F) for 1 hour as the virus will be inactivated at this temperature,cow colostrums and pasteurized (74°C (165°F) for 15 seconds) milk or milk replacer until they are weaned **(Pattarin, 2011).**Kids fed pasteurized milk are less likely to seroconvert than kids fed 24 unpasteurized milk **(Knowles, D. P. et al., 1992).**

2.6 Current infection status

CAE occur worldwide especially in intensive dairy industry countries with prevalence exceeding 65 % **(Knowles, D. P. et al., 1992).**In Malaysia, the disease was first reported by Noordin et al in year 2010 , where 20 goats from a farm showed nervous signs and 4 of the goats died later. Post mortem and virus isolation revealed it was a CAE case. In year 2013, Jesse *et al*, reported a case of suspected CAE in a Boer cross kid which was diagnosed according to clinical signs, post mortem and histology result. Since then no data being collected in Malaysia.

Chapter 3.0: Materials and Methods

3.1 Methodology

Four goat farms under the Foster Farm Programme of Faculty of Veterinary Medicine, UPM were selected randomly for our study. 91 goats were selected via convenient sampling method from each of the farms.

3.2 Blood collection

Blood sample was collected via jugular venipuncture using 21 G vacutainer. Blood was collected in plain tubes (red tube) and immediately stored in the ice box after collection.

3.3 Serum sample preparation

Blood samples in the plain tube are brought back to the clinical lab and centrifuged at 3000 rpm for 5 minutes. The resulting supernatant is the designated serum. Following centrifugation, the serum was transferred to eppendorf tube using a clean pipette. The desired volume of serum for each eppendorf tube is 1.5 ml. Serum from each plain tube was separated into two different eppendorf tube to be stored at different temperature. The serum sample to be used for the ELISA kit is stored at -20°C whereas another serum sample are maintained at -80°C for a backup storage.

3.4 Serology testing

3.4.1 cELISA test kit procedure

The cELISA utilized for the determination of seropositivity to CAEV is produced and distributed by Veterinary Medical Research and Development (VMRD, Inc). The test detects antibodies to the surface envelope of CAEV. The protein is

designated as CAEV-63 SU gp135. The description and procedure of the test is as follows.

Serum samples, reagents and plates were brought to room temperature prior starting the test.Single and multichannel adjustable-volume pipettors and disposable plastic tips, ELISA microplate absorbance spectrophotometer with 630 nm filter, distilled water, paper towels and wash bottle were prepared.Controls and serum samples was loaded into the antigen coated plate using the pipettor which was set at 50 µl. The side of the loaded assay plate was tapped several times to make sure the samples coat the bottom of the wells. Later, the plate was incubated at room temperature for an hour.The plate was washed 3 times after 1 hour of incubation using wash solution which was prepared manually. The well contents was dumped into the sink and the remaining sera and controls were removed by sharply striking the inverted plate 4 times on a clean tower paper. Next, 1X wash solution was filled into each well using multichannel filling pipettor. The wash solution was emptied from the plate by striking the inverted plate sharply on a clean paper as above. The procedure was repeated for a total of 3 washes.Next, 50 µl of diluted (1X) Antibody-Peroxidase Conjugate was added to each well. The side of the loaded assay plate was tapped several times to make sure the conjugate coats the bottom of the wells. The plate was incubated for an additional 30 minutes at room temperature.After 30 minutes of incubation, the plates was washed 3 times .50 µl of Substrate solution was then added to each well and side of the loaded assay plate was tapped several times to make sure the substrate coats the bottom of the wells. The plate was incubated for another 20 minutes at room temperature.50 µl of Stop solution was added to each well after the

20 minutes of incubation. The side of loaded assay plate was tapped several times to mix the substrate solution and stop solution.After adding stop solution, the plate was immediately read on a microplate absorbance spectrophotometer. The optical density(O.D.) reading wavelength was set to 630 nm.

Percent inhibition is calculated as follows: Percent inhibition = 100 [1 – (Sample optical density / Negative control O.D.)]. Sensitivity to the test as read was reported to be 100%, specificity 99.6%.Samples were reported as positive and negative by the lab based on percent inhibition being above or below 35%. Individual percent inhibition was reported for each of the samples.

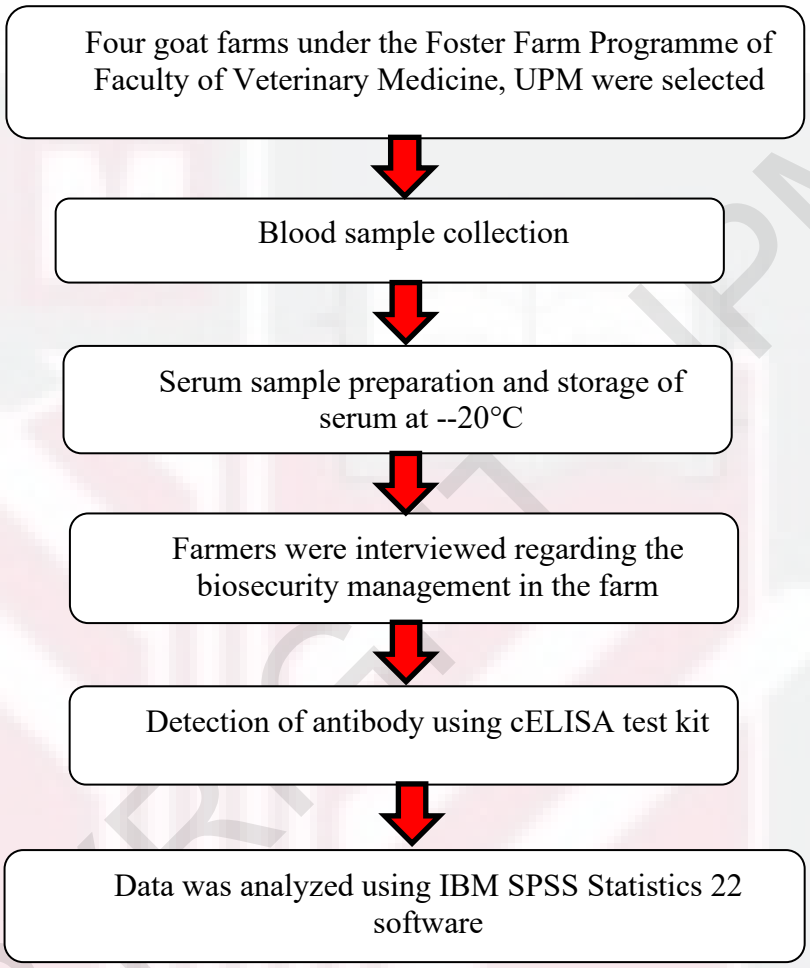
3.5 Risk factor data

Age, breed and gender were recorded for each individual animal selected as sample. Farmers were interviewed regarding the biosecurity management and the origin of the animal.

3.6 Statistical Methods

The data analysis for this study was done using the IBM SPSS Statistics 22 Software. The P value was calculated using Pearson Chi-square to determine whether the risk factors has any significant association in the prevalence of CAE among the goat population in Foster Farm Programme of FPV, UPM.PHI and Cramer's V test was used to determine the strength of association between the risk factors and the seropositive result obtained.

Figure 1.0: Flow chart describing the flow of experiment



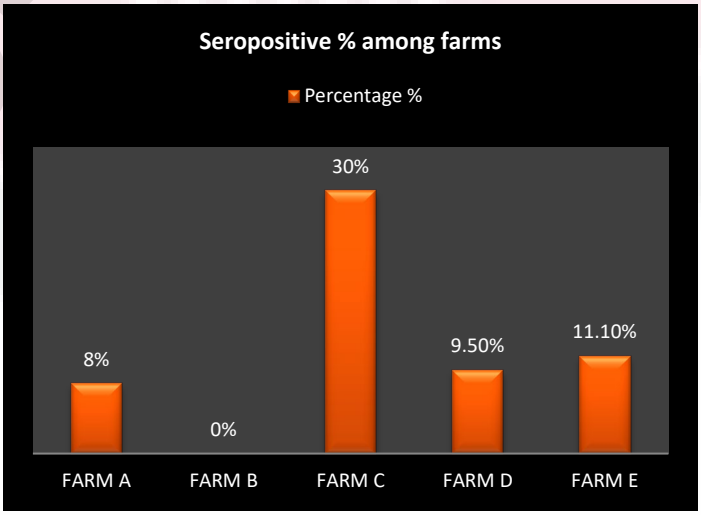
Chapter 4.0: Results

4.1 Result of serological sampling for Caprine Arthritis Encephalitis

Seroprevalance rate of Caprine Arthritis Encephalitis among small ruminant in Foster Farm Programme, UPM revealed that 8 serum samples out of 91 were positive with the apparent prevalence rate of 8.8% and true herd prevalence of 8.42 %. Among the 5 different farms, only 4 farms shows seropositive results against CAE as shown in Table 1 and Graph 1.

Farm	Serum collected	Seropositive sample	Percentage %
FARM A	25	2	8.0
FARM B	26	0	0.0
FARM C	10	3	30.0
FARM D	21	2	9.5
FARM E	9	1	11.1

Table 1 : Seroprevalence of CAE in goats in 5 different farms



Graph 1 : Seroprevalence of CAE in goats in 5 different farms

4.1.1 Calculation of apparent prevalence

Prevalence =no. of positive sample/sample size

= 8/91

= **8.8 %**

4.1.2 Calculation of true prevalence

Apparent prevalence rate of 8.8 % with sensitivity of 100 % and specificity of 99.6%.

True prevalence = PtRt=PaRt+(Sp-1)/Se+Sp-1 (Toma, B. *et al.*, 1999)

Where;

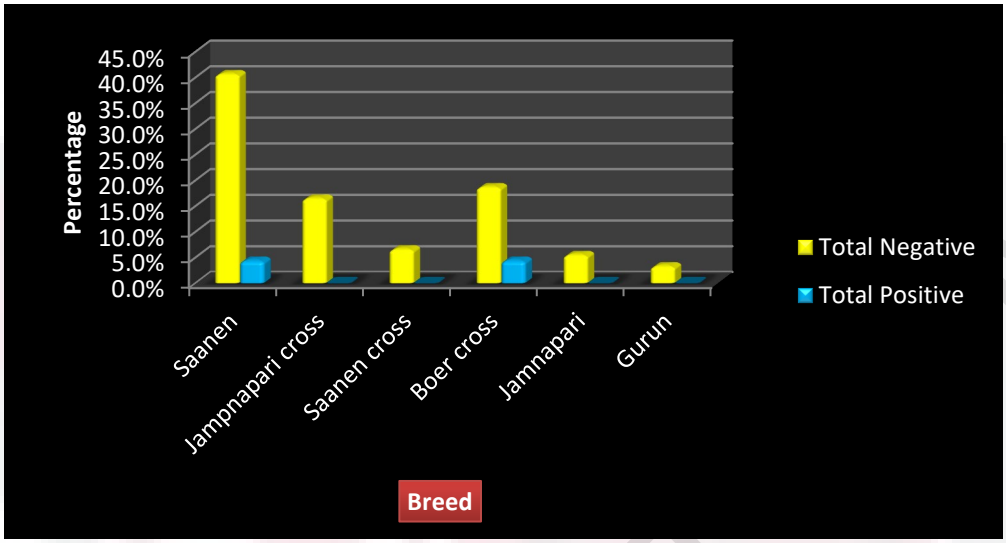
PtRt = true prevalence rate
Se = sensitivity of test
PaRt = apparent prevalence rate
Sp = specificity

PtRt = 8.8+(0.9961)/(1+0.996-1)= **8.42 %**

4.2 Risk Factor Analysis

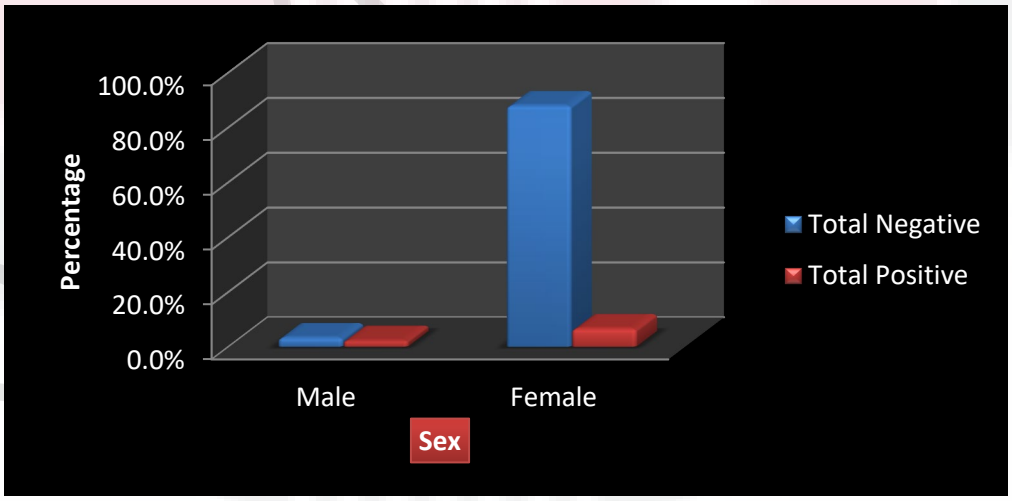
4.2.1 Chi-square

Chi square was used with $p<0.05$ shows statistically significant association. Sex of the animal was statistically significant with seroprevalence of CAE among goat population in Foster Farm Programme with $p<0.005$ where female was more significant compared to male. Other risk factors such as breed of goats, biosecurity management, age and source of origin shows no significant association with seroprevalence of CAE with $p >0.05$.



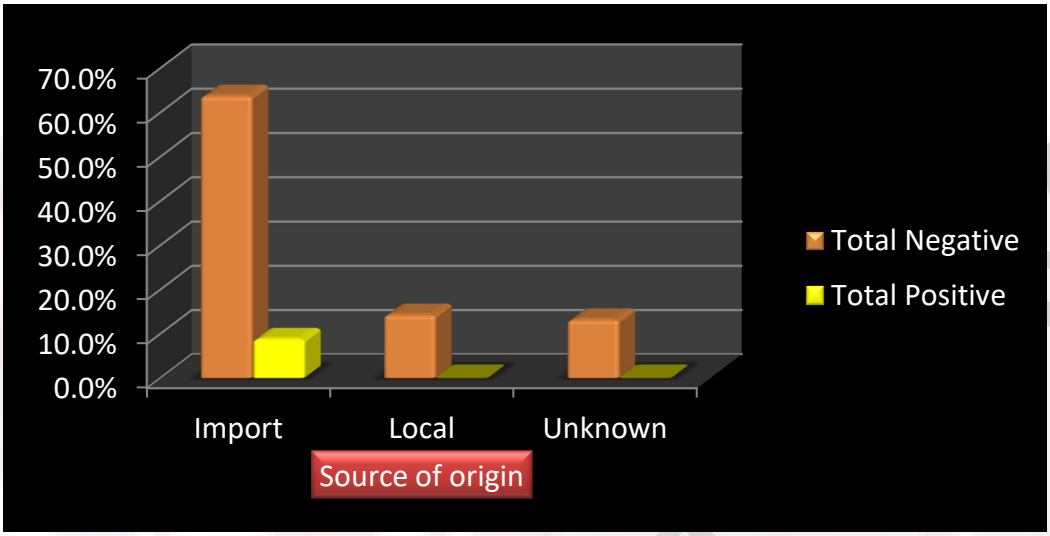
Graph 2 : Breed related seroprevalence of CAE

Graph 2 shows, 50 % of Saanen goat and 50% of Boer cross has seropositive result against CAE, whereas other breeds are seronegative against CAE. There is no statistically significant association with ($p>0.05$) between breed of the animals and the seroprevalence of CAE.



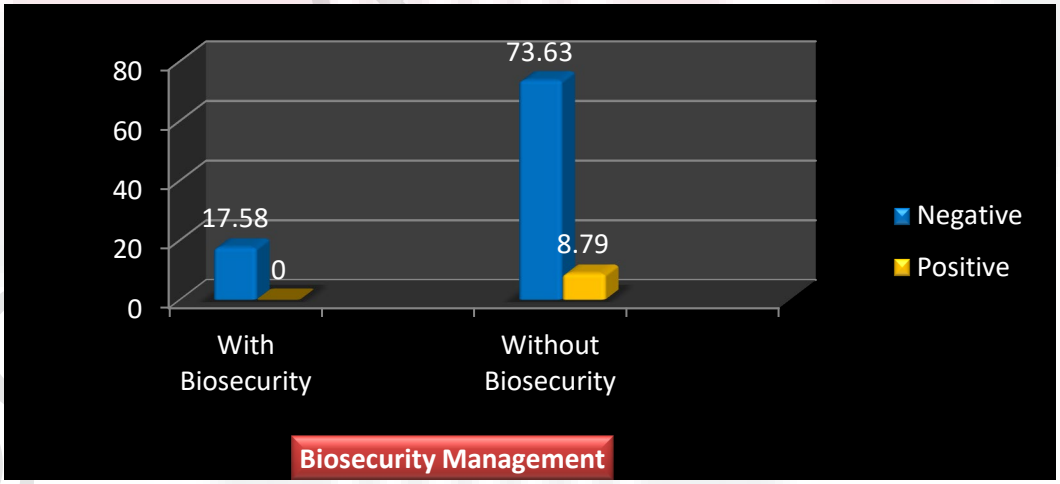
Graph 3 : Sex related seroprevalence of CAE

Higher number of female goats shows seropositive compared to male goats.. There is statistically significant association ($p<0.05$) between sex of the animals and the seroprevalence of CAE.



Graph 4 : Source of origin related seroprevalence of CAE

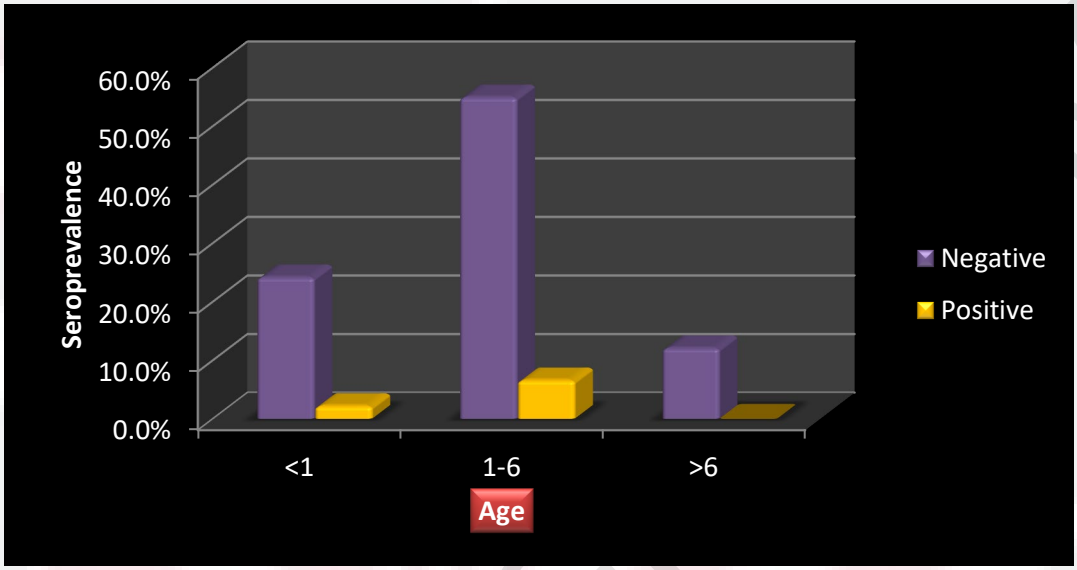
The animals were divided into three categories, the imported, local and of unknown origin. However, all the seropositive goats were imported from overseas. There is statistically no significant association ($p>0.05$) between origin of the animals and the seroprevalence of CAE.



Graph 5 : Biosecurity management related seroprevalence of CAE

The farm that does not practice biosecurity measures , shows seropositive result compared to the farm that practiced biosecurity measures. There is no statistically

significant association with (p>0.05) between biosecurity management and the seroprevalence of CAE.



Graph 6 : Age related seroprevalence of CAE

Animal within the age of 1-6 has higher seropositive compared to other age group. There is statistically no significant association with (p>0.05) between age and the seroprevalence of CAE.

Chapter 5.0: Discussion

This study revealed herd seroprevalance of CAE among goat population in Foster Farm Programme in FPV,UPM was 8.42 %, which was reported to be 9 times lower compared to prevalence of CAE reported in United States in year 1981 (Ratanapob, N. *et al.*, 2009) . Moreover, countries such as Canada, Australia, New Zealand, France, Sweden and China has prevalence of more than 65 % according to OIE.Serprevalence rate of 8.42% is still low compared to other countries , yet this value only represents the 5 Foster Farm Programme in the Selangor area. Serological testing against CAE need to be done in each sates of Malaysia in order to know the status of CAEV in our country. Higher prevalence rate of CAE reported in a few countries are associated with risk factors such as herd management, breed of goats, size of herd, and age of the animal (Pattarin, 2011).

Risk factors associated are the sex of the animal which shows significant association with seroprevalance of CAE. Higher number of doe shows seropositive results compared to bucks, however this is contradicting to the studies done by Grewel et al who reported higher seroprevalence in bucks than in does. The contraindicating facts could be due to different sample size of animals used in the studies.

Higher seropositive was seen in Saanen and Boer cross goats in this study, which may be due to the higher sample collected from these two breeds. However, there is no significant association with the breed of goat and seroprevalance towards CAE. The result from this study not in agreement with studies done by Greenwood et al where lower seroprevalance of CAEV was reported in Saanen breed in a study done in South Wales. Dawson et al, reported lower seroprevalence in Golden Guernsey

goats than other breeds, and no evidence of infection in Toggenburg goats, but apparently not all breeds had equal opportunity for exposure. Other crosssectional studies have failed to demonstrate a consistent association of breed with CAEV infection (Rowe and East,1997).

Farm that do not practice biosecurity management showed higher seropositive result compared to the farm that practices biosecurity practice. This supports the statement by Al-Qudah et al, where poor biosecurity and sanitary management practiced more likely to transmit disease. The farm that practiced biosecurity management has a very limited access to any outside turnout.

For this study, all the seropositive goats were imported from overseas.Imported goats can be carriers and spread the disease to the herd before it can be detected. Thus, farms need to practice a strict quarantine protocol before importing goats for breeding purpose as to avoid introduction of the disease into the herd.

For the age factor, animal within the age of 1-6 years old has higher seropositive compared to other age group in this study.In a study done by Al-Qudah et al, it was reported that goats older than 3 years were more likely to be CAEV seropositive than younger goats. An increase in seroprevalence with age was found in a few studies which may be explained by lifelong infection plus continued transmission, resulting in increasing cumulative proportion infected with age (Rowe and East, 1997).

6.0 Conclusions and Recommendation

Conclusions

Herd seroprevalence of CAE among goat population in Foster Farm Programme is 8.42%. Risk factors associated with seroprevalence at herd level were sex of the animals and farm that do not practice biosecurity management.Suggestion for this study would be to increase the sampling size and even sampling for each category such as the breed of the goats, type of goats, age, and sex.Quarantine factor should be added in the quantitative risk assessment to estimates the probability of introduction level of CAEV into farm via imported goats if quarantined.

Recommendations

The status of CAEV among the five farms need to be reported to relevant authorities such as to Department Of Veterinary Service (DVS). This is to alert the department so that relevant control and prevention measures can be taken. Control and prevention methods such as frequent serological testing need to be done in order to know the status of the disease in each state of Malaysia.Isolating and culling the infected goats are important to control horizontal transmission within the herd. Isolating kids from seropositive dam and practicing pasteurized feeding can help to reduce the problem.

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8.0 Appendix

ID	Age	Sex	Breed
MA1	>1	F	Saanen
MA2	>1	F	Saanen
MA3	>1	F	Saanen
MA4	>1	F	Saanen
MA5	>1	F	Saanen
MA6	>1	M	Saanen
MA7	>1	F	Saanen
MA8	>1	F	Saanen
MA9	>1	F	Saanen
MA10	>1	F	Saanen
MA11	>1	F	Saanen
MA12	>1	F	Saanen
MA13	>1	F	Saanen
MA14	1	F	Saanen
MA15	>1	F	Saanen
MA16	>1	M	Jamnapari
MA17	>1	F	Jamnapari
MA18	>1	F	Jamnapari Cross
MA19	>1	F	Jamnapari
MA20	>1	F	Saanen
G1	>1	F	Saanen
G2	>1	F	Saanen
G3	>1	F	Saanen
G4	>1	F	Saanen
G5	>1	F	Saanen
G6	>1	F	Saanen
G7	>1	F	Saanen
G8	>1	F	Saanen
G9	>1	F	Saanen
G10	>1	F	Saanen
G11	>1	F	Saanen
G12	>1	F	Saanen
G13	>1	F	Saanen
G14	>1	F	Saanen
G15	>1	F	Saanen
G16	>1	F	Saanen
G17	>1	F	Saanen
G18	>1	F	Saanen
G19	>1	F	Saanen

G20	>1	F	Saanen
G21	>1	F	Saanen
G22	>1	F	Saanen
G23	>1	F	Saanen
G24	>1	F	Saanen
G25	>1	F	Saanen
K1	>1	F	Jamnapari Cross
K2	>1	F	Jamnapari Cross
K3	>1	F	Jamnapari Cross
K4	>1	F	Jamnapari Cross
K5	>1	F	Jamnapari Cross
K6	>1	F	Jamnapari Cross
K7	>1	F	Saanen Cross
K8	>1	F	Saanen Cross
K9	>1	F	Jamnapari Cross
K10	>1	F	Boer Cross
K11	>1	F	Jamnapari Cross
K12	<1	F	Boer Cross
K13	<1	F	Boer Cross
K14	>1	F	Saanen Cross
K15	>1	F	Jamnapari Cross
K16	>1	M	Jamnapari Cross
K17	>1	F	Boer Cross
K18	>1	F	Saanen Cross
K19	>1	F	Saanen Cross
K20	>1	F	Boer Cross
K21	>1	F	Boer Cross
K22	>1	F	Jamnapari Cross
K23	>1	F	Jamnapari Cross
K24	>1	F	Jamnapari Cross
K25	>1	F	Saanen Cross
0577	>1	F	Boer Cross
1512	<1	F	Boer Cross

9278	>1	F	Boer Cross
04XX	>1	F	Boer Cross
0778	>1	F	Boer Cross
0777	>1	F	Boer Cross
0144	>1	M	Boer Cross
NE 050306	>1	F	Gurun
Boer 1	>1	F	Boer Cross
9279	>1	F	Boer Cross
9272	<1	F	Boer Cross
6037	>1	F	Boer Cross
Boer 2	>1	F	Boer Cross
NE 050306 (Kelabu)	>1	F	Gurun
0876	>1	F	Saanen
Jacko Jr	>1	F	Jamnapari
Jacko	>1	M	Jamnapari
Boer 3	>1	F	Boer
Milky	>1	F	Boer Cross
MA21	>1	F	Jamnapari Cross
K26	>1	F	Boer Cross

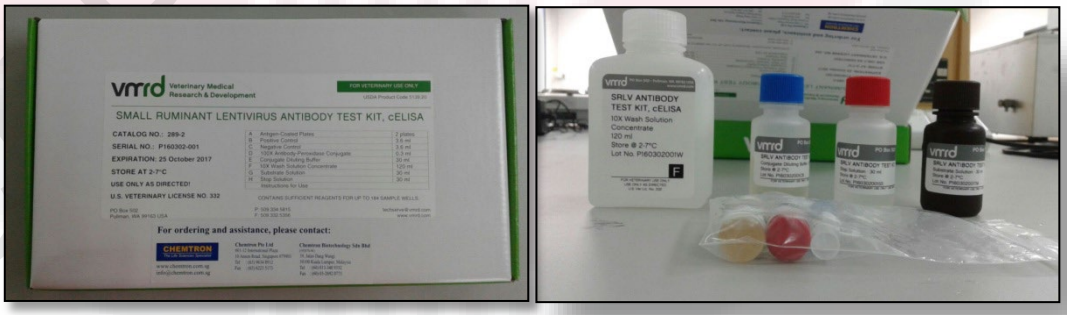

Figure 2 : Competitive ELISA kit