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Short communication

Seroprevalence of small ruminant lentivirus infection in goats in Thailand

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Abstract

Small ruminant lentivirus (SRLV), which causes caprine arthritis encephalitis in goats and ovine progressive pneumonia (maedi-visna disease) in sheep, is classified in genus *Lentiviruses* belonging to *Retroviridae* family. It persists in infected goats and sheep, which mostly are sub-clinical. A serological survey was conducted to determine the prevalence of small ruminant lentivirus infection in Thai goat population. Serum samples were taken from 1,925 goats distributed throughout the country, then they were tested for the presence of SRLV antibodies using commercial indirect enzyme-linked immunosorbent assay (ELISA) test kits. Results revealed that a total of 68 goats were found seropositive, representing the apparent prevalence and true prevalence of 3.57% and 2.60%, respectively. The seroprevalence, revealed in this study, was lower than in the previous reports. The decreasing of seroprevalence might be caused by successful control strategies from Department of Livestock Development (DLD).

Key words: small ruminant lentivirus, ELISA, goats, prevalence

Introduction

Small ruminant lentivirus (SRLV), causing chronic progressive multisystemic disease in goats and sheep, is divided into several subgroups (A-E) (Grego et al, 2018). The virus causes slow progressive inflammatory lesions of the joints, mammary glands, lungs and brain of goats (Cork et al. 1974, Crawford et al. 1980, Narayan and Cork 1985). Goats exposed to SRLV may not show any clinical signs or may develop one or more of clinical syndromes such as polyarthritis, neurologic dysfunction, indurative mastitis, interstitial pneumonia or weight loss (Smith and Sherman 2009). SRLV can transmit both horizontally and vertically (Smith and Sherman 2009). In goats, lactogenic transmission has been assumed to be the major route of vertical transmission (Smith and Sherman 2009, Minguijon et al. 2015) by shedding the virus particles and infected macrophages and epithelial cells in the colostrum and milk. Direct, closed contact with infected animal is the main route of horizontal transmission (Smith and Sherman 2009), but the mechanism is not clearly understood (Reina et al. 2009). After infection, both humoral and cell-mediated immunity are induced in SRLV-infected goat but they are not protective (Smith and Sherman 2009). The specific antibodies of SRLV are produced lifelong with variation of titer (Minguijon et al. 2015).

SRLV is widespread around the world with high prevalence in countries with intensive goat rearing industries (Smith and Sherman 2009). It has been reported in several countries with high variation of prevalence after being first described in 1974 by Cork et al. (1974) in United States, such as 8.52% in goats in two localities in Egypt (Baraka et al. 2018), 0.4% in goats in Yucatan, Mexico (Torres-Acosta et al. 2003) and 23.22% in goats in southern Spain (Barrero Dominguez et al. 2017). In Japan, seroprevalences of caprine arthritis encephalitis virus (CAEV) infection in goats were reported in herd and animal level to be 15.0% and 10.0%, respectively (Konishi et al. 2016), while 8.8% was the seroprevalence in Selangor, Malaysia (Jesse et al. 2018). In Thailand, the seroprevalence of CAEV in western part of the country was determined and reported to be 5.52% (Lin et al. 2011).

At present, there are no treatment for any clinical forms of CAE (Smith and Sherman 2009). The effective vaccines against SRLV have not been successful developed yet. Several types of vaccines have been tested but protection has not been guaranteed (Blacklaws 2012). As results of the absence of protective vaccines and no specific treatment, infection avoidance is the important aspect of control program and eradication (Minguijon et al. 2015).

So far, current situation of the small ruminant lenti-

virus infection in goat population throughout all parts of Thailand has not been investigated. The studies of prevalence of SRLV infection in Thailand were report regionally. In the western part of Thailand, the prevalence was 5.52% (Lin et al. 2011) while in the southern part of the country the seroprevalence of SRLV infection was 2.36% (Antarasena et al. 2012). Therefore, this study is simply aimed to determine the seroprevalence of small ruminant lentiviruses infection in goats raised in Thailand. The results of this study would be helpful in planning further control or prevention strategies.

Materials and Methods

Sample size calculation

The goat population in Thailand was estimated to be 832,533, according to data from Department of Livestock Development of Thailand. Goat population in Thailand was divided geographically into 5 groups: central, eastern, northern, western, and southern part of Thailand (Fig. 1). The sample size was calculated using Promesa version 2.3.0.2. for cluster sampling, the goat population were divided into 5 groups geographically and the farms in each group were randomly collected (expected prevalence was 5.52% (Lin et al. 2011), level of confidence was 95% and 0.20 acceptable relative error). The minimal sample size was 1,643 samples as shown in Table 1.

Sample collection

Sample collection was performed during October 2019 to February 2020. In total, 1,925 blood samples from 328 herds were collected from goat through jugular venipuncture with aseptic technique and transported in an icebox to laboratory. The description of blood samples is presented in Table 1.

The number of animals to be sampled from each herd was determined using the formula:

$$n = \{1 - (1 - p_1)^{1/d}\} \{N - d/2\} + 1$$

where N stands for population size of each herd, d is the minimum number of affected animals expected in the population, n is required sample size and p_1 is probability of finding at least one case in the sample (Thrusfield 2005).

Sample preparation

Blood samples were centrifuged at 2500×g for 5 minutes to harvest serum. The harvested serum was stored at -20°C until determination of antibodies against small ruminant lentiviruses.

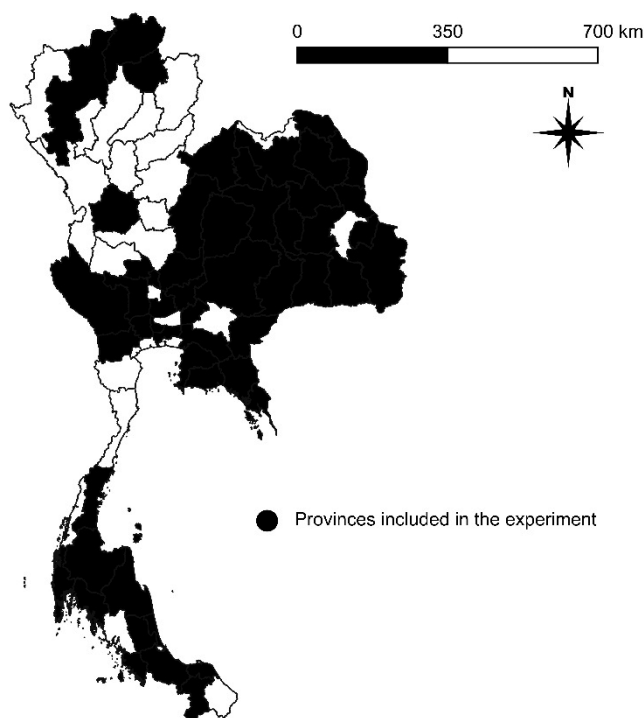


Fig. 1. Distribution of goats examined for antibodies against CAEV in Thailand. The black areas are provinces which were included in this study.

Table 1. Sample size of each region (0.2 acceptable relative error and 95% level of confidence).

Regions	Number of herds	Population number	Number of sampled herds	Number of Sampled goats
Central	3281	104069	53	206
Eastern	4501	115344	71	228
Northern	2622	75302	86	149
Western	4263	160844	20	317
Southern	51183	376974	98	743
Total	65850	832533	328	1643

Sera analysis

The serum samples were examined for the presence of antibodies against SRLV using indirect enzyme-linked immunosorbent assay (ELISA) test kits (IDEXX CAEV/MVV total Ab test®, IDEXX Laboratories, Inc., Maine, USA) which, in the validation report of the test kits, has sensitivity of the test kit of 1.00 and the specificity of 0.99. The laboratory procedures were done according to the manufacturer instruction.

Statistical analysis

Seroprevalence of SRLV antibodies was estimated by using ProMesa Version 2.3.0.2. The apparent prevalence (\hat{p}) was converted to true prevalence (\hat{t}) using sensitivity (α) and specificity (β) of the test (Rogan and Gladen 1987).

$$\hat{t} = (\hat{p} + \beta - 1) / (\alpha + \beta - 1)$$

The confidence interval for prevalence was calculated as follows:

$$CI = p \pm z \times SE$$

where CI stands for confidence interval, z represents the value obtained from the standard normal distribution, SE is the standard error of the proportion (Hazra A 2017).

Results

A total of 1,925 goat serum samples were included in this study. Sixty-eight goat sera showed as positive to small ruminant lentiviruses antibody (Table 2).

The overall apparent prevalence of SRLV infection in goats in Thailand was 3.57% (95% CI = 2.75-4.40) and true prevalence was 2.60% (95% CI = 2.18-3.02), respectively.

Table 2. Seroprevalence of small ruminant lentivirus infection in goats in Thailand.

Regions	Population number	Examined samples	Number of positive	Percent	95% CI
Central	104069	254	3	1.18	0.00-2.51
Eastern	115344	274	10	3.65	1.43-5.87
Northern	75302	205	6	2.93	0.62-5.23
Western	160844	360	18	5.00	2.75-7.25
Southern	376974	832	31	3.73	2.44-5.01
Total	832533	1925	68	3.57	2.75-4.40

Discussion

In our study, the overall seroprevalence of SRLV infection in goat population in Thailand was 2.60%, which was relatively low as compared to the previous studies in the goat population of the western part of Thailand (Lin et al. 2011). Lin et al. (2011) reported the true prevalence of SRLV infection in the western part of Thailand being 5.52%. It may be caused by strategic plan from Thailand Department of Live-stock Development, so called “CAE-free herd program”. Briefly, all goats in the farms should be tested for SRLV infection, the seropositive goats must be separated from seronegative goats and slaughtered within 7 days. Moreover, seronegative goats have to be re-tested in 6 months. Furthermore, in 2018, Thai goat population comprised almost entirely meat goats (96.38%, according to data from Department of Live-stock Development of Thailand), which were at lower risk of infection than dairy goats (Lin et al. 2011).

However, the CAE is not yet eradicated in Thailand. This might be due to the fact that the “CAE-free herd program” is only implemented in goats and is voluntarily practiced by some farmers. Nonetheless, the strategic plan should also be implemented in other small ruminants since they can be infected and transmit the SRLV (Castro et al. 1999, Shah et al. 2004, Mselli-Lakhal et al. 2007, Gjerset et al. 2009). Therefore, the control and prevention strategies must be implemented in all farms throughout the country.

In this study, the number of positive samples was low. The positive predictive value (PPV) was 0.79. Though the sensitivity (100%) and specificity (99.8%) of the test were very high, the PPV would be increased when the studied population had higher prevalence.

Conclusions

In Thailand, the apparent and true seroprevalence were 3.57% and 2.60%, respectively. The current control strategies can decrease seroprevalence. However, to eradicate the CAE, the efficient control and preven-

tion strategies should be strictly implemented in all small ruminant farms.

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