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# Seroprevalence of Brucellosis in Small Ruminants in Thailand, 2013

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**Abstract**

Brucellosis is a zoonotic disease caused by Gram-negative coccobacilli bacteria, *Brucella melitensis*, commonly found in small ruminants. It caused outbreaks among humans in several provinces of Thailand. The Department of Livestock Development has implemented a surveillance system for brucellosis in small ruminants since 1997. This study aimed to describe the seroprevalence of brucellosis in small ruminants and identify factors associated with spread of brucellosis in Thailand using the national surveillance data in 2013. The surveillance data in small ruminants during 2013 included herd management, movement history, location and laboratory results of tested animals from all eight veterinary laboratories in Thailand. Association between disease status at herd level and all those factors was analyzed by multivariate logistic regression analysis. The seroprevalence of brucellosis was 12.1% (438/3,626) at herd level for both goats and sheep. At individual animal level, seroprevalence were 1.4% (1,297/94,722) and 1.6% (139/8,658) for goats and sheep respectively. Free-ranging was the only one management practice significantly associated with brucellosis infection in small ruminants at herd level. Improving biosecurity of herd management, especially avoid sharing pasture and communal area should be concern to prevent introduction and spreading of brucellosis in Thailand.

**Keywords:** brucellosis, *Brucella melitensis*, seroprevalence, Thailand, small ruminants

## Introduction

Brucellosis is a zoonotic disease in various animal species caused by Gram-negative coccobacilli bacteria of *Brucella* species. *Brucella melitensis* is commonly found in small ruminants, including sheep and goats. There are various routes of transmission such as contact with infected tissue, blood, urine, reproductive secretion or aborted fetus. The disease can cause significant economic and public health impact in several countries, especially in the Middle East, Asia, Africa, South and Central America, the Mediterranean and the Caribbean regions.[1]

Goat population in Thailand has been increasing since 1993[2] due to the goat farming promotion policy by the government of Thailand. However, there were some negative impacts from the promotion policy such as increased brucellosis outbreak in both animal and human population. Human outbreaks were found in several provinces of Thailand, including Kanchanaburi, Bangkok, Satun and Phetchabun. All of these human cases had history of either consumption of raw milk from infected goats or direct contact with infected goats.[3]

The Department of Livestock Development (DLD), Thailand has been implementing a surveillance system for brucellosis among small ruminants in Thailand nationwide since 1997.[4] Although the surveillance system and control measures for brucellosis reduce the disease occurrence, the disease still exists in all over the country. Analysis of the surveillance data was needed to identify the disease situation and find the associated risk factors. Hence, the objectives of this study were to determine seroprevalence of brucellosis in small ruminants and factors associated with disease spreading in Thailand during 2013 using the information from the national brucellosis surveillance system.

## Methods

The National Institute of Animal Health and seven Regional Veterinary Research and Development Centers in Thailand conducted brucellosis testing in serum samples of small ruminants that were

submitted from various provinces all over the country in 2013. Samples were collected from animals in both surveillance and movement control programs. Information on herd management such as location of farms, type of small ruminants, herd size, history of new animal introduction, raising pattern, breed, water source and type of feed was also collected.

Modified rose bengal test (RBT), enzyme-linked immunosorbent assay (ELISA) and complement fixation test (CFT) were used for laboratory serodiagnosis. If the animal was in the brucellosis free herd, it was confirmed to have brucellosis by CFT and either RBT or ELISA. An animal from the infected herd or movement purpose was regarded to have infection from a positive result of any RBT, ELISA or CFT.[4] A herd that had at least one positive sample was classified as the infected herd. The herds without a specific owner were excluded from this study.

Brucellosis situation in animal and herd levels were described using statistic indices. Association between disease status and type of animal, herd location, history of movement and herd management factors were analyzed using multivariate logistic regression. All variables with p-value less than 0.2 were included in the final model. The herd management factors included raising pattern, breed, water source and type of feed. Geographic location was divided into four regions following the regional livestock administrative system in Thailand: the northern region (regions 5 and 6), the southern region (regions 8 and 9), the central, eastern and western region (regions 1, 2 and 7) and the northeastern region (regions 3 and 4). Maps in this study were created by Quantum GIS.[5]

## Results

Total 103,380 small ruminants from 3,626 herds were tested in the surveillance system in 2013. It accounted for 21.4% (103,380/482,317) of small ruminant heads and 8.7% (3,626/41,674) of ruminant herds nationwide. Total 438 herds were positive among 3,626 tested herds (12.1% herd seroprevalence, 95% CI = 11.1-13.2). In animal level, 1,297 (1.4%) goats and 139 (1.6%) sheep were seropositive (Table 1).

Median of seroprevalence in positive herds (within-herd prevalence) was 8.6% (1st and 3rd quartiles = 4.2% and 22.5%). Median herd size of the tested herds was 22 animals per herd (1st and 3rd quartiles = 11 and 44) while median herd size of positive herds was 30 animals per herds (1st and 3rd quartiles = 16 and 56).

**Table 1. Result of brucellosis testing among small ruminants in Thailand, 2013**

| Species | Number tested | | Number positive (percent) | |
|---|---|---|---|---|
| | Herd | Sample | Herd | Sample |
| Goat | 3,319 | 94,722 | 384 (11.6) | 1,297 (1.4) |
| Sheep | 307 | 8,658 | 54 (17.6) | 139 (1.6) |
| Total | 3,626 | 103,380 | 438 (12.1) | 1,436 (1.4) |

Brucellosis infection was spreading among small ruminants throughout all regions in Thailand. High seroprevalence was found in Phichit (30.6%), Phetchabun (7.6%), Kanchanaburi (6.8%) and Loei (5.2%) provinces. Phichit Province, the highest prevalence area, is located in the lower northern part of Thailand (Figure 1).

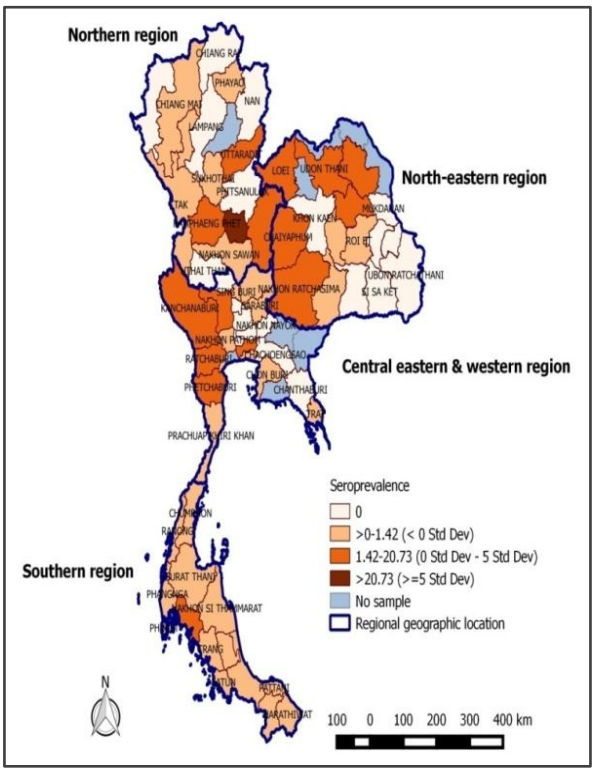


**Figure 1. Seroprevalence (percentage) of brucellosis among small ruminants by province in Thailand, 2013**

Environmental conditions such as weather and geographical characteristics differ with geographical location in Thailand. Thus, four geographical regions were included in the analysis for determining the associated factors. Variables with p-value were lower than 0.2 were included in final logistic regression model, including free-ranging animals in public area, herd location, middle to large herd sizes (>30 animals per herd), introduction of new animal before case detection, being goat farm, and using natural animal feeds such as grass and hay. Free-ranging was found to be the only significant factor associated with brucellosis infection in herd level in the final model.

Free-ranging herds were 2.2 times more likely to be infected than non-free-ranging herds (Table 2).

## Discussion and Conclusion

As per findings from this study, lower seroprevalence of brucellosis in goats and sheep was observed in 2013 when compared with the situation in 2012 (5.1%)[6]. This finding is consistent with the decreasing prevalence during 2009 to 2013 reported by DLD[4]. This might result from prevention and control measures of brucellosis in small ruminants such as testing and slaughtering policy, and establishing of sheep and goats standard farm.

Since 2000, the standard farm policy was developed by DLD, encouraging sheep and goat farmers to request for the standard farm certification. All the standard farms must complete the brucellosis testing for all sheep and goats aged more than six months. Animals tested positive shall be slaughtered. The remaining animals in the herd shall be retested every two months until all animals in the herd show negative result for three times consecutively. At sixth month following the final testing, the herd can be declared as free from brucellosis.

Moreover, testing for brucellosis in goats and sheep prior moving from the original provinces could also contribute to decreasing brucellosis prevalence in Thailand. The provinces with high prevalence of brucellosis should be further explored as several factors might relate to high prevalence such as frequency of movement and effectiveness of control and prevention measures at local level.

The factor associated with brucellosis infection in this study was free-range system, which was similar to the finding from Reviriege's study in 2000[7]. If there were an infected animal in the free-ranging area, other animals in the same place could be infected as well. Moreover, as the bacteria could tolerate high humidity in soil and water, it would easily accumulate and infect to animals in public areas. However, a previous study identified other possible risk factors of brucellosis among small ruminants in Thailand such as goat replacement from the farm with unknown brucellosis status[8], free-ranging[6], distance to nearby farm, source of water and large herd size[9,10]. The findings might vary depending on scale and area of the studies.

The seroprevalence of brucellosis among small ruminants in this study was the best available information to determine the seroprevalence in the whole country. Nevertheless, it might not represent the situation well since the samples were collected on voluntary basis. Small-scale owners might not be requested for testing their animals.

**Table 2. Association between possible risk factors and brucellosis infection at herd level among small ruminants in Thailand, 2013**

| Variable | Positive herd | | Negative herd | | Crude odds ratio (95% CI) | Adjusted odds ratio (95% CI) |
|---|---|---|---|---|---|---|
| | Exposed | Not exposed | Exposed | Not exposed | | |
| Free ranging | 55 | 140 | 200 | 962 | 1.89 (1.33-2.67) | 2.20 (1.38-3.48) |
| Herd size >30 | 145 | 155 | 725 | 1,330 | 1.72 (1.34-2.19) | 1.28 (0.84-1.95) |
| Introduction of new animal | 7 | 205 | 79 | 1,139 | 0.49 (0.21-1.03) | 0.61 (0.18-2.10) |
| Type of small ruminant (goat) | 384 | 54 | 2,935 | 253 | 0.61 (0.45-0.84) | 0.84 (0.43-1.64) |
| Non-native breed | 259 | 22 | 1,934 | 126 | 0.77 (0.49-1.25) | - |
| Natural feeding | 113 | 62 | 575 | 408 | 1.29 (0.93-1.81) | 1.08 (0.69-1.69) |
| Open water source | 7 | 208 | 55 | 1,273 | 0.78 (0.32-1.66) | - |
| Region | | | | | | |
| Northeastern | 55 | 383 | 240 | 2,948 | 1.44 (1.05-1.77) | 1.71 (0.33-8.91) |
| Northern | 40 | 398 | 201 | 2,987 | 1.25 (0.87-1.81) | 0.30 (0.04-2.45) |
| Southern | 96 | 342 | 1,192 | 1,996 | 0.51 (0.40-0.65) | 0.33 (0.04-2.54) |
| Central, eastern & western | 247 | 191 | 1,555 | 1,633 | 0.51 (0.40-0.65) | Reference |

Small-scale herds should also be included in the surveillance system due to potential of high negative impact to animals and farmers. Moreover, as this study used the existing information from the surveillance system, some variables were missing and information on history of animal movement might not be accurate.

In conclusion, low seroprevalence of brucellosis was found among small ruminants in Thailand during 2013. Raising goats in free-ranging area was risky for brucellosis infection. Improving biosecurity of herd management, especially having own pasture area and avoiding animal round up in communal area, should be focused to strengthen the existing control measures.

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## Suggested Citation

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