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Goat farm management and *Brucella* serological test among goat keepers and livestock officers, 2011–2012, Nakhon Si Thammarat Province, southern Thailand

Thanidtha Te-Chaniyom [a,b], Alan F. Geater [a], Wandee Kongkaew [c], Usa Chethanond [b], Virasakdi Chongsuvivatwong [a,*]

[a] Epidemiology Unit, Faculty of Medicine, Prince of Songkla University, Hatyai, Songkhla 90110, Thailand
[b] Faculty of Veterinary Science, Prince of Songkla University, Hatyai, Songkhla 90110, Thailand
[c] Veterinary Research and Development Center (Southern region), Thung Song, Nakhon Si Thammarat 80110, Thailand

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ABSTRACT

Brucellosis, a zoonotic disease particularly affecting goats, emerged in Thailand in 2003, resulting in both an occupational hazard for goat keepers and livestock officers, and production losses. Farm management practices have been identified as risk factors associated with *Brucella* sero-positivity in many studies. Our finding in this study should be considered in order to strengthen the system of biosecurity control in farm animals as one health approach. The objectives of the study were to describe the distribution of potential risk factors by types of goat farms and to document the prevalence of human *Brucella* sero-positivity among goat keepers and livestock officers in Nakhon Si Thammarat, Thailand.

A cross-sectional study was conducted from September to December 2012. The study population included three types of goat farms: standard, community enterprise and private goat farms that were located in Nakhon Si Thammmarat Province in southern Thailand. Information on whether the farm had any *Brucella* sero-positivity goats since 2011 was retrieved from the local livestock office records. Information on farming management was also traced back to 2011. Field researchers collected information from goat keepers of the selected farms using a structured questionnaire. Goat keepers on all farms pre-identified (January to June 2012) as having had at least one positive goat were considered to have been exposed. Goat keepers on a random sample of farms having all goats with negative results were considered to be unexposed. Venous blood samples were collected from goat keepers exposed and unexposed and from livestock officers and the samples were tested by IgG ELISA. Statistical analysis was done under the complex survey design in R software.

Fourteen standard farms, 66 community enterprise farms and 68 private farms participated in the study; 82.4% (122/148) used public pasture and 53.4% (79/148) shared breeder goats with other farms. Farm management practices corresponding to pre-identified risk factors were more common in private farms. Large herd size (≥51 goats) and having dogs and/or rats on the farm were significantly associated with *Brucella* infection in animals ($P < 0.05$). Similar proportions of goat keepers in positive goat farm and livestock officers were positive for *Brucella* antibody (8.3% and 8.8% respectively).

Several goat farming management practices in the study area may increase the risk of *Brucella* infection in animals. Livestock officers in the area have a high risk of being infected with *Brucella*. Improving goat farm biosecurity practices in needed to reduce the risk of brucellosis in this area.

1. Introduction

Brucellosis is a zoonotic disease caused by a gram negative bacterium, *Brucella* spp. [4,7]. In livestock, especially goats, *Brucella melitensis* (*B. melitensis*) is also the most common and can lead to mastitis, abortion and reduction of milk production [4,7]. It has been estimated that 6 months after the introduction of *Brucella* infected animals into a herd, the infection rate can rise up to 50%–70% [7]. The organism can also infect humans and cause brucellosis, a systemic disease presenting with prolonged fever, which can be fatal if not treated [9]. For humans, *B. melitensis* is the most virulent species [4]. (See Fig. 1.)

In western and central parts of Thailand risk factors for *Brucella* sero-positivity in goat farms included herd size, close vicinity to other goat farms, grazing in communal pasture, having dogs on the farms, sharing buck with other farms, importing female breeder goats with an unknown

* Corresponding author.
E-mail address: cvirasak@medicine.psu.ac.th (V. Chongsuvivatwong).

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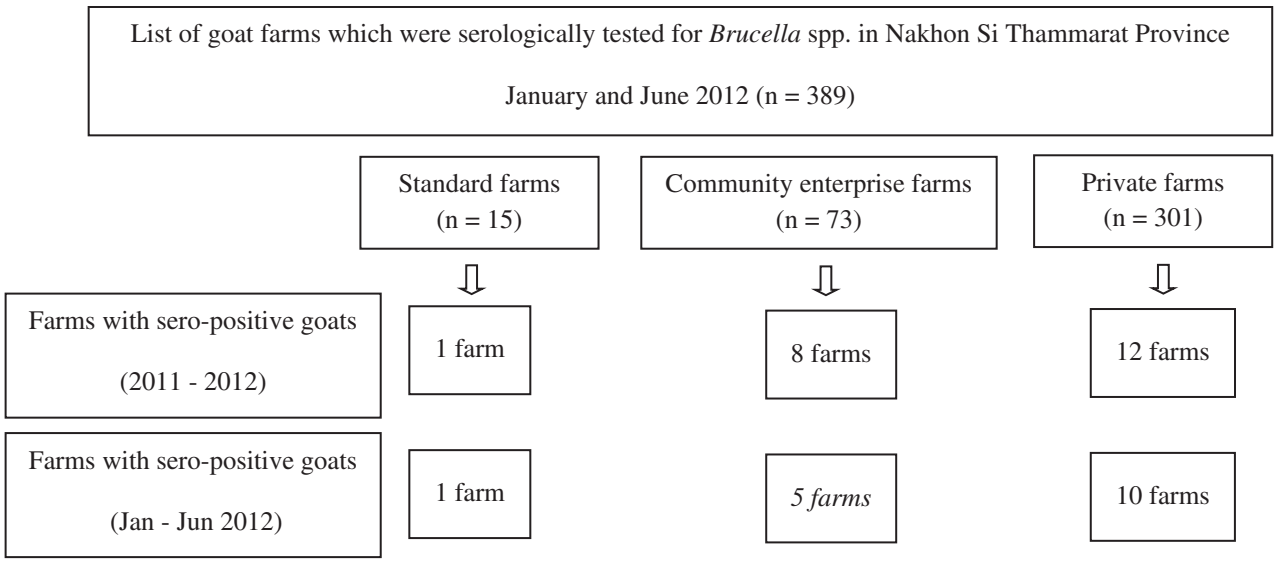

Fig. 1. Sampling frame of the study stratified by type of goat farm and serological status in goat farms, Nakhon Si Thammarat Province, Thailand, 2011–2012.

source of *Brucella* infection and not using disinfectant [8,17,18,21]. Sero-prevalence of goat *Brucella* infection in the southern part of Thailand during 2004–2006 was 1.47%, while in the western part it was 3.98% [2,14].

In central Thailand, the first cases of human brucellosis emerged in 2003 [9,10]. In southern Thailand, three human cases were diagnosed in 2004 during an abortion outbreak in goat farms [5]. Since 2003, human brucellosis cases have been reported nearly every year.

Brucellosis can be prevented by improving biosecurity practices in farms [4]. In Thailand, the Department of Livestock Development (DLD) promotes five principles of effective goat farming including farm attributes, farm management, herd health management, environmental management and animal welfare [6]. A goat farm registered as a standard farm with the DLD must follow the DLD guidelines. This biosecurity control in goat farm has been in effect since 2006. However, a community enterprise or private farm is not required to comply with these guidelines.

Based on concepts of "one health", the current study tried to link animal health surveillance data with health of the human contact. The objectives of this study were to describe the distribution of potential risk factors by type of goat farm and to document the prevalence of human *Brucella* sero-positivity among goat keepers and livestock officers in Nakhon Si Thammarat, Thailand.

2. Methods

2.1. Study setting

The study was conducted in Nakhon Si Thammarat Province. The province ranks 8th among all provinces in goat population with 1677 goat farms and 18,807 goats registered with the DLD in 2011 [19]. This province also has the largest human population in southern Thailand with 1.5 million inhabitants [12]. The DLD has set up a specific disease surveillance and monitoring program focused on brucellosis and other diseases to track live goat movement across provinces. Since 2012, Nakhon Si Thammarat Province has established a brucellosis-free farm project. All goats in every farm with <50 animals should be tested. A sample of goats will be tested if there are more than 50 goats. The Veterinary Research and Development Center (Southern region) (VRDC (Southern region)) uses the modified Rose Bengal test (100% sensitivity and 96.3% specificity on serum samples [8]). A serial test on Complement Fixation Test (CFT), recommended by the national guideline was omitted due to the shortage of materials for CFT at the VRDC (Southern region), only Rose Bengal Test (RBT) was available and used. Any positive goats should be culled under veterinarian officer supervision. During the following one month, another sample of goats should be tested until all goats are negative. At that time the farm should be tested twice a year.

2.2. Study population

Our cross-sectional survey was conducted in 17 of the 20 goat-raising districts of Nakhon Si Thammarat Province during September to December 2012. From January to June 2012, Nakhon Si Thammarat Provincial Livestock Office had tested for *Brucella* sero-positivity, on a total of 389 farms in these districts. These farms formed the sampling frame of the current study. The study goat farms were classified into 3 categories: 15 standard farms (certified by DLD); 72 community-enterprise farms (group of farms encouraged by the local livestock office but no certification.); and 302 private farms (not certified, but accessed by the local livestock office). Definition of diseased farm was a farm that had at least one sero-positive goat according to the data collected by questionnaire or records from the livestock offices.

2.3. Study samples

With small population of 15 standard and 72 community enterprise farms, they were all used in the study. On the other hand, of 302 private farms, 64 randomly selected were used. The sample size of the third group allowed 95% confidence interval of a risk factor, say, poor farm management, being $\pm$10% deviating from estimate value of 30% (finding from author pilot survey in a nearby province) For human subjects, the 389 farms in the database were re-stratified into farms with at least one *Brucella* sero-positive animal (16 farms) and the sero-negative farms (373 farms). All 16 farms in former group and 48 farms randomly selected from the latter group were visited. All goat keepers aged 7 years or older, who had stayed at the farm for at least 3 months were invited to join the study. All livestock officers who were responsible for brucellosis surveillance program, who working in the farms for at least two months were also invited to participated.

2.4. Data collection

Field researchers collected information from goat keepers using a structured questionnaire that had been piloted in a nearby province in southern Thailand where culture and the farm population were similar.