Outbreak, Surveillance and Investigation Reports
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Seroprevalence of Q Fever among Dairy Cattle in Nongpho Sub-district, Ratchaburi Province, Thailand, 2015

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Abstract

Q fever, a zoonosis caused by *Coxiella burnetii*, is an important occupational health risk for livestock farmers, veterinarians and public health officers. However, information about Q fever was limited in Nongpho Sub-district which had the highest dairy cattle density in Ratchaburi Province. This cross-sectional study aimed to assess the seroprevalence of antibody against *C. burnetii* among dairy cattle in Nongpho Sub-district. Serum samples were collected from all 10 villages of the sub-district during 21 April to 26 May 2015, including a total of conveniently selected 135 cattle in 27 dairy farms. The sera were tested for antibody against *C. burnetii* using enzyme-linked immunosorbent assay. An investigation team administered a structured questionnaire to collect information of the seropositive herds. The seroprevalence of individual cattle was 5.2% while seroprevalence at the herd level was 25.9%. Among the seropositive farms, farmers had limited knowledge and practices on biosecurity and sanitation. Animal health authority should develop an integrated strategy to improve biosecurity and sanitation practice in dairy cattle farms.

Keywords: Q fever, dairy cattle, seroprevalence, Nongpho Sub-district, Thailand

Introduction

Q fever is a zoonotic disease caused by *Coxiella burnetii* which is a Gram-negative, obligate intracellular bacterium. *C. burnetii* infections have been reported in humans, farm animals, pets, wild animals, birds and arthropods worldwide. Q fever is transmitted by aerosol, direct contact or ingestion.[1] Shedding of bacteria occurs through secretion, excretion, vaginal discharge, milk, feces and urine of infected animals. During birthing and abortion, the bacteria are excreted massively with genital secretion, placenta and fetal fluid.[2] Arthropods, mainly ticks, are reservoirs for Q fever transmission while the risk of transmission is associated with wildlife.[3]

In humans, the infection can manifest as either in acute or chronic form. The acute form commonly manifests as flu-like syndrome, pneumonia, or granulomatous hepatitis, and can resolve quickly after antibiotic therapy. Chronic Q fever occurs almost exclusively in patients with predisposing conditions, including those with heart valve lesions, vascular abnormalities and immunosuppression. Clinical signs of the chronic form are vascular infections, hepatitis and chronic fatigue syndrome. This form requires prolonged antibiotic therapy for 18 months or more. Complications of the chronic form might be severe to fatal if the patient does not receive the appropriate antibiotic treatment.[4] Patients with asymptomatic infection carry a risk for progression to chronic form of the disease. After either symptomatic or asymptomatic infection, antibodies may remain detectable for months, years or lifelong.[5] Moreover, Q fever infection in pregnant women can provoke placentitis, and lead to premature birth, restricted growth, spontaneous abortion or fetal death.[4] Q fever infection in cattle usually remains asymptomatic. However, it may present with reproductive disorders such as abortion, metritis and infertility.[6]

In Thailand, reports of Q fever revealed widespread infection since 1966. The prevalence of Q Fever among cattle in Thailand was reported to be 2-7%.[7,8] According to a previous study, prevalence of Q fever among people working in slaughterhouses was estimated to be 1%.[7] Recently, Q fever infection was reported among people living in the northeastern part

of Thailand[9] where endocarditis human cases caused by Q fever were identified during 2012[10]. In Chiang Mai, the northern province of Thailand, proportions of seropositive dairy cattle at herd and individual levels were 62% and 5% in 2012.[11]

This study was conducted to determine the seroprevalence of Q fever in a western province of Thailand and investigate the potential factors for disease transmission among dairy cattle herds based on farmers practices. Q fever seroprevalence in dairy cattle and the potential reservoir for human infection could provide useful information to assess the risk of Q fever among both farmers and animals in Ratchaburi.

Methods

We conducted a descriptive cross-sectional study in Nongpho Sub-district, Ratchaburi Province, the western province of Thailand. Nongpho Sub-district had the highest population density of dairy cattle in the province. Totally 6,447 dairy cattle were raised in 290 farms in the whole area of all 10 villages of Nongpho sub-district. A total of 135 cattle from 27 herds were selected using convenience sampling.

Blood samples were collected from the median caudal vein of individual cattle from 21 Apr to 26 May 2015. The blood samples were centrifuged to extract 3 cc of serum which was then tested for immunoglobulin G (IgG) phase one and phase two specific antibodies of *C. burnetii* using a commercial indirect enzyme-linked immunosorbent assay (ELISA) kit, LSIVET ruminant milk/serum Q fever ®. Sensitivity of the ELISA kit was 87% and specificity was 100% according to the manufacturer's data.[12] The laboratory testing was conducted at the Veterinary Research and Development Center for Western Region in Ratchaburi Province.

A herd was considered to be a seropositive herd for Q fever if at least one animal in the herd yielded positive result for Q fever. A questionnaire was administered to owners of the seropositive herds to collect information on cattle such as age, gender, history of abortion and farm management in July 2015. The data obtained were analyzed using statistical software. Prevalence of seropositivity at cattle and herd levels were calculated. In the seropositive farms, characteristics of the seropositive cattle were compared with the seronegative cattle.

Results

Nongpho Sub-district is located at the eastern part of Photharam District in Ratchaburi Province. Geographic distribution of farms with positive results for *C. burnetii* was illustrated in figure 1.

Total 27 farms and 135 dairy cattle in all 10 villages of Nongpho Sub-district were included in this study. All animals in this study were tested negative for brucellosis. Size of the farm area in average was 565.4 m^2.

There were seven dairy cattle from seven different farms in five villages that were positive against *C. burnetii*. The prevalence of *C. burnetii* in dairy cattle at the individual animal level was 5.2% (7/135) and at the farm level was 25.9% (7/27). Villages 3 and 9 had the highest proportion of seropositive individual cows (25.0%) (Table 1).

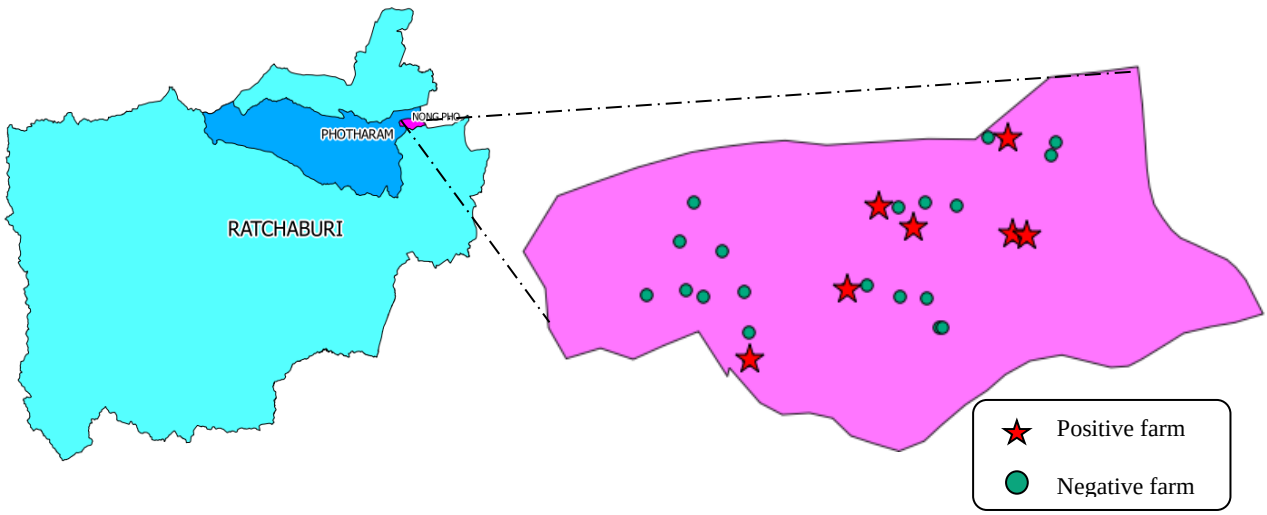

Figure 1. Geographic distribution of cattle farms where serum samples tested against *Coxiella burnetii* in Nongpho Sub-district, Photharam District, Ratchaburi Province, Thailand, 2015

Table 1. Proportion of seropositive results against *Coxiella burnetii* at individual and herd levels in Nongpho Sub-district, Photharam District, Ratchaburi Province, Thailand, 2015

Village	Number tested		Number positive		Percent of proportion positive	
	Animal	Herd	Animal	Herd	Animal	Herd
1	7	4	0	0	0	0
2	3	1	0	0	0	0
3	8	4	2	2	25.0	50.0
4	30	4	1	1	3.3	25.0
5	17	3	0	0	0	0
6	15	2	1	1	6.7	50
7	10	2	0	0	0	0
8	27	4	2	2	7.4	50.0
9	4	1	1	1	25.0	100
10	14	2	0	0	0	0
Total	135	27	7	7	5.2	25.9

Only one out of seven seropositive farms had a resting stall for new cattle (14.3%). In three farms (42.9%), a surrounding fence existed and disinfecting equipment before or after using with cattle was observed. Although 42.9% of seropositive farms had one separate stall for sick or calving cows, the normal and sick stalls were in the same area. About 57.1% of seropositive farms applied the external parasite prevention program two times per year whereas other farms conducted it annually. All seropositive farms raised other kinds of pet on the farm areas (Table 2).

Among the seropositive herds, most farmers (71.4%) cleaned the stall only two times per day. All of them used chlorine to disinfect the stall floor. Some of the seropositive farms (28.6%) sold the aborted fetus and all of them sold the placenta waste. Majority of the farmers (85.7%) kept the dry manure less than five meters from the farm area and all of them sold the dry manure. Most of the farmers did not use gloves while removing aborted fetus or placenta waste (71.4%), placenta (85.7%) or assisting with birth (100%) (Table 2).

All farmers in the seropositive herd neglected to disinfect their vehicles, visitor's footwear and equipment before entering into the farm area. In addition, water treatment was not observed in the farms. None of the farmers or their family members had heart disease, pregnancy or abortion before. All the farmers used to drink unpasteurized milk.

Table 2. Characteristics of farm management in *Coxiella burnetii* seropositive farms, Nongpho Sub-district, Photharam District, Ratchaburi Province, Thailand, 2015 (n=7)

Variable	Number	Percent
Days open > 150 days (n=6)	2	33.3
Prevention from outside		
Having stall for new cattle	1	14.3
Having surrounding fence	3	42.9
Drinking and using underground water in farm	6	85.7
Animal management		
Always disinfecting before or after using equipment with another dairy cattle	3	42.9
Having stall for sick dairy cattle	3	42.9
Having stall for calving cattle	3	42.9
Culling cattle	4	57.1
Conducting program for prevention external parasite for 2 times/year	4	57.1
Having at least one other pet on farm area	7	100.0
Disposal management		
Cleaning stall 2 times per day	5	71.4
Selling abortion waste	2	28.6
Selling placenta waste	7	100.0
Distance between farm and place to keep dry manure (< 5 meter)	6	85.7
Selling dry manure	7	100.0
Sanitation practice		
Not using glove for removal of abortion or placental waste	5	71.4
Not using glove for removal placenta	6	85.7
Not using glove for birth assistance	7	100.0

Physical examination of cows in the seropositive farms did not find any ticks. Survey of the farms with seropositive dairy cattle found that the median body condition score (BCS) was three in seropositive cattle and 3.5 in seronegative cattle. The average milk production was 8.3 kg/cow/day in seropositive cattle and 10.0 kg/cow/day for the seronegative cattle. Milking machines were used in all farms to produce milk twice per day.

The average age was five and 4.8 years in seropositive and seronegative cattle respectively. Reproductive

disorder problems were regularly found in this sub-district. About 28.6% of the cows had history of abortion when compared to the seronegative ones (5.9%). However, there was no confirmation on the cause of abortion. Other characteristics of the cows such as infertility were not different between seropositive and seronegative cattle (Table 3).

Table 3. Comparison of characteristics among individual cattle in *Coxiella burnetii* seropositive farms, Nongpho Sub-district, Ratchaburi Province, Thailand, 2015

Variable	Positive (n=7)		Negative (n=34)	
	Number	Percent	Number	Percent
Age > 5 years	3	42.9	11	32.4
Abortion history	2	28.6	2	5.9
Pregnancy	1 (n=6)	16.7	13 (n=32)	40.6
Infertility	2	28.6	8 (n=32)	25.0

Discussion and Conclusion

The antibody against *C. burnetii* was described for the first time in dairy cattle from Nongpho Sub-district. Seven cows from seven seropositive farms were found to have *C. burnetii*. Although low seroprevalence (5.2%) in dairy cattle was demonstrated, there was evidence of *C. burnetii* circulating in these five villages, implying that abortion and sickness in both cows and farmers should be monitored regularly. Most of the seropositive farms had no resting stall for replacement cattle or surrounding fence partly due to limited budget for the construction and partly because they thought that it was not important.

This survey found that the farmers did not clearly understand about the biosecurity system. Although there was no evidence found in this study that using the same equipment could transfer *C. burnetii* infection from infected cattle to uninfected ones, lack of precaution for disinfecting vehicles, visitors' footwear and equipment before entering into the farm area might increase the risk of *C. burnetii* infection in dairy cattle as fomites can transfer the pathogen[13,14].

Tick infestation can be one of the biological transmitters.[2] The external parasite control program yielded good results in this sub-district as no tick was found in all farms. All of the farms had the external parasite control program at least once a year and this should be maintained regularly to prevent the infection.

All seropositive farms allowed dogs to come into contact with cattle on the farms. The previous study found that domestic animals had the highest prevalence of Q fever infection, especially in dogs[7]. Hence, farmers in dairy cattle farms should be informed not to allow dogs to contact with cattle.

In addition, dry manure beside the farm area could increase the risk of Q fever infection in seropositive farms, and selling the infected aborted or placenta waste could spread the infection to the carcass shop as well[15].

Sanitation practice of the farmers might not be good enough to prevent Q fever infection. In case of performing the high risk activities such as birth assistance, placenta removal, handling of carcass and cleaning birth fluid, gloves, mask and goggle should be used.

Abortion history and infertility were not different between seropositive and normal cattle. The normal cattle might have other underlying problems for infertility that might never been diagnosed and treated in appropriate ways as most of the farmers had less concern on long drying period, infertility and abortion occurred in their cattle, and rarely utilized the veterinary services. Therefore, there is remained possibility that the other 34 cattle that lived in the same seropositive farms will get Q fever and undetected.

The survey was not carried out in the seronegative farms due to time limitation. Moreover, we did not collect samples from dogs in the positive farms. In this cross-sectional study, we were not certain of the temporal relationship between risk factors and Q fever infection. Another study showed that poor sanitation and inappropriate sanitation practice in the farms posed a risk of transmitting Q fever from the dairy cattle to human[16]. The nature of convenience sampling prevented us from validating the Q fever situation of all cattle in Ratchaburi Province. Despite that, as the data on Q fever in Thailand was limited, this study was one of the few studies that provided baseline information for future studies to identify the causal factors.

Although no acute human case was reported during the study period, the local people might have the chronic disease as *C. burnetii* had been circulating in the villages. Thus, people who worked with dairy cattle such as farmers, veterinarians and livestock officers should use personal protective equipment to reduce the risk of Q fever infection from dairy cattle. Biosecurity in farms should also be improved through communication and public education.

Acknowledgement

Colleagues from Photharam District Livestock Office and Ratchaburi Province Livestock Office, Dr. Pilaiporn Jaetiyawan, and laboratory technicians of the Veterinary Research and Development Center for Western Region are acknowledged for their technical assistance. We also would like to thank Dr. Kittipat Sujit from Department of Livestock Development for providing guidance in data analysis.

Suggested Citation

Chaipanich W, Wathakul M, Hinjoy S. Seroprevalence of Q fever among dairy cattle in Nongpho Sub-district, Ratchaburi Province, Thailand, 2015. OSIR. 2016 Jun;9(2):16-20. <http://www.osirjournal.net/issue.php?id=97>.

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