

SEROPREVALENCE OF *TOXOPLASMA GONDII* INFECTION IN DAIRY COWS IN NORTHEASTERN THAILAND

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Abstract. The objective of this study was to investigate the seroprevalence of toxoplasmosis in dairy cows in Thailand. During 2007, the sera of 445 cows from the three largest dairy farming provinces in northeastern Thailand (Khon Kaen, Udon Thani and Sakon Nakhon Provinces) were collected and analyzed. Antibodies to *T. gondii* were determined using a latex agglutination test; 99 (22.3%) were seropositive for *T. gondii* (cutoff, 1:64). The highest titer was 1:1,024. Cows age 1 and 5 years old had the highest seroprevalence (24.7%) followed by those to > 5 years old (21.6%) and those < 1 year old (9.1%). Sakon Nakhon had the highest percentage (26.4%) of dairy cows infected with *T. gondii* and among herds tested (85.7%). The seroprevalence of dairy cows was highest (37.5%) during the sixth lactation. The prevalence in heifers was the lowest (8.8%). The high incidence of *T. gondii* infection in cows underlines the risk for humans to become infected by contaminated food or water, particularly from meat or milk.

INTRODUCTION

Toxoplasma gondii is a zoonotic protozoan parasite with worldwide distribution. It is capable of infecting all warm-blooded animals and is estimated to infect 4 to 77% of humans (Tenter *et al*, 2000). Although not normally a significant problem for healthy individuals, *Toxoplasma* infection can be life threatening in congenitally infected and immunosuppressed patients (Chintana *et al*, 1998). Its greatest impact is in the late clinical course of AIDS, where up to 25% of patients may develop toxoplasmic encephalitis (Luft *et al*, 1984; Lucas *et al*, 1993). In humans, *T. gondii* is transmitted either by ingesting oocysts or by eating raw or undercooked meat or unpasteurised milk containing infective stages of the parasite (Riemann *et al*, 1975; Sacks *et al*, 1982). Because *T. gondii* can be transmitted directly

by animal-human contact or through contact with contaminated feces, soil or herbage; it can also be transmitted through contaminated food or water. In animals, infection not only results in significant reproductive and economic losses, but also has implications for public health since consumption of infected meat or milk can facilitate zoonotic transmission.

Serological studies in Thailand have found evidence of widespread infection in humans (Pradatsundarasa and Papisarathorn, 1966; Chintana *et al*, 1998; Sukthana *et al*, 2001; Maruyama *et al*, 2003), dogs and cats (Nishikawa *et al*, 1989; Jittapalapong *et al*, 2007), swine (Sriwaranard *et al*, 1981; Tantasuran *et al*, 1989), goats (Jittapalapong *et al*, 2005), tigers (Thiangtham *et al*, 2006), elephants (Tuntasuvan *et al*, 2001), and rodents (Jittapalapong *et al*, 2006). There are no published studies of toxoplasmosis in dairy cows in Thailand.

It is unclear if *T. gondii* infection is present in milk-producing animals, especially dairy cows, in northeastern Thailand. Dairy cows are the most important source of milk for Thai people. Lack of modern farming has increased the prevalence of *T. gondii* in many

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countries, including Thailand. After transport from slaughterhouses, meat may easily be contaminated with *T. gondii* oocysts by the surrounding environment. Open-air markets are commonly in Thailand and may be potential sources of pathogen contamination since stray cats are commonly found around markets.

Infection in cattle does not usually cause clinical symptoms, since cows have a high natural resistance to *T. gondii*. Little is known about infection with and the prevalence of *T. gondii* antibodies in dairy cows. The purpose of this study was to determine the frequency of antibodies against *T. gondii* among dairy cows in northeastern Thailand.

MATERIALS AND METHODS

Sample collection

In 2007, 445 Holstein-Friesian cows were randomly selected from 55 dairy farms in 3 provinces from northeastern Thailand (Khon Kaen, Udon Thani and Sakon Nakhon Provinces) to examine for *T. gondii* infection. Blood was collected from the jugular or caudal vein and sera were separated for further use. The serum specimens were stored at -20°C until used. The ages of the cattle were classified into 3 groups: >0-1 year old, >1-5 years old and >5 years old.

Table 1
Factors associated with *T. gondii* infection among dairy cows in northeastern Thailand.

Factors	Category	Number examined	Number positive (%)
Age	0-1 year	33	3 (9.1)
	>1-5 years	227	56 (24.7)
	>5 years	185	40 (21.6)
Farm holders	Khon Kaen	28	22 (78.6)
	Mueang	11	10 (90.9)
	Ubolratana	6	4 (66.7)
	Nam Phong	7	5 (71.4)
	Kranuan	4	3 (75)
	Udon Thani	13	10 (76.9)
	Mueang	3	2 (66.7)
	Si That	5	5 (100)
	Kut Chap	5	3 (60)
	Sakon Nakhon	14	12 (85.7)
Mueang	14	12 (85.7)	
Dairy cows	Khon Kaen	233	47 (20.2)
	Mueang	110	23 (20.9)
	Ubolratana	48	9 (18.8)
	Nam Phong	25	6 (24)
	Kranuan	50	9 (18)
	Udon Thani	121	28 (23.1)
	Mueang	15	3 (20)
	Si That	76	21 (27.6)
	Kut Chap	30	4 (13.3)
	Sakon Nakhon	91	24 (26.4)
Mueang	91	24 (26.4)	
Total		445	99 (22.3)

Serological determination

The presence of *T. gondii* antibodies was analyzed using a latex agglutination test (LAT) kit (Toxocheck-MT; Eiken Chemical, Tanabe, Tokyo, Japan) following the protocol of Tsubota *et al* (1977a,b) as described by Maruyama *et al* (2003). The cutoff titer used for this test was 1:64. The results obtained were analyzed using the chi-square test, and the level of significance was set at $p < 0.05$.

RESULTS

Ninety-nine dairy cows (22.3 %) were greatest seropositive. The highest titer was 1:1,024. Cows >1-5 years old had the greatest seroprevalence (24.7%), followed by those > 5 years old (21.6%) and < 1 year old (9.1%). Sakon Nakhon Province had the greatest percentage of *T. gondii* infected dairy cows (26.4%) and herds (85.7%) (Table 1). Seroprevalence in dairy cows was highest (37.5%) during the sixth lactation (Table 2). The prevalence in heifers was the lowest (8.8%).

DISCUSSION

Bovine abortion due to *T. gondii* infection may result in a reduction in milk production and culling of animals, and thus a substantial economic loss. The seroprevalence of *T. gondii* infection in cattle has been studied in many countries. It varies between countries, regions, herds, methods of diagnosis and even at different times in the same herd. In our study, seropositivity for *T. gondii* in dairy cows in northeastern Thailand is extremely high (22.3%) compared to 3.2% of cattle in Montana, USA (Dubey, 1985), 1% in Brazil (Pita Gondim *et al*, 1999), 0% in Iran (Sharif *et al*, 2007), 2.3% in China (Yu *et al*, 2007), 10.5% in Vietnam (Huong *et al*, 1998), 6.6% in Central Ethiopia (Bekele and Kasali, 1989) and 9% in Indonesia (Matsuo and Husin, 1996). There are many possibilities for toxoplasmosis transmission in dairy farms in Thailand.

A large cat population may be related to the possibility of infection. Most dairy farms in this study had cats as pets and no boundaries existed

Table 2
Lactation associated with *T. gondii* infection in dairy cows in northeastern Thailand.

Lactation number	Number of negative cows	Number of positive cows (%)	Total number
0	31	3 (8.8)	34
1	61	17 (21.8)	78
2	66	19 (22.4)	85
3	46	21 (31.3)	67
4	39	11 (22)	50
5	51	16 (23.9)	67
6	5	3 (37.5)	8
7	11	3 (21.4)	14
8	26	3 (10.3)	29
9	5	1 (16.7)	6
10	2	1 (33.3)	3
11	3	1 (25)	4
Total	346	99 (22.3)	445

between the dairy farm and their house. Cats are capable of roaming in all areas, including food storage areas and stalls. We cannot make conclusions regarding this hypothesis since we did not evaluate the sera of cats at those farms.

Cats play an important role in human toxoplasmosis, but the link with dairy cows is unclear but may be related to ingestion of raw milk or meat (Garcia Vazquez *et al*, 1993). In Thailand, these are legal requirements for the hygienic handling and pasteurization of cows' milk. Toxoplasmosis is a public health concern due to its association with consumption of uncooked meat or unpasteurized milk (Riemann *et al*, 1975; Sacks *et al*, 1982). Milk and meat from intermediate hosts may serve as a potential source for human toxoplasmosis, because of their greater susceptibility to infection (Skinner *et al*, 1990).

In this study, the high frequency of *T. gondii* infection in dairy cows has potentially important implications for public health. Firstly, most cows are bred for milk production and therefore eventually enter the food chain. In northeastern Thailand cooking is generally adequate to destroy infectious cysts in tissues, but a possible source of infection is raw milk. Secondly, since cows may become infected by ingestion of contaminated oocysts, the high prevalence of *T. gondii* in dairy herds suggests that oocysts are widely dispersed in the environment and thus also pose a risk to human health.

ACKNOWLEDGEMENTS

This research was funded by Kasetsart University Research and Development Institution (Kor-Sor-Dor 32.50), Kasetsart University. We would like to thank the provincial veterinarians and staff of Khon Kaen, Udon Thani, and Sakon Nakhon for their kind help with blood sample collection and all the dairy farmers for their willingness to participate.

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