CHAPTER I

INTRODUCTION

1.1 Thailand Overview

Thailand is situated in Southeast Asia, is adjoined to Laos and Myanmar to the North, Cambodia and the Gulf of the Thailand to the East, Myanmar and the Andaman Sea to the West and Malaysia to the South. Thailand is located between latitudes 5° 4´N and 20° 6´ N and longitudes 97° 1´ to 106 °E longitude. Its total area is about 514,000 square kilometers (198,455 square miles) and human population is about 67,091,089 (July2012est). [CIA (Central Intelligence Agency) World Factbook] www.indexmundi.com/thailand/demographics_profile.html

Figure 1.Thailand Map with 5 groups of provinces (thailandholidayhouse.com)

Thailand is divided into 77 provinces, which are gathered into 5 groups of provinces by location (en.wikipedia.org/wiki/Thailand). The second largest component of agricultural is livestock production. The government helps livestock sector by facilitating the improvement of beef and dairy production through cross-breeding and artificial insemination using high-grade breeds imported from the United States, Switzerland, Germany, Denmark, and Australia. Thai beef is exported to Singapore and Hong Kong, and the sector is angling to gain entrance to the Japanese market.

Thailand is an agricultural country with approximately 34% of the households working in agriculture and 93% of them situated in rural areas. There are two major activities in the agriculture area; the cultivation of crops (54%) and integrated crop-livestock farming (35%). The major forms of livestock in Thailand are pigs, chicken and cattle. Thailand is a major agricultural exporter to countries all over the world (Gatphayak et al., 2013).

1.2 Bovine tuberculosis

Bovine tuberculosis (bTB) caused by *Mycobacterium bovis* (*M. bovis*) is a chronic bacterial disease of cattle, human, other domestic animals and wildlife. *M. bovis* is a member of *Mycobacterium tuberculosis* complex (MTBC) and closely related to the bacteria that caused human and avian tuberculosis. Transmission is by inhalation of infected aerosols, by ingestion of unpasteurized milk from infected cows or through breaks in the skin. Aerosol transmission is the most frequent route of infection in cattle (OIE, 2009).

As an infectious zoonotic disease, public health problem and economic impact occur in all over the world. The occurrence of *M. bovis* infection in human, domestic animals and wild animals approves the relevance of this zoonosis (Thoen et al., 2009). Global prevalence of tuberculosis caused by *M. bovis* is 3.1% of all human TB cases. There are less than 1% of all TB cases occur in region where bTB had been largely eliminated in cattle (Cosivi et al., 1998).

Tuberculosis (TB) is one of the leading causes of deaths caused by infectious disease in worldwide. It is an important disease in human and animals (Thoen et al., 2009). There is only a small percentage of human tuberculosis case caused by *M. bovis;* however it is a pathogen of significant economic important in wild and domestic animals, especially in countries where little information is available on the incidence of *M. bovis* infection in human (Cosivi et al., 1998).

1.3 Cattle population and bovine tuberculosis status in Thailand

Zoonotic TB is present in Thailand and Department of Livestock Development (DLD) performs routine tuberculin test annually. DLD is a National Veterinary Authority of Thailand and is responsible for prevention, control and eradication of animal diseases, animal health and productivity, livestock extension, veterinary public health, animal welfare, food safety of animal derived products and other veterinary services. DLD conducts National control and eradication program (bTB free farm project) by using single intradermal tuberculin test (SIDT) for surveillance, monitoring and disease control. DLD performs SIDT test for bovine tuberculosis control program and reactors are slaughtered. DLD reports that the overall prevalence in cattle and buffalo is 0.5% and many herds and provinces are reactors free (Information, 2004-09, DLD (PVS), 2012). bTB prevalence in Mae Wang district is about 4-5% (DLD official data).

In Thailand, there were 4.5 million heads of native cattle, 1.9 million heads of beef cattle and 0.56 million heads of dairy cattle in 2011. DLD reports bovine tuberculosis as a notifiable disease and performs bTB free farm project by caudal fold test. Thailand is divided into 9 livestock administrative regions for the administration purpose and geographical condition. Number of animal population in Thailand and population of cattle and buffaloes by region are described in Table 1 and 2.

Table 1: Number of animal populations by region in Thailand, 2011

Region	Cattle *	Buffalo	Sheep	Goat	Pig	Poultry	Equidae	Others**
Region 1	592,979	33,940	5,017	56,940	1,098,703	93,420,382	910	2,678
Region 2	233,826	54,558	1,363	8,830	1,821,213	73,390,783	487	2,750
Region 3	2,190,899	558,754	1,487	12,223	1,084,503	55,835,767	2,524	7,315
Region 4	1,248,826	342,876	683	4,097	583,957	22,723,013	1,413	5,334
Region 5	702,383	124,935	1,090	12,238	1,067,507	20,470,236	1,573	2,225
Region 6	568,894	77,417	3,538	30,564	666,768	29,343,717	672	2,906
Region 7	866,563	8,821	8,647	79,747	2,253,536	33,305,072	961	2,914
Region 8	286,977	13,343	780	53,001	541,521	14,010,904	461	1,421
Region 9	452,418	19,535	29,130	169,927	564,066	15,717,627	572	880
Total	7,143,765	1,234,179	51,735	427,567	9,681,774	358,217,501	9,573	28,423

*Including native, beef and dairy cattle

**Including elephants, farmed deer, camels and farmed wild boars

Source:(DLD (PVS), 2012)

Table 2: Number of cattle and buffaloes by region in Thailand, 2011

Region	Native cattle	Breeders and cross-bred cattle	Fattening beef cattle	Dairy cattle	Buffalo	Total
Region 1	207,393	195,574	16,723	173,289	33,940	626,919
Region 2	128,258	60,954	2,451	42,163	54,558	288,384
Region 3	1,599,677	479,724	7,882	103,616	558,754	2,749,653
Region 4	791,811	420,758	7,931	28,326	342,876	1,591,702
Region 5	536,379	108,735	3,996	53,273	124,935	827,318
Region 6	369,910	184,090	7,133	7,761	77,417	646,311
Region 7	388,447	278,928	51,647	147,541	8,821	875,384
Region 8	220,170	61,305	3,711	1,791	13,343	300,320
Region 9	407,611	40,050	1,858	2,899	19,535	471,953
Total	4,649,656	1,830,118	103,332	560,659	1,234,179	8,377,944

Source:(DLD(PVS),2012)

Table 3: Dairy cattle population in Chiang Mai

Districts in Chiang Mai	Number of dairy cattle		Number of farms	
	2553	2554	2553	2554
Muang	32	32	2	2
Chom Thong	–	–	–	–
Mae Chaem	15	15	1	1
Chiang Dao	–	–	–	–
Doi Saket	221	277	13	15
Mae Taeng	260	419	19	28
Mae Rim	869	869	41	41
Samoeng	–	–	–	–
Fang	99	226	6	10
Mae Ai	56	86	9	7
Phrao	3	25	1	3
San Pa Tong	2,776	3,415	66	91
San Kamphaeng	4,735	4,585	201	198
San Sai	2192	2,812	74	90
Hang Dong	28	28	6	6
Hot	–	–	–	–
Doi Tao	–	–	–	–
Omkoi	–	–	–	–
Saraphi	316	433	10	12
Wiang Haeng	–	11	–	1
Chai Prakan	7,247	8,532	205	219
Mae Wang	1,193	801	18	18
Mae On	8,368	8,370	383	384
Doi Lo	262	642	6	19
Total	28672	31569	1061	1145

Source: DLD database (2010-2011)

Although the prevalence data on animal TB in developing countries are insufficient, information on bTB occurrence and control measures exists (Cosivi et al., 1998). Transmission to humans can occur, even if effectively controlled by herd testing, milk pasteurization, meat inspection and health surveillance. Although some recent opinion considers this risk to be negligible, it is still considered a public health risk. In addition, bTB affects cattle health, impacts negatively on profitability, trade and also impacts on the welfare of affected farming families (Skuce et al., 2012). Since bTB is the most complex and difficult multiple species endemic disease, the epidemiology is exceptionally complicated and the relationship between evidence, uncertainty and risk has been difficult to communicate (Krebs, 2012).

bTB infection in cattle is usually diagnosed *in vivo* on the basis of delayed hypersensitivity reactions. Infection is diagnosed by necropsy and histopathology and bacteriology techniques in dead animals. Although polymerase chain reaction (PCR) can be used for confirmation of infection, bacterial culture remains the gold standard method for routine confirmation of infection. Tuberculin skin test is the standard method for diagnosis of bTB (OIE, 2009).

There are three classifications of bTB risk factors in cattle based on animal, herd and region/country levels. Most of the studies dealing with *M. bovis* in developing countries were focused on African countries such as Tanzania, Zambia, Ethiopia and Uganda. In developed regions, bTB researches are particularly found in Western Europe (United Kingdom, Ireland, Spain, Italy or France), in North America (USA and Canada) and New Zealand (Humblet et al., 2009). In Asian region, bTB is partly controlled or not controlled at all in 29 countries and only seven countries apply test and slaughter policy and consider as a notifiable disease. Information on human cases caused by *M. bovis* in developing countries is scarce(Cosivi et al., 1998).

In developing countries, where HIV and bovine TB are likely to be common, the ability of HIV infection may lead to higher incidence of human TB caused by *M. bovis* and it might also be increased human-to-human transmission. This should be great public health concern in region where bTB is present and control measures are not applied or are applied inadequately. It is considered that more researches need to determine when *M. bovis* is of zoonotic importance and what the fundamental mechanisms of transmission are. So, identification of locally operative risk factors for

bTB and develop appropriate control measures should be implemented in bTB endemic area particularly in developing countries (Cosivi et al., 1998). Since bTB still endemic in both developed and developing countries, the more research needs to verify the accuracy of bTB situation in worldwide.

1.4 Objectives

The main objective of the study is to compare the cell-mediated immune responses of bovine and avian PPD injections in dairy cattle.

The other objectives are:

1. To determine the presence and prevalence of bTB in dairy cattle in Chiang Mai.
2. To investigate the age of cattle and purchasing of cattle are risk factors for bovine tuberculosis in dairy farm (Chiang Mai).