CHAPTER 1

INTRODUCTION AND OBJECTIVES

1.1 Introduction

Salmonella has been recognized worldwide as an important foodborne pathogen. Non-typhoidal *Salmonella* constitutes the vast majority of isolates belonging to the genus *Salmonella* and represents the leading cause for infectious gastroenteritis in the world. Each year, an estimated 1.4 million persons are infected with non-Typhi *Salmonella* in the United States, resulting in 15,000 hospitalizations and 400 deaths (Voetsch *et al*., 2004). In France, the estimated number of annual cases of salmonellosis reaches 30,000 with 92-535 consecutive deaths (de Valk and Vaillant, 2004*).* *Salmonella* infections are also responsible for huge economic consequences. In Denmark alone, the costs related to food-borne cases of salmonellosis were estimated between US$ 10.4 and $ 25.5 million in 2001 (Aarestrup *et al*., 2007).

Animal to human transmission of *Salmonella* strains has identified raw meat and raw milk and poultry and poultry products to be the most important sources of human infections by *Salmonella* (Gorman and Adley, 2004; Weill *et al*., 2004) Broilers contribute substantially to the transmission of *Salmonella* to humans, the importance of salmonellosis increases with the world-wide increase in demand for poultry products. In the United States as an example, consumers have continuously increased their consumption of poultry meat over the past century. There has been a 17-fold increase in the per capita turkey meat consumption and a 5.7-fold increase in chicken consumption, besides a nearly 20% increase in pork consumption since 1910 (Buzby and Farah, 2006; Foley *et al*., 2008). Increasing animal food consumption may increase the chance of consumers becoming exposed to *Salmonella* through food and food products.

Salmonella (S.) Enteritidis is the most common source of human salmonellosis in EU countries and the second most common serotype (besides *S.* Typhimurium) in the United States (CDC, 2007; Jong and Ekdahl, 2006). This increased prevalence of

S. Enteritidis in chicken and chicken meat might be associated with the increase of human salmonellosis, however this evidence has not been conclusive (Sakai and Chalermchakit, 1996).

Significant associations were found between the contamination level of a broiler flock and the hygiene of the broiler house, feed and water in the broiler house, and both the animal and non-animal material sampled in the environment. These factors also seem to be the most determining factors for carcass contamination with *Salmonella* in slaughterhouses. A large percentage of birds are colonized by *Salmonella* during growth and the skin and meat of carcasses are frequently contaminated by pathogens during slaughter and processing (FAO and WHO, 2001). Contamination of poultry carcasses with *Salmonella* seems to be mostly linked to flock contamination during rearing and/or transportation to slaughter (Nicholson *et al*., 2005) or within the processing plant (Hafez *et al*., 2001). Thus, the prevalence level of *Salmonella* contamination in broiler and slaughterhouses depends on various identified risk factors, including season, parent flock and hatchery of origin, feed mills, various hygienic measures and the management of the animals (Cardinale *et al*., 2004).

In order to reduce the level of S*almonella*-contamination of meat and other products of farm animals, a fundamental element of control strategies is to identify *Salmonella*-infected herds and animals and their sources of infection as early as possible in primary production. By this, further spread in subsequent stages of the production cycle could be reduced. Such an effective pre-harvest control program would decrease the number of *Salmonella*-contaminated animals which arrive at the processing plant. Thus, in order to meet the higher safety demands of consumers of meat and farm animal products, a policy with more effective strategies to reduce the prevalence of *Salmonella* has to be implemented. A combination of pre- and post-harvest control programs should ultimately provide the safest products for consumers. Control programs are best formulated by setting reduction targets which are based on scientific, authoritative data on the prevalence of *Salmonella* and on the most frequent zoonotic serotypes at different stages of production cycles. As details of sampling, the investigations on the prevalence of *Salmonella* are highly dependent on e.g. sample-handling, culture method, the type of flock and its housing (WHO, 2002; Hafez, 1999;

Hafez, 2001); standardized investigation methodology is needed to derive valid results. The European Union (EU) by its Directives 92/117 of 1992 and 2160/2003 has formulated policy and methodology for its 27 member states to control specified zoonotic agents, including *Salmonella*, in animals and products of animal origin. Specific subsequent EU regulations on mandatory investigations of *Salmonella* in poultry include Regulation 1003/2005 of 2005 to address parent breeding flocks, and Regulation 1168/2006 of 2006 for baseline surveys of the prevalence of certain serotypes of *Salmonella* in laying hen flocks.

EU Regulations for baseline surveys on the prevalence of *Salmonella* in broiler flocks are contained in Regulation 2160/2003 (‘on the control of salmonella and other specified food-borne zoonotic agents’), EU SANCO/1688/2005Rev.1: Working Document 15/07/05 (‚Baseline Survey on the Prevalence of *Salmonella* in Broiler Flocks of *Gallus gallus* in the EU - Technical Specifications’) and Decision 2005/636/EC (‘concerning a financial contribution by the Community towards a baseline survey on the prevalence of *Salmonella* spp. in broiler flocks of *Gallus gallus* to be carried out in the Member States’).

Surveys in the EU were carried out between 2005 and 2006 in all EU member states and results were published (EFSA, 2007a, b). Based on the results, the EU has set reduction targets; *Salmonella* will have to be reduced by a specific minimum percentage each year, with steeper targets for member states with higher levels of *Salmonella*. For the execution of control programs, each EU member state had to submit a national control programme on *Salmonella* reduction in 2007.

Thus, this study used the tested and proven EU methodology to estimate the prevalence of *Salmonella* spp. in flocks of broiler chickens of a defined commercial, industrial production line in northern Thailand. Results may serve to define reduction targets, if necessary.

1.2 Objectives

1. To determine the prevalence of *Salmonella* spp. of broiler flocks.
2. To identify the five most frequent serovars of *Salmonella* in the flocks.
3. To investigate some potential risk factors which may be associated with the occurrence or freedom of *Salmonella* in the flocks.