

CHAPTER 1

Introduction

1.1 Historical background

The increasing world population and demand for poultry consumption as a low-priced and accessible source of protein has led to an annually expanding poultry global consumption trend. In 2017, the forecasted poultry meat production reached over 90 million metric tons (ready to cook equivalent) (United States Department of Agriculture, 2016). Thailand, the third world exporter, second only to Brazil and the European Union (USDA, 2016), has major exported to Japan and EU with, respectively, 50% and 35% market shares (Petchseechoung, 2016), which has led to a gradual escalation of the poultry industry. Thai local consumption has been forecasted to approximate 70% of country production and production has increased similarly to the global trend by 4-5% in 2017, from 670 million tons in 2016 (Thailand Ministry of Foreign Affairs, 2016). Currently, consumers have become more aware of foodborne zoonotic diseases due to widespread outbreaks of avian influenza reported throughout the world. In addition, the increase in broiler meat supply may have led to an increase in probability of foodborne disease from consumption of broiler meat and its products.

Thailand has two major types of poultry production systems: backyard and intensive (or commercial) production. The backyard production system aims to mainly serve the demand of local consumption while the commercial production system focuses on both local higher economic markets as well as exportation. The slaughter production system defined in this study was specified by slaughter capacity (head per day). A small-scale or backyard slaughterhouse has a capacity of less than 100 head per day while the large-scale (or commercial type) has a capacity of more than 10,000 head per day. Large differences of production capability depended on investment volume and target market. The backyard slaughterhouse is the operating unit in which the owners supply meat products within or around their households, typically slaughter chickens received from

small farms or their own backyard rearing for day to day consumption. Generally, customers are people who live in those areas and have less access to urban markets or supermarkets. Instead, commercial slaughterhouses have potential capability to produce and distribute poultry meat products to higher markets in Chiang Mai and other provinces in the Upper Northern region of Thailand because of higher slaughter capacity and higher broiler supply from contract farms.

Among several species of causative foodborne agents, *Campylobacter* is a major common leading cause of diarrhea and foodborne bacterial gastroenteritis worldwide (Kaakoush, Castaño-Rodríguez, Mitchell, & Man, 2015; O'brien, 2017). Estimated annual incidence rates of human enteritis cases caused by *Campylobacter* spp. in high-income countries are between 4.4 and 9.3 per 1,000 population (World Health Organization [WHO], 2013). This hyperthermophilic gram-negative bacteria require microaerophilic conditions for growth and amplification (Bolton, 2015). Among over 16 species and 6 subspecies of *Campylobacter* (Melero, Cocolin, Rantsiou, Jaime, & Rovira, 2011), *C. jejuni* is the species predominantly found in poultry and its products (O'brien, 2017). The most common symptom of *C. jejuni* infections is enteritis. Other extra-intestinal consequences included Guillain-Barré syndrome, the muscle weakness and acute paralysis as a result of peripheral nerve damage caused by human immune response against lipo-oligosaccharide molecules of bacteria that mimic the human peripheral nerve structure (Yuki, 2007), reactive arthritis, and bacteremia (Wei et al., 2016). Campylobacteriosis has been mostly reported in developed countries while infections caused by this agent remain underreported in developing and underdeveloped countries due to fewer studies and lower surveillance, especially less information regarding the prevalence and concentration of the agent along chicken slaughtering process. Studies from Poland (Wieczorek & Osek, 2015) showed that the prevalence of *C. jejuni* in broiler slaughterhouses after chilling process was 27.25% (576 of 2,114 swab samples) and the prevalence of *C. jejuni* in final meat products from broiler slaughterhouses in Southern Spain was 20.48% (17 of 83 carcass samples) (Torralbo et al., 2015). One study in Thailand with samples collected at each step of the slaughtering process found that the concentration of *C. jejuni* ranged from approximately 1-3 log/CFU (Osiriphun et al., 2011). A relatively small dose of *C. jejuni* which contained 360-500 organisms is

sufficient to cause infection in human (Kothary & Babu, 2001; Hara-Kudo & Takatori, 2011).

Globally, a small number of studies on *Campylobacter* contamination rate and level of contamination at various steps during chicken processing in slaughterhouses have been published (Guerin et al., 2010), the same as in Thailand. Moreover, data on contamination rate and level of contamination at each step along slaughter process, especially comparison between backyard and commercial slaughterhouses, has rarely been provided to consumers. The objectives of this study were to estimate the percentage of *Campylobacter jejuni* contamination in each type of slaughterhouse and the concentration at each slaughtering step. This information will be used in an exposure assessment of *Campylobacter jejuni* in broiler meat from slaughterhouses to represent the exposure of *C. jejuni* and to estimate the risk of campylobacteriosis in humans from consumption of contaminated broiler meat in Northern Thailand. This information will also emphasize the importance of this pathogen to policy makers and stakeholders related to the broiler production chain to help developing recommendations or guidelines to control the contamination of *C. jejuni* for local consumption and international trade.

1.2 Objectives of the study

1.2.1 To determine contamination rate of *Campylobacter jejuni* in commercial and backyard slaughterhouses in Chiang Mai province at each slaughter step

1.2.2 To determine level of *C. jejuni* contamination on chicken carcasses in commercial and backyard slaughterhouses in Chiang Mai province at each slaughter step

1.2.3 To exchange practical control measures or recommendations between slaughterhouses regard to decrease the level of *C. jejuni* contamination on chicken carcasses