CHAPTER IV

DISCUSSIONS

Pre-slaughter *Salmonella* infections of pigs at farm and slaughter levels

The overall prevalence estimate of *Salmonella* infections of pigs at the farm level of 69.5% and at the slaughterhouse level of 80.5 % constitute the first report of its kind on the infection status of pigs herd in Thailand from the farms of origin of animals to slaughter. So far, no other comparable investigations on *Salmonella* prevalences at the farm and slaughterhouse levels have been carried out in the country. In Europe, any farm found of having *Salmonella* prevalences at the herd level higher than 50% is categorized under the highest level (level 3) and is placed under special control measures at the expense of owners (Anonymous 1998b; Christensen et al., 1997, 1998, 1999). Results of this study showed that none of the study pig farm had prevalence less than 50%. Hence, these farms could not be spared punitive measures if they were located in Europe. However, it worth noting that at present there is no such management system for monitoring and controlling *Salmonella* infections and contaminations in the production chain of pigs and pork products in place in Thailand yet. The study results though strongly point to the need to start introducing such systems. Without that, *Salmonella* bacteria easily will continue to be introduced into the farms through feed, pest and birds, workers, contaminated soil and water without the farmer being aware of the problem.

Based on *Salmonella* identifications from mesenteric lymph nodes, it can be estimated that in fact close to 70% of slaughter pigs were already infected at their farms. Isolating Salmonella from lymph nodes identifies chronic infections.

During transportation and holding of pigs at the lairages, pre-slaughter cross-infection/contamination is possible and probable. Finding of this study supports this by investigations of the fecal samples prior to slaughter. An additional prevalence of new *Salmonella* infections of at least 13% was detected in pigs between farm and slaughter. Berend et al. (1997) has indicated that shedding of *Salmonella* bacteria often is triggered by stress factors, for example transportation and crowding.

Contamination rates of pig carcasses in relation to pre-slaughter *Salmonella* infection levels

Berend et al. (1997) showed that percentages of *Salmonella*-contaminated pig carcasses were directly proportional to pre-slaughter infection levels. Pigs being infected thus also will have contaminated carcasses, no process during slaughter helps to break this line. Comparatively, results from this current study revealed similar trends in both slaughterhouses, Muang and Sansai. Although the two slaughterhouse-specific contamination rates were not significantly different, they were nevertheless biologically of high levels in comparison with those reported from developed countries (Berends and Snijders 1997; Buschmann, 1999). The prevalence of *Salmonella* bacteria recorded in the carcass swabs was almost the same as that found in fecal samples. These were 53.2 and 54.9%, respectively. This result reflects inefficiency and major deficits in the hygienic practice in the slaughtering process.

Therefore, the hygienic standards of the slaughter system need to be addressed if *Salmonella* contamination of the carcasses is to be controlled at this stage.

Probable Risk factors of *Salmonella* infection in pigs and carcass contamination

The farm prevalence of *Salmonella* of 69.5% and that of pre-slaughter of 80.5%, together with 54.9% contamination rate of carcasses, constitute major food quality assurance as well as food safety concerns. However, the risk factors enhancing or potentiating the transmission along the pig and carcass production chain could not be delineated in this study. But, based on other investigators findings it can be safely surmised that contamination of carcasses with *Salmonella* bacteria is dependent on the burden of infection at farm level, the pre-slaughter stress factors that trigger shedding of the bacteria, and on the hygienic standards of the slaughtering process (Berends and Sniders, 1997).

Distribution of *Salmonella* serotypes

In Europe, *Salmonella* Enteritidis has replaced *Salmonella* Typhimurium in the last decade as the most important serotype causing public health problem. In this study, however, *Salmonella* Typhimurium was the most frequent isolate. This serotype has already been isolated from salmonellosis outbreaks in humans in Thailand in addition to *Salmonella* Panama. In order to estimate the proportions of human-pathogen strain in the samples investigated in this study, further typing of a representative number of samples, predominantly for *Salmonella* Enteritidis and *Salmonella* Typhimurium, is presently done.

Chain of infection and their risk factors

The result of 69.5% infection at farm level, 80.5% at pre-slaughter level, together with 54.9% contamination rate of the carcasses are the basis to assess the hazard due to Salmonella infection. Each step along the production chain reflects chances and probabilities of *Salmonella* entering the chain. Specific risk factors enhancing the chance of infection along this chain could not be determined in this study. The situation from the two slaughterhouses were not much difference, so that similar and major processes of infection along the chain are suggested. Other studies though showed that the probability of eventually resulting in a contaminated carcass essentially depends on the burden of infection at the farm level, on stress factors during the pre-slaughtering phase, and on the hygiene of slaughtering processes at the slaughterhouse itself (Berends and Snijders 1997).

Applicability of Danish Mix-ELISA for screening *Salmonella* infections in pigs

The Danish Mix-ELISA is used as a mass screening test in support of *Salmonella* monitoring and control program in several countries (Buschmann, 1999). It is rapid, inexpensive and simple to conduct. In this study, the Danish Mix-ELISA would have been able to only detect up to 59.5 % of the *Salmonella* positive samples. Modification of this test or development of a new comparable one for local use in Thailand is strongly recommended.

CONCLUSION

The global demand of safe food by consumers is of major public health and economic importance for internal and external reasons in Thailand. This is because the country wholly relies on agricultural products. Product quality assurance of being free of food-borne pathogens is a requirement of consumers nationally and a pre-condition of importing countries. The way to achieve this requirement is however not simple in term of know-how and management.

Results of this study shed first lighted on the magnitude of the *Salmonella* problem in pork, with *Salmonella* already being present at high levels at the level of pig raising and the problem being exacerbated by processes prior to and during slaughter. In order to bring this health hazard under control, the overall transmission pathway of *Salmonella* therefore has to be considered and the specific critical points have to be investigated in more detail, for the purpose of eventually arresting the current *Salmonella* situation. Without doubt, a regulatory system is needed to monitor and support "clean primary production", stress-free transportation of pigs and a hygienic slaughtering process. A functional system to trace slaughter pigs back to their farm of origin as key component of such a system has to be developed and implemented. *Salmonella* control has to start at the farm level. Apart from setting up an efficient monitoring system which is an essential part of the control program, further research and management decisions within the pork production sector are urgently needed in order to further substantiate and start programs aimed at reduction of *Salmonella* bacteria and other risks at production level. Along with the building up of individual good hygienic practices in the production and slaughtering system, the

application of an encompassing e.g. HACCP system in primary pig production and for pork products is highly recommended.